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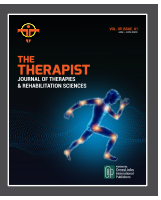

Original Article

Comparative Analysis of Speed Endurance Production and Maintenance Drills: A Study on Enhancing Performance in Hockey Players

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ABSTRACT

Hockey features a variety of high-intensity motions that cause tiredness during the most intense moments of play. During these gaming phases, anaerobic energy turnover and muscular activation are significant, which may exhaust the physiological mechanisms that fight tiredness. **Objective:** To determine the effects of speed endurance production and speed endurance maintenance drills on hockey players. **Methods:** A quasi-experimental study was conducted at Gojra hockey club, Gojra. Total sample size was 60 male healthy field hockey players. Participants were selected by sealed envelope method and divided into Group A (speed endurance production) and Group B (speed endurance maintenance). Speed endurance production group received very high intensity training around 30 seconds exercise interval time followed by 2-3 minutes rest period to guarantee sufficient recovery time. Speed endurance maintenance training group involve small side games in 30-60 sec similar recovery time. The data were analysed using SPSS 23.0. **Results:** The age of participants with mean± SD was 21.60 ± 4.6. SEP and SEM techniques were applied in both groups. The result shows significant effect with ($p<0.05$) in all respective tests: 50-meter, 400-meter, yo-yo distance and yo-yo Intermittent Recovery 2 and non-significant with ($p>0.05$) in 100-meter, 200-meter and fatigue index test in between group analysis. It shows statistically significant effect within groups. **Conclusions:** Study concluded that speed endurance production and speed endurance maintenance is effective in improving intermittent exercise capacity and fatigue index in both groups.

INTRODUCTION

Hockey is national game of Pakistan and standout amongst the most famous games in Pakistan. The Pakistan national field hockey group is maintained and run by the Pakistan Hockey Federation (PHF), the representing body for hockey in Pakistan [1]. Hockey is described by high power discontinuous movements and quick changes in speed and span also, visit body contact. The hockey player performs a game of at least 15 minutes in which vigorous move with ball performed to get goal. Each move keeps going from 4 to 90 seconds with at least five minutes of recuperation and breaks in between the game [2, 3]. The extreme force screams entail the hockey player to create muscle quality

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control also, anaerobic perseverance. Physical attributes of world class players demonstrate that the goal keeper are always having more height and weight as compared to other players of the team than advances ostensibly because of positional requests. The players of hockey are always having a specific body type. They are having lean body as for hockey players having more weight can disturb their capabilities to perform the game and skating skills can be disturbed [4, 5]. Physiological profiles of tip top hockey groups uncover the significance of oxygen consuming perseverance anaerobic power and perseverance strong quality and skating speed. During the hockey play demonstrates picks up in anaerobic perseverance however there is no alteration in oxygen consuming perseverance [6, 7]. Despite the fact that a comprehension of the hidden energetics is vital from an examination viewpoint, professionals are more intrigued by the basic relationship between entrenched field wellness and then again execution tests [8]. Irregular trainings for a time period of 5 to 10 minutes leads to almost 80 to 90% of HRmax includes a noteworthy which leads to an increase in the transport of oxygen to the important parts of body. During preparing the power, the change in the maximum uptake of oxygen occurs almost 20 to 35% and it continues till 5 to 12 weeks, with singular varieties because of starting level of wellness, span and recurrence of training. When preparing it at a decreased force of 50 to 70%, just an 8– 12% expansion in the oxygen uptake seen in already stationary investigation [9]. The respiratory endurance of muscles and heart continuance have for quite some time been perceived as one of the central segments of physical wellness. Since aggregation of lactic corrosive is related with skeletal muscle weariness, anaerobic digestion can't participate at a measurable noteworthy value to the vitality used [6, 10]. Several studies have found differences in total oxygen consumption among distinct types during tasks conducted at optimal processing speed. The reasons for this changeability are not surely knew, but rather it appears to be related to the anatomy attribute, mechanically expertise, involvement of nerves and muscles aptitude and capacity of flexible vitality are imperative. The present economy regularly characterized as the enduring position in which maximum oxygen intake speed or as vitality as the running of it per meter cost (mLkg-1m-1) [11, 12]. The discovered qualities for hockey players were 10– 16% less than for centre separation sprinters. Hockey players have around 25% more than ball players and sprinters. Additionally, Hungarian world class hockey players have 20 to 32% larger amount of less oxygen consumption-coordinated access gathering. One issue with such estimations is their restricted pertinence to the dashing and hazardous developments of soccer. Anaerobic execution assessment as far as hockey-particular field tests may be the most ideal approach for the hockey players [12-14]. In this study, a critical gap was identified in understanding the impact of different training methods on hockey players' fatigue management and energy utilization. This research filled this gap by objectively evaluating and comparing the effects of speed endurance production and maintenance drills on players' performance. The significance of the study lies in its potential to inform optimized training strategies, enhancing players' performance during high-intensity periods of play.

