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A comparative study of selected physical fitness attributes of women field hockey players on the basis of their playing position

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Abstract
The aim of the present study was to investigate the effect of playing position on Shoulder strength, Abdominal strength, speed, agility and Endurance performances of Female field Hockey players. For this purpose forty only (N=40) selected from different Universities of Northern India who win a medal in Inter-College level competition and the Age group of 18-25 years. They were divided into 4 groups according to playing position: Goalkeeper (GK), Attacker/Forward (A/F), Defender (D) and Mid fielder (MF). Each subject performed 5 tests presented in a random order: The Flexed Arm Hang (FAH) of shoulder strength, Sits-ups (SU) of the abdominal strength, Shuttle run (SR) the agility, 50Meters Dash of the speed and 6 Minutes Run/Walk of endurance. According to the results of one-way analysis of variance only speed variable (0.003, $p<0.05$) was discriminatory among the selected playing position, whereas no significant difference was obtained for Shoulder strength, Abdominal strength, agility, and endurance ((0.103, 0.818, 0.080 and 0.189, $p>0.05$)).

Keywords: Physical fitness, women hockey, playing position and ANOVA

Introduction
Within the last 20 years, the sport of field hockey has seen some rather quick and significant modifications. With a five-minute halftime break after 35 minutes of play, games used to last 70 minutes prior to 2019. But in modern times, hockey has evolved into a fast-paced, very skilled game that is primarily a team sport. The game consists of four 15-minute quarters that alternate between quick bursts of speed and slower movements for rest periods. There is a 15-minute halftime break and a 2-minute break between the first and final quarters. The players must be very attentive and engaged during the action. In addition to movement speed, movement strategy is also important. In order to meet the game's criteria, the player must execute several dodge moves and straight runs at great speed. Positional play, which places players in highly definite roles, is a feature of both football and hockey. Because of the ball's speed, players must be on their toes, fast on their feet, nimble, and well-coordinated with strong neuromuscular control and postural reflexes. Speed, endurance, and strength are required on the synthetic surface of hockey (Kumar *et al*., 2021) [4]. To fully use each player's unique talents, a very high degree of physical condition is required. Modern hockey is known for its quick attacks with quick crossing in the middle of the field, constant free running by players without the ball, constant position switching during attacks, and players' chosen physical fitness traits of speed, endurance, shoulder strength, abdominal strength, and agility. According to contemporary hockey. Positional play is very significant in the team sport of hockey. Team sports are those where various physical fitness factors all contribute significantly to giving unique advantages for certain playing positions, especially at the highest levels of performance when there is a great degree of player specialization.

Materials and Methods
Selection of Subject: For the purpose of the present study four positional groups were taken for the present study. A total of forty (N=40) i.e. Goalkeeper (GK, n1= 10), Attacker/Forward (A/F, n2 =10), Defenders (D, n3 = 10) and Mid fielder (MF, n4=10) Female field hockey players were selected as subjects for the study. These subjects belong to selected from only universities of Northern India who participated in Northern and All India Inter Universities and their age group of 18 to 25 year.

Selection of Variables: The following "Physical Fitness Attributes" mentioned in Table No 1 were selected for the study

Table 1: Test and Criterion Measures for the Selected Variables

S. No	Variables	Tools/ Instruments	Unit of measurements
1.	Shoulder Strength	Flexed Arm Hang	In seconds
2.	Speed	50-meter dash	
3.	Shuttle run	Shuttle run	
4.	Endurance	6-minute run/walk	In meters
5.	Abdominal Strength	Sits-ups	In numbers

Administration of Test

Speed

- **Purpose:** The objective of this test was monitoring the development of the athlete's ability, effectively and efficiently to build up acceleration, from a standing start or from starting blocks, to maximum speed.
- **Equipment:** Flat non-slip surface and Stopwatch.
- **Procedure:** This test requires the athlete to sprint as fast as possible over 50meters. The athlete was asked to warm up for 10 minutes. The scholar was asked to mark out a 50 meters straight section with cones. The athlete was asked to start on command and sprints as fast as possible over the 50 meters. The scholar was asked to start the stopwatch on the athlete's 1st foot strike after starting and stops the stopwatch as the athlete torso crosses the finishing line. The test was conducted 3 times.
- **Scoring:** The fastest recorded time was taken to assess the athlete's performance

