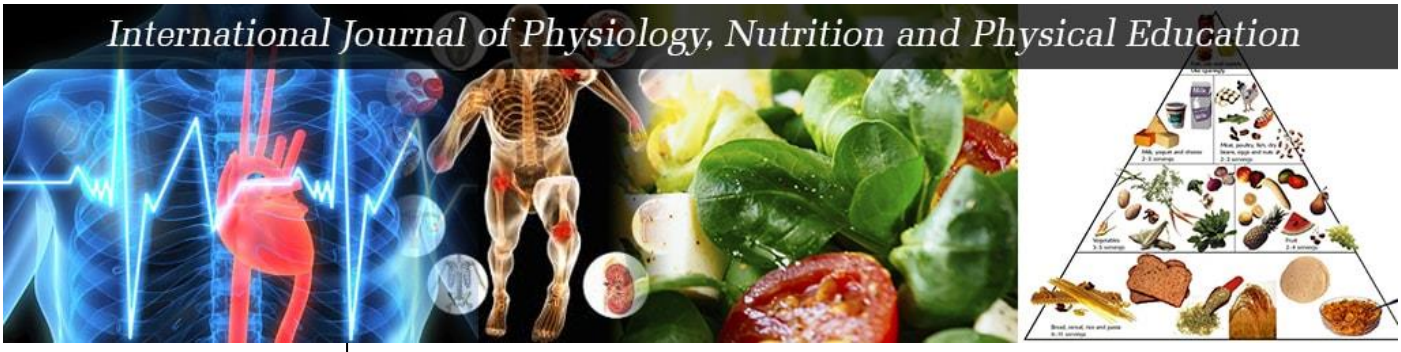

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Rajneesh Kumar
Volleyball Coach, Department of Volleyball, SAI, Netaji Subhas National Institute of Sports, Patiala, Punjab, India

Anuradha Lehri
Assistant Professor, Department of Sports Science, Punjabi University, Patiala, Punjab, India

Simarjeet Singh
Scientific Officer, Department of GTMT, SAI, Netaji Subhas National Institute of Sports, Patiala, Punjab, India

Shivani Sharma
PhD Scholar, Department of Sports Science, Punjabi University, Patiala, Punjab, India

Correspondence
Rajneesh Kumar
Volleyball Coach, Department of Volleyball, SAI, Netaji Subhas National Institute of Sports, Patiala, Punjab, India

12-week training induced effects on selected fitness parameters among field hockey players

Rajneesh Kumar, Anuradha Lehri, Simarjeet Singh and Shivani Sharma

Abstract
The purpose of this study was to assess effect of 12-week training on selected fitness parameters. 28 young field hockey players, were selected for the study. Variables change of direction speed (CODS), maximum speed, shoulder strength, leg strength and flexibility were measured two times with an interval of 12-weeks. Measurements obtained were compared using paired t-test to assess the effects of training. The level of significance was set at 0.05. Results shows that shoulder strength, maximum speed and leg strength found to be statistically significant at $p < .01$ while flexibility found to be statistically significant at $p < .05$. No statistically significant difference was found in case of CODS. It was concluded that selected training programme is proficient to develop general fitness of the players and can be used by the coaches. For improvement in CODS skill specific training alongside speed and strength training is necessary.

Keywords: Field hockey, physical fitness, strength, speed, cods, fitness training

Introduction
Field hockey is one of the successful team sport and popular among both men and women categories at all levels ranging from youth, junior and professional [1]. This game incorporates repeated physical contact, extended moderate intensity running and intensive bouts of sprints including jogging [2]. High level of physical demands are imposed on the players during the match [1].

Field hockey players need to be highly conditioned to tackle specific demands of the game such as moderate intensity running for long duration, repeated high intensity sprints and techno-tactical execution [3]. From a physiological point of view, field hockey is a game which require high level of aerobic and anaerobic fitness [4, 5]. Field hockey players must be proficient in producing energy rapidly and able to recover quickly from the physiological load exerted on them during training and competition. Consequently, both the aerobic and the anaerobic systems must be well developed to enable the player to perform maximally and recover quickly [6]. Relevant studies show that field hockey players entail significant level of cardiorespiratory fitness, muscular endurance, strength and power [7].