METHODS

It was a quasi-experimental study. This research was carried out at the Gojra hockey club. The investigation lasted six months. A total of 60 players were recruited for this study and assigned to two groups of 30 hockey players each. Sample size was calculated through open Epitool calculator by comparing the means. For sample selection, convenience sampling with randomization was used in two groups: group A and group B. The study's inclusion criteria were male hockey players aged 16 to 30 who were registered with the club and had attended at least two training sessions per week for the previous three months. Exclusion criteria included any G-II or higher strain, sprain, fracture, or dislocation in the previous three months, as well as any major neuro-musculoskeletal or cardiovascular pathology. Prior to the intervention, players worked out four times per week and played a full-length game. They held three weekly sessions (Monday, Wednesday, and Friday) during the training intervention period. All training sessions were 90 minutes long and included both warm-up and technical/tactical skill development, with the exception of the last 20 minutes, when the habitual conditioning part (i.e. aerobic high-intensity, strength, or speed/agility drills) was replaced by speed endurance training. All SEM and SEP training sessions were held on artificial turf and were closely monitored. The participants were subjected to three and five repetitions, respectively, during the first and second sessions. The players did six to eight repetitions beginning with the third. During the 8-week intervention period, participants completed three speed endurance sessions per week (all with 100% compliance). Aside from the one prescribed in the hockey environment, no other physical exercise was performed. To minimise any potential interference from external variables, the players maintained their normal lifestyle and food intake in the weeks preceding the intervention phase, which lasted eight weeks. Both groups were tested at the beginning and end of the eight-week intervention period. All of the players underwent physical fitness tests, which were conducted by the same staff, at the same time, on the

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same hockey pitch, and under the same conditions. Each test was run twice per session, with the best reading used for analysis. During matches and training sessions, the respective coaches would report on injuries and the players' participation. One medical physician and one physical therapist at the medical centre were unaware of the group assignment. Outcome measures of the study were 50-meter run, 100-meter run, 200-meter run, 400-meter run, F=fatigue index test and YOYO fitness tests (Aerobic fitness). 50-meter run, 100-meter run, 200-meter run and 400-meter run tests determine acceleration, maximum running speed, and speed endurance based on the distance run. The test consists of a single maximum sprint over a predetermined distance, with time recorded. Following a standardised warm-up, the test is performed over a specific distance, such as 100, 200, 400, or yards, depending on the sport and what you are attempting to measure. The fatigue index measures anaerobic capability, also known as endurance. It is the rate at which each athlete's power falls; in other words, it represents the rate at which you tyre when sprinting. The running-based anaerobic sprint test (or RAST) for fatigue index combines statistics from six sprints, using your maximum power and the statistics from your best sprint (your minimum power), the statistics from your slowest sprint, and the average of your sprints to arrive at a figure in watts per second. The higher your tiredness index, the less likely you are to retain power during a series of sprints. The Yo-Yo Intermittent Tests are identical to the Yo-Yo Endurance Test (a version of the beep test), except that subjects in the intermittent tests take a brief active break (5 and 10 seconds for the sporadic endurance and intermittent recovery tests, respectively). Each Yo-Yo Intermittent Test comes in two variants: beginner Level 1 and advanced Level 2. Team Beep Test software may be used to execute the Yo-Yo tests. All analyses were carried out using SPSS software (version 23.0, SPSS Inc). The data's normality was determined. A paired t-test was used to examine the difference between the interventional and control groups' prior and post intervention results, and an independent t-test was used to evaluate the difference between the interventional and control groups' pre and post intervention results. A value of p< 0.05 score was deemed statistically significant. All ethical concerns were taken into account. Informed consent forms were signed by all study participants prior to data collection. The dignity and privacy of all participants were prioritized.