600 M Run/Walk

- **Purpose:** The purpose of the test is to measure maximal functional capacity and endurance of the cardio-respiratory system**.**
- **Procedure:** 600-meter walk and Run can be organized on track subject runs a distance of 600 yards. The subject takes a standing start from the starting line. The subject may walk in between. However, the objective is to cover the maximum distance in the 6 minutes when she crosses the finish line she is informed of her distance.

Abdominal Strength

- **Purpose:** The purpose of the sit-up is to evaluate abdominal muscular strength endurance.
- **Procedure:** To assume the starting position, the subject was asking to lie on his back with knees flexed, feet on floor, with heels between 12 and 18 inches from the buttocks. The feet were held by the partner to keep them in touch with the testing surface. The subject, by tightening his abdominal muscles, curls to the sitting position. Arm contact with the chest must be maintained. The chin should remain tucked on the chest. The sit-up is completed when the elbow touches the thighs. To complete the sit-up the subject returns to the down position until the mid-back makes contact with the testing surface. The timer was asked to give the signal "ready go" the sit-up performance was asked to start on the word "go". Performance was stop on the word "stop"
- **Scoring:** The number of correctly executed sit-ups in 60 seconds was the score.

Agility

- **Purpose:** Shuttle run was used to measure speed and agility.
- **Equipment:** Wooden blocks, marker cones, measurement tape, stopwatch, non-slip surface was used for this test.
- **Procedure:** The subjects were asked to stand in stationary position (hands cannot touch the ground) behind the starting line marked on the ground, with one foot in front of the other. This test requires the subjects to run back and forth between two parallel lines as fast as possible. The testing area was asked to mark with two lines of cones 30 feet apart and three balls were asked to place behind one of the lines. Starting at the line opposite to the blocks; on the signal, "Ready? Go!" the subject runs to the other line, picks up a ball and returns to place it behind the starting line, then returns to pick up the second ball, then again run quickly and place it behind the starting line, finally then the subject was returns to pick the third ball and runs with it back across the line.
- **Scoring:** Two trails were given to the subjects, and the quickest time was recorded. Results were recorded to the nearest tenth of a second.

Shoulder Strength

- **Purpose:** to measure upper body strength and endurance by measuring how long they can hang with their chin above the bar.
- **Equipment:** Stopwatch, Horizontal overhead bar at an adequate height, stool or step (optional) and a gym mat to be placed under the bar.
- **Procedure:** Subjects grasped the overhead bar. The grip for the President's Challenge allows using either an overhand grip (palms facing away from body) or underhand grip (palms facing toward body). Position the body with the armed flexed and the chin clearing the bar. The chest should be held close to bar with legs hanging straight. The body must not swing, the knees must not be bent, and the legs must not kick. The participants should be assisted to this position. The subject holds this position for as long as possible. Only one trial is required.
- **Scoring:** The total time in seconds is recorded - timing is stopped when student's chin touches or falls below the bar. The type of grip used should also be recorded with the results.