With the changes in playing surface (grassy ground to Astroturf surface) the technical, tactical and physiological demands of the game has been changed [8]. In order to adapt to imposed demands the players have to develop physiological qualities [7]. Success at highest level in sport with high physiological demands like hockey, may be determined by the body composition of the player to some extent [9, 10]. However, only physical composition cannot be considered as a sole determinant for the success at higher level. As training of a player is a complex and multidimensional process and it requires high level of physical and physiological qualities and techno-tactical efficiency [11].

Physical training has positive effects on the sports performance [8] and the purpose of this study was to determine if and to what extent the physical fitness parameters change after 12-week training in preparatory phase among young field hockey players.

Methodology
Experimental Design
Young Field hockey players undergoing regular training were selected and change of direction speed (CODS), maximum speed, shoulder strength, leg strength and flexibility were measured

in the initial phase of the preparatory period (PP-2). These variables were tested again after the 12-week of training and measurements obtained were compared with each other to assess the improvements resulted by selected training programme.

Subjects

Total 28 male young field hockey players (decimal age 14.89±1.66-year, height 168.28±7.52cm and weight 54.91±8.59kg), were selected for the study. All the selected subjects were undergoing regular training at Netaji Subhas National Institute of Sports, Patiala. All the subjects were physically fit and voluntarily consented to participate in the study.

Training Protocol

Subjects were trained for 12 weeks under carefully controlled and monitored conditions. Players undergo 120 minutes of training in morning and evening (including warm-up and cool down) with a total of 11 sessions per week. Before each session, students were performed warm-up activities for 20 minutes which consist of self-assisted static mild stretching exercises, walking, jogging and running and at last dynamic stretching exercises. Subjects participated in above 95% training sessions and no injury took place during this phase. Weekly training programme for fitness training is presented in table 1.

Table 1: Weekly training program for 12-week training of field hockey players.

Days/Week	Mon		Tue		Wed		Thu		Fri		Sat	
Session	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
Time	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min
Strength		*				REST	*					*
Endurance					*				*			
Speed	*			*				*			*	
Flexibility	*				*					*		
Coordination			*					*		*		

To develop strength both upper and lower body exercises were used. Detailed description of training programme adopted to develop strength has been presented in table 2. After general warm up, first 15 minutes of each strength training session included specific warm up exercises with a light load. Subjects performed one set of five repetitions on each exercise. To develop aerobic endurance, slow continuous method was used in initial 6 micro cycles and varied pace method was adopted for last 6 micro cycles [11]. To develop speed repetition method was used and 6-8 liner sprints of 50-60meter were performed with maximal intensity. To develop flexibility slow stretch and hold method was used and exercises were selected for all the major muscles of the body. To develop coordination, ladder drills, Multidirectional movements and agility drills with and without ball were performed.

Table 2: Training program adopted to develop strength.

Exercises	Week 1-4		Week 5-8		Week 9-12	
	Repetition	Set	Repetition	Set	Repetition	Set
Bench Press	12 RM	5	10 RM	4	8 RM	3
Shoulder Press	12 RM	5	10 RM	4	8 RM	3
Back-half Squat	12 RM	5	10 RM	4	8 RM	3
Burpee Jumps	10	4	12	4	15	4
Dead Lift	12 RM	5	10 RM	4	8 RM	3

RM – Repetition maximum

Anthropometric measurement

Apart from the selected physical fitness parameters height and weight of the subjects were also measured. Height of the subjects were measured using standardized Anthropometer (GPM-100) with an accuracy of 0.001 m, and body mass measurements were made on a standardized weighing scale (Omron HN-286) with an accuracy of 0.01kg.

Fitness assessment

To assess selected fitness variables i.e. change of direction speed, shoulder strength, maximum speed, leg strength and flexibility; 6×10m shuttle run, mini basketball throw, 30m run test (flying start), vertical jump test and forward bend & reach tests were selected respectively. Selected tests were adopted from Sports Authority of India National Sports Talent Contest Schemes [12] and SAI Test Battery for the Talent Identification [13]. These tests are used for the selection, retention and weeding out of trainees in various schemes of SAI.

Measurement protocol

Selected fitness parameters were tested two times with an interval of 12-weeks. The first testing was carried out in the first micro-cycle of preparatory phase two (PP-2). To avoid the diurnal effects, the tests conducted during pre and post testing were scheduled at the same time of the day (± 60 minutes). Subjects were explained and demonstrated the exact procedure of each test and proper time was given for warm up. Optimal recovery time was given between the tests to avoid the effects of fatigue on the test performance. Before each testing, subjects were instructed to; not to use caffeinated drinks before 4 hours, not to undergo rigorous physical training for 12 hours, to avoid heavy food before testing, to sleep for 08 hours and to maintain optimal hydration level during testing.