RESULTS

The mean age of the participants with standard deviation was 21.17±2.53. Between group analyses were done through independent test. Table 1 showed mean values of 100m Run test, 50m run, YOYO Distance test, YOYO VO2Max, two hundred meter run test and fatigue index for SEP and SEM at 8th week. The p value (p<0.05) shows a significant difference between both groups except for 200m run and fatigue index.

Table 1: Between group analysis (Independent t-test)

Variables		Mean ± SD	p-value
100m run 8th week	SEP	15.17 ± 0.56	<0.05
	SEM	13.80 ± 0.44	
50m run 8th week	SEP	7.06 ± 0.38	0.028
	SEM	6.92 ± 0.20	
YOYO distance 8th week	SEP	572.00 ± 85.19	0.001
	SEM	460.00 ± 85.59	
YOYO Vo2max week 8th	SEP	41.20 ± 0.71	<0.001
	SEM	40.26 ± 0.71	
200m run week 8th	SEP	27.53 ± 0.58	0.834
	SEM	27.59 ± 0.91	
Fatigue index 8th week	SEP	84.10 ± 2.44	0.178
	SEM	82.30 ± 3.92	

SEP = Speed endurance production
SEM = Speed endurance maintenance

Table 2 shows the results of Mann-Whitney test for table shows YoYo level, 400m run at 8th week. The p-value (p<0.05) shows a significant difference in both groups (Table 2).

Table 2: Between group analyses (Mann-Whitney Test)

Variables		Median (IQR)	Mean Rank	p-value
YOYOIR2 level 8th week	SEP	0.9	26.70	0.001
	SEM		14.30	
400m run 8th week	SEP	0.27	15.20	0.004
	SEM		25.80	

SEP = Speed endurance production
SEM = Speed endurance maintenance

Within Group analysis was done by using Paired t-test. Table 3 shows the mean and S.D of pre and post SEP and SEM of 100m Run test, 50m run, YOYO Distance test, YOYO VO2Max, two hundred meter run test and fatigue index at baseline and after 8 weeks. There was significant difference in pre and post values with p<0.05 (Table 3).

Table 3: Within group analysis (paired t-test)

Variables		Mean ± SD	p-value
50m	Pre SEP	8.6± 0.27	0.002
	Post SEP	7.06 ± 0.38	
	Pre SEM	7.31 ± 0.21	0.022
	Post SEM	6.92 ± 0.20	
100m	Pre SEP	16.76 ± 0.41	<0.001
	Post SEP	15.71 ± 0.56	
	Pre SEM	14.64 ± 0.41	<0.001
	Post SEM	13.80 ± 0.44	

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200m	Pre SEP	30.11 ± 0.80	<0.001
	Post SEP	27.53 ± 0.58	
	Pre SEM	29.30 ± 0.83	<0.001
	Post SEM	27.59 ± 0.91	
YOYO distance	Pre SEP	348 ± 90.93	-<0.001
	Post SEP	572.0 ± 85.19	
	Pre SEM	272.0 ± 65.66	< 0.001
	Post SEM	460.0 ± 85.59	
YOYO VO2 max	Pre SEP	39.34 ± 0.74	<0.001
	Post SEP	41.20 ± 0.71	
	Pre SEM	38.68 ± 0.55	< 0.001
	Post SEM	40.26 ± 0.71	
Fatigue index	Pre SEP	67.15 ± 4.35	<0.001
	Post SEP	84.10 ± 2.44	
	Pre SEM	67.70 ± 4.41	< 0.001
	Post SEM	82.30 ± 3.92	

SEP = Speed endurance production
SEM = Speed endurance maintenance

Table 4 shows the median of pre and post SEM of 400 meter run rate and YOYO level. There was significant difference in pre and post values with p<0.05.