Statistical Technique

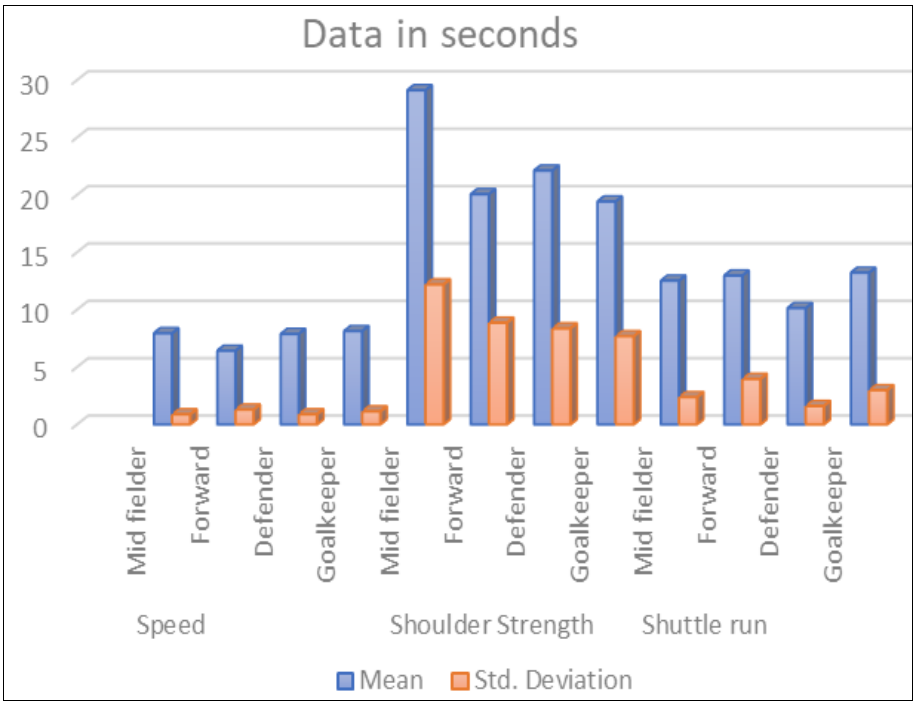
Analysis of Variance (ANOVA) technique was used as the statistical technique in IBM SPSS 21.0 for knowing the significant difference among the playing position of selected physical fitness attributes. (Verma J P, 2013) [10]

Results

Table 1: Descriptive statistics for the Selected Variables for different playing positions

Variables	Playing Position	Mean	Std. Deviation
Speed	Mid fielder	7.9480	.87846
	Forward	6.4200	1.28560
	Defender	7.8820	.88361
	Goalkeeper	8.1320	1.13841
Shoulder Strength	Mid fielder	29.1180	12.20348
	Forward	20.0590	8.86433
	Defender	22.1160	8.36383
	Goalkeeper	19.4230	7.68387
Abdominal Strength	Mid fielder	26.2000	4.15799
	Forward	25.0000	3.16228
	Defender	25.1000	2.33095
	Goalkeeper	25.1000	2.99815
Agility	Mid fielder	12.5260	2.37598
	Forward	12.9670	3.95870
	Defender	10.1340	1.59792
	Goalkeeper	13.2160	2.97655
Endurance	Mid fielder	549.0000	3.16228
	Forward	546.0000	16.46545
	Defender	509.0000	86.46772
	Goalkeeper	525.0000	26.35231

Table and Fig No. 1 represents the descriptive statistics i.e., mean, and standard deviation of selected physical fitness attributes for different playing position. For speed (in seconds), the mean and standard deviation of mid fielder, forward, defender, and goalkeeper was 7.9±0.87, 6.42±1.28, 7.88±0.88 and 8.13±1.13 respectively. For Agility (in seconds), the mean and standard deviation of mid fielder, forward, defender, and goalkeeper was 12.52±2.37, 12.96±3.95, 10.13±1.59 and 13.21±2.97 respectively. For shoulder strength (in seconds), the mean and standard deviation of mid fielder, forward, defender, and goalkeeper was 29.11±12.20, 20.05±8.864, 22.11±8.363 and 19.423±7.68 respectively. For Abdominal Strength (in numbers), the mean and standard deviation of mid fielder, forward, defender, and goalkeeper was 26.2±4.15, 25±3.162, 25.1±2.33 and 25.1±2.99 respectively. For endurance (in meters), the mean and standard deviation of mid fielder, forward, defender, and goalkeeper was 549±43.16, 546±16.46, 509±86.46 and 525±26.35 respectively.