Statistical tools

Descriptive statistical tests Mean and Standard Deviation were calculated and paired t-test was applied to determine effects of 12-week training on selected physical fitness variables. The level of significance was set at 0.05 and data were analysed using Statistical Package for Social Sciences (IBM SPSS) version 23.

Results and discussion

Mean and standard deviation values of first and second testing of CODS, shoulder strength, maximum speed, leg strength and flexibility; and their mean difference has been presented in table 3.

Table 3: Mean, SD and Mean Difference of First and Second Testing

Variable	N	First Testing	Second Testing	Mean Difference
		Mean ± SD	Mean ± SD	
CODS (sec)	28	14.88±.489	14.73±.572	0.15
Shoulder Strength (m)	28	7.72±1.31	8.25±1.30	-0.53
Maximum Speed (sec)	28	3.99±.232	3.85±.232	0.14
Leg Strength (cm)	28	38.34±12.50	47.36±6.96	-9.02
Flexibility (cm)	28	12.98±4.25	13.54±4.40	-0.56

Mean differences among variables shows difference in results of first and second testing. It indicates positive effect of 12-week training. However, to assess whether these changes were statistically significant or not 't' values were calculated. Table 4 shows the paired differences of mean, SD and 't' values of selected fitness variables. The't' values of Change of direction speed, shoulder strength, maximum speed, leg strength and flexibility were 1.56, -5.52, 6.70, 4.20 and -2.11 respectively.

Table 4: Paired differences of Mean, SD and't' values of selected variables

Variables	Paired Differences		't' value
	Mean	SD	
Shoulder Strength (mtr.)	-.525	.503	-5.52**
Leg Strength (cm.)	-9.02	11.36	-4.20**
Maximum Speed (sec.)	.139	.110	6.70**
Flexibility (cm.)	-.554	1.39	-2.11*
CODS (sec.)	.150	.509	1.56

** Significant at $p < 0.01$ ('t' value at DF 27 = 2.77)
* Significant at $p < 0.05$ ('t' value at DF 27 = 2.05)

In case of shoulder strength (t = -5.52) and leg strength (t = -4.20) results found to be statistically significant at p<.01. It indicates that with 12-week of training, both upper and lower body strength has improved. These results are supported by several studies [14, 15]. The jumping ability is an end product of shoulder, trunk and leg strength. A significant improvement in jumping ability (vertical jump) may be the outcome of increased shoulder and leg strength. Variable maximum speed (t = 6.70) was also found statistically significant at p<.01. Several studies supported the results [14, 16, 17]. Studies shows that strength and power has positive effects on the liner speed [11, 15] and it is also influenced by hamstring flexibility [18, 19]. Therefore, the reason behind improvement in maximum speed may be the improvement in shoulder strength, leg strength and flexibility of hamstring muscle group. In case of flexibility (t=-2.11) result was found statistically significant at p<.05 which shows that flexibility has improved to a significant level. The result was supported by previous studies [14]. Contrary to the previous studies [14, 20, 21] no significant improvement has been observed in change of direction speed (t = 1.56). Only one study with similar results was found [14]. The reason behind this may be the training means and methods adopted during training. Liner speed has influence on the development of change of direction speed but only developing liner speed is not sufficient. The change of direction speed is dominated by skill and technique, therefore, training of CODS should involve skill and movement specific activities [22].

Conclusion

The purpose of this was to investigate effect of 12-week training among young field hockey players. Based on the results of this study highly significant improvement has been seen in shoulder strength, leg strength and maximum speed ability. While in the case of flexibility desired improvements has been observed. With selected training programme no improvement has been seen in variable Change of direction speed (CODS).

Practical applications and recommendation

The results of the study show that 12-week training improves physical fitness of players to a desired level. Therefore, during the pre-competition phase, coaches can use selected training programme to improve general physical fitness of their trainees. Field hockey player's display significant improvement in upper and lower body strength which depicts that training programme selected for the development of strength is acceptable can be used by the coaches to develop strength of players of similar age. Though speed and strength have direct relationship with Change of direction speed, but training specific to the task is needed for the improvement in CODS. At the same time authors would like to recommend that similar studies with more number of subjects and more variables can be conducted to explore training-induced adaptations in young players.

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