Table 4: Within group analysis (Wilcoxon Test)

Variables		Median (IQR)	p-value
400 meter run test	Pre SEP	0.35	<0.001
	Post SEP	0.27	
	Pre SEM	0.36	<0.001
	Post SEM	0.27	
YOYO level	Pre SEP	1.1	<0.001
	Post SEP	1.32	
	Pre SEM	1.0	<0.001
	Post SEM	1.25	

SEP = Speed endurance production
SEM = Speed endurance maintenance

Figure Shows the Pre and Post Training on 50 Meter Run among the Group.

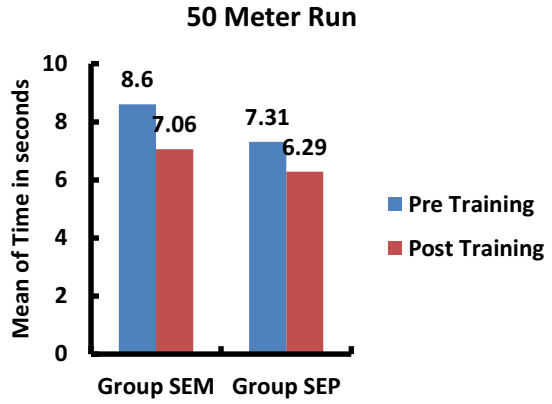

Figure 1: Pre and Post Training on 50 Meter Run among the Group

Figure 2 Shows the Pre and Post Training on 100 Meter Run among the Group.

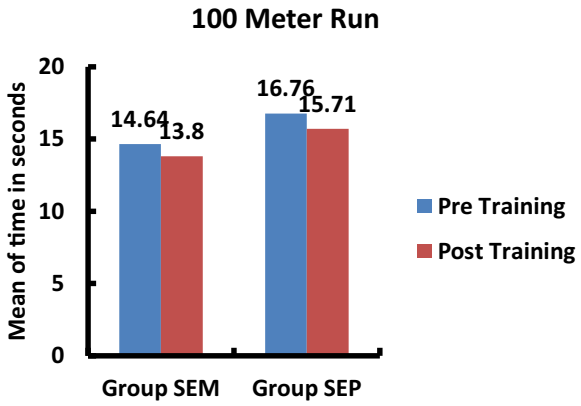

Figure 2: Pre and Post Training on 100 Meter Run among the Group

Figure 3 shows the Pre and Post Training on 200 Meter Run among the Group.

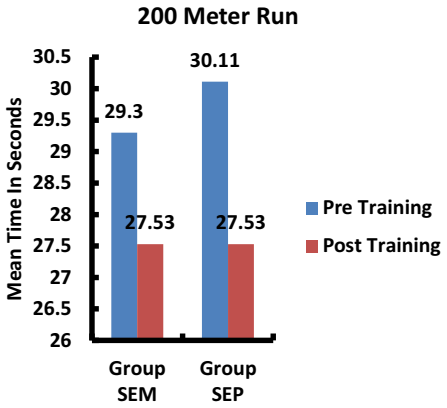

Figure 3: Pre and Post Training on 200 Meter Run among the Group

Figure 4 shows the Pre and Post Training on YoYo Distance among the Group

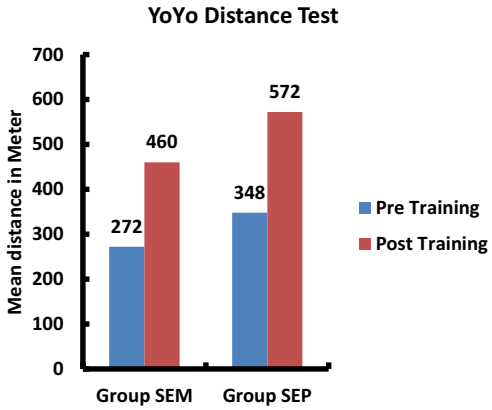

Figure 4: Pre and Post Training on YoYo Distance among the Group

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Figure 5 shows the Pre and Post Training on Fatigue Index among the Group.