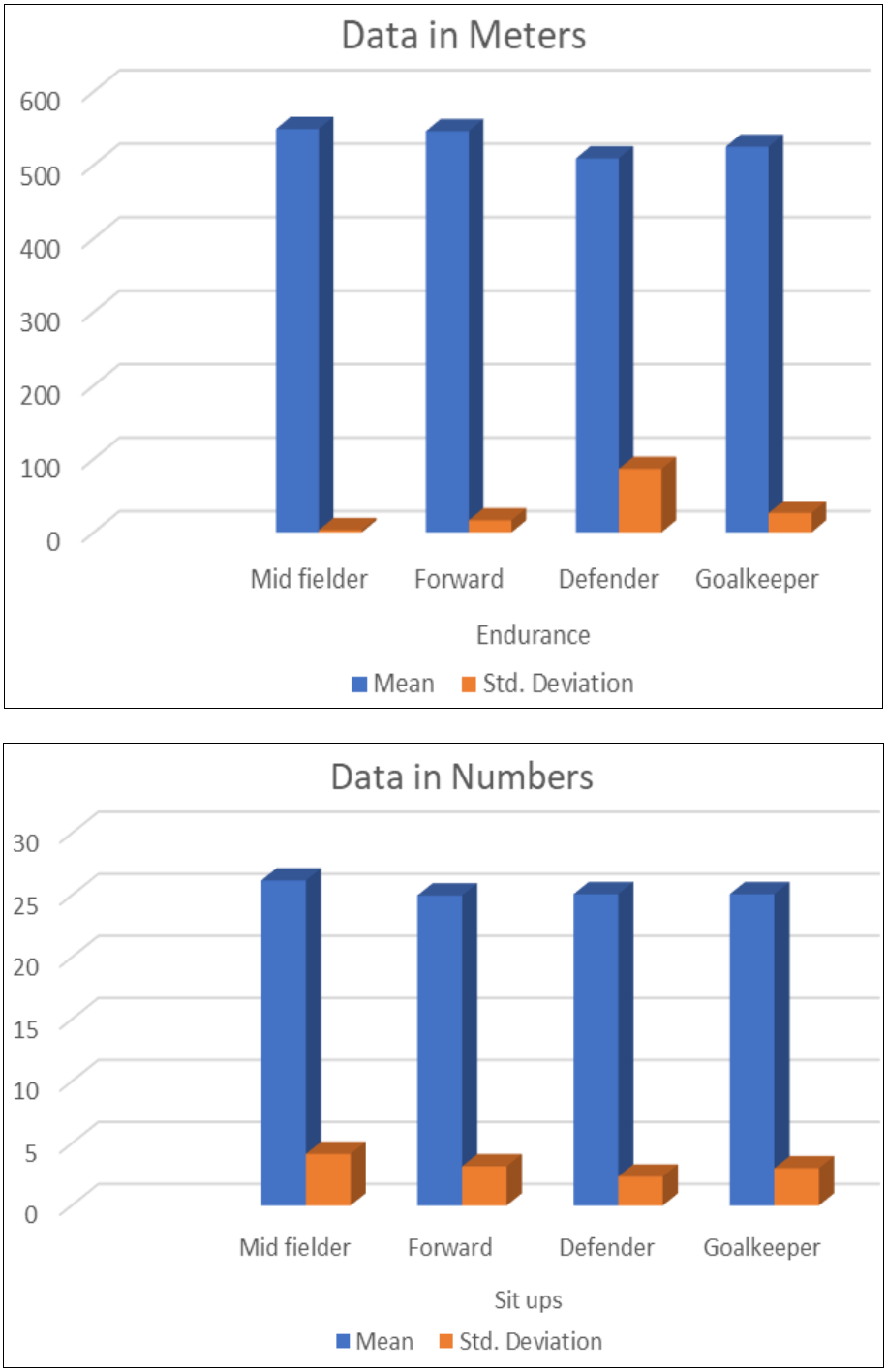


Fig 1: Graphical representation of descriptive statistics

Table 2: Test of Homogeneity of Variances

Variables	Levene Statistic	df1	df2	Sig.
Speed	2.157	3	36	.110
Shoulder Strength	1.142	3	36	.345
Abdominal Strength	1.104	3	36	.360
Agility	2.636	3	36	.064
Endurance	11.281	3	36	.000

Table no. 2 represents the test of homogeneity of variances for selected physical fitness attributes. This test is pre-requisite for one way ANOVA, the test significance should be more than 0.05 which reflects that data across all the group was not same.

Here for speed, shoulder strength, Abdominal Strength and Agility obtained significant value were 0.110, 0.345, 0.360 and 0.064 respectively except for endurance variable the homogeneity across the group as similar as sig. value was less than 0.05.

Table 3: ANOVA table

Variables		Sum of Squares	df	Mean square	F	Sig.
Speed	Between Groups	18.760	3	6.253	5.557	.003
	Within Groups	40.511	36	1.125		
	Total	59.271	39			
Shoulder Strength	Between Groups	592.436	3	197.479	2.216	.103
	Within Groups	3208.471	36	89.124		
	Total	3800.908	39			
Abdominal Strength	Between Groups	9.700	3	3.233	.310	.818
	Within Groups	375.400	36	10.428		
	Total	385.100	39			
Shuttle run	Between Groups	59.947	3	19.982	2.442	.080
	Within Groups	294.568	36	8.182		
	Total	354.515	39			
Endurance	Between Groups	10627.500	3	3542.500	1.676	.189
	Within Groups	76070.000	36	2113.056		
	Total	86697.500	39			

Table no. 3 represents the analysis of variance for selected physical fitness attributes i.e., within the group variation and difference between selected playing positions i.e., between the group variation. The obtained p-value for speed was 0.03 (p<0.05), hence the null hypothesis of no variation between the group for speed was reject at 0.05 level of significance. Whereas, the obtained values for shoulder strength, Abdominal Strength, Agility and endurance were 0.103, 0.818,0.080 and 0.189 (p>0.005) respectively, hence the null hypothesis of no variation between the group for shoulder strength, Abdominal Strength, Agility and endurance was accepted at 0.05 level of significance. According to table no. 3 significance difference was obtained for only speed and post hoc analysis i.e., Scheffe Test was employed for determining which group had better speed.

Table 4: Pair-wise comparison (Scheffe Test)

Dependent Variable	(I) Playing Position	(J) Playing Position	Mean Difference (I-J)	Std. Error	Sig.
Speed	Mid fielder	Forward	1.52800*	.47441	.026
		Defender	.06600	.47441	.999
		Goalkeeper	-.18400	.47441	.985
	Forward	Mid fielder	-1.52800*	.47441	.026
		Defender	-1.46200*	.47441	.036
		Goalkeeper	-1.71200*	.47441	.010
	Defender	Mid fielder	-.06600	.47441	.999
		Forward	1.46200*	.47441	.036
		Goalkeeper	-.25000	.47441	.964
	Goalkeeper	Mid fielder	.18400	.47441	.985
		Forward	1.71200*	.47441	.010
		Defender	.25000	.47441	.964
Shoulder Strength	Mid fielder	Forward	9.05900	4.22195	.222
		Defender	7.00200	4.22195	.442
		Goalkeeper	9.69500	4.22195	.173
	Forward	Mid fielder	-9.05900	4.22195	.222
		Defender	-2.05700	4.22195	.971
		Goalkeeper	.63600	4.22195	.999
	Defender	Mid fielder	-7.00200	4.22195	.442
		Forward	2.05700	4.22195	.971
		Goalkeeper	2.69300	4.22195	.938
	Goalkeeper	Mid fielder	-9.69500	4.22195	.173
		Forward	-.63600	4.22195	.999
		Defender	-2.69300	4.22195	.938
Abdominal Strength	Mid fielder	Forward	1.20000	1.44415	.875
		Defender	1.10000	1.44415	.900
		Goalkeeper	1.10000	1.44415	.900
	Forward	Mid fielder	-1.20000	1.44415	.875
		Defender	-.10000	1.44415	1.000
		Goalkeeper	-.10000	1.44415	1.000
	Defender	Mid fielder	-1.10000	1.44415	.900
		Forward	.10000	1.44415	1.000
		Goalkeeper	.00000	1.44415	1.000
	Goalkeeper	Mid fielder	-1.10000	1.44415	.900
		Forward	.10000	1.44415	1.000
		Defender	.00000	1.44415	1.000
Agility	Mid fielder	Forward	-.44100	1.27925	.989

		Defender	2.39200	1.27925	.336
		Goalkeeper	-.69000	1.27925	.961
	Forward	Mid fielder	.44100	1.27925	.989
		Defender	2.83300	1.27925	.198
		Goalkeeper	-.24900	1.27925	.998
	Defender	Mid fielder	-2.39200	1.27925	.336
		Forward	-2.83300	1.27925	.198
		Goalkeeper	-3.08200	1.27925	.141
	Goalkeeper	Mid fielder	.69000	1.27925	.961
		Forward	.24900	1.27925	.998
		Defender	3.08200	1.27925	.141
Endurance	Mid fielder	Forward	3.00000	20.55751	.999
		Defender	40.00000	20.55751	.302
		Goalkeeper	24.00000	20.55751	.716
	Forward	Mid fielder	-3.00000	20.55751	.999
		Defender	37.00000	20.55751	.370
		Goalkeeper	21.00000	20.55751	.791
	Defender	Mid fielder	-40.00000	20.55751	.302
		Forward	-37.00000	20.55751	.370
		Goalkeeper	-16.00000	20.55751	.894
	Goalkeeper	Mid fielder	-24.00000	20.55751	.716
		Forward	-21.00000	20.55751	.791
		Defender	16.00000	20.55751	.894
*. The mean difference is significant at the 0.05 level.					

Table no. 4 represents post hoc analysis for selected physical fitness attributes for different playing positions. As above mentioned, significant difference was obtained for speed only, here researcher explored the pair-wise comparison of speed at different playing positions. Forward players had lesser speed mean timing when compared to goalkeeper, mid-fielder, and defender players with mean difference of 1.71, 1.52 and 1.46 respectively.

Discussion on Findings

Given that there is so much competition in hockey these days, the game has become very hard, and the roles of each player at each position are clear. Researchers looked at top hockey players' motor and bodily skills to find out what makes them stand out in relation to their playing position. It was decided that the best way for players to meet the demands of their position is for them to have a good mix of motor fitness traits and bodily traits. The results of this study, which compared the physical health of field hockey players at different places, are listed below, along with a discussion of them.

The speed of forward players was found to be greater to that of other position players, including goalkeepers, defenders, and midfielders, in the data study above. The game of hockey today is all about speed and strength. The forwards must be fast and flexible enough to run fast, stop quickly, turn around quickly, and change direction quickly. The other results of the study reflected that selected females were having no sig. difference among them for shoulder strength, Abdominal Strength, agility and endurance. These results were contrary to Singh, 2020 (Singh, 2020) [9] and Boone *et al*. (2012) [2]

For the forwards, speed is a very important tool. During a match, forward players usually have to run faster, while fullbacks and midfielders have to serve and pass the ball to the forwards. The forward players need to have good speed because they must sprint quickly to turn the ball into a goal and pass their opponents' defense players. Because of these things, the speed of the forward players in Men's Hockey was found to be better than that of the goalkeepers, defenders, and mid-fielders. But because there wasn't any critical literature about the study of speed and positional hockey players, the present study couldn't be compared to it. But in terms of average speed, the results of this study were very similar to those of national players Singh, 2020 [9], Singh, K. and Kumar, R. (2018) [8], Gil, S.M. *et al*. (2007) [3] and Bhalla, Dhruv (2019) [1].

Conclusion

In this study researcher compared female field Hockey players for their playing position i.e., Forward, Mid fielder, Defender and Goalkeeper for selected physical fitness attributes i.e., Shoulder strength, Abdominal strength, speed, agility and endurance. According to the results of one-way analysis of variance only speed variable (0.003, $p<0.05$) was discriminatory among the selected playing position, whereas no significant difference was obtained for Shoulder strength, Abdominal strength, agility, and endurance ((0.103, 0.818, 0.080 and 0.189, $p>0.05$)).

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