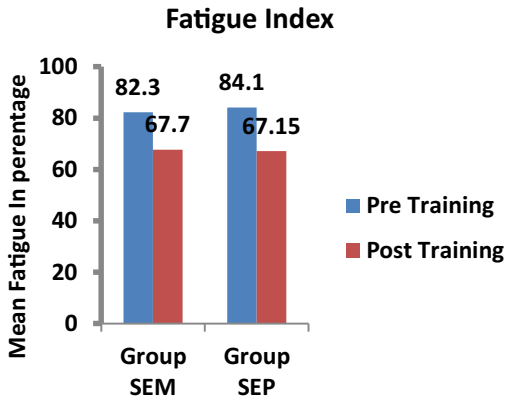

Figure 5: Pre and Post Training on Fatigue Index among the Group

DISCUSSION

The objective of the study was to determine the effects of speed endurance production and speed endurance maintenance drills on hockey players. The mean age of the participants with standard deviation was 21.17 ± 2.53. The results of the study revealed the p value ($p<0.05$) and shows a significant difference in 100m Run test, 50m run, YOYO Distance test, YOYO VO2Max, YoYo level and 400m run in both groups except for 200m run and fatigue index which showed a significant difference $p>0.05$. The 50-meter run performed in players to access their efficiency for the speed endurance production and speed endurance maintenance. Results showed positive speed endurance production and speed endurance maintenance. The results are in line with the findings of a previous research [15]. The results obtained for 10- meter test shows resemblance with the earlier studies done on it for hockey players. 15. Delextrat et al., shows positive trend in the speed endurance production and speed endurance maintenance. They test hockey players for 80-meter test and it comes to be 16.99 ± 0.49. This increasing trend is significant and correlate with findings of my results. Bangsbo et al., finds the positive trend in players run for 80 meter to access the speed endurance production and speed endurance maintenance [16]. This increasing trend was found correlated with present research parameters [17]. The 200-meter run performed in players to access their efficiency for the speed endurance production and speed endurance maintenance. The results show positive trends in speed endurance production and speed endurance maintenance for 200 meter run in both groups. The results obtained for 200-meter test shows resemblance with the earlier studies done on it for hockey players. Fiorenza et al., shows positive trend in the speed endurance production and speed endurance maintenance [18]. They test hockey players for 200-meter test and it comes to be 25.95 ± 0.99. This increasing trend is significant and correlate with findings of present results. The 400-meter run performed in players to access their efficiency for the speed endurance production and speed endurance maintenance. The positive trend for the value of 400-meter run is present. The results obtained for 400-meter test shows resemblance with the earlier studies done on it for hockey players. laia et al., shows positive trend in the speed endurance production and speed endurance maintenance. They test hockey players for 400-meter test and it comes to be 26.99 ± 0.32. This positive trend is significant and correlate with findings of present results [19]. In present study, the results show positive trends in speed endurance production and speed endurance maintenance for Fatigue Index test in both groups. The results obtained for fatigue index test shows resemblance with the earlier studies done on it for hockey players. Jensen et al., shows positive trend in the speed endurance production and speed endurance maintenance. They test hockey players for fatigue index test and it comes to be 72.59 ± 0.23. This increasing trend is significant and correlate with findings of present results [20]. The YO-YO level test performed in players to access their efficiency for the speed endurance production and speed endurance maintenance. The positive trend found in SEM group for the YO-YO level test. The results obtained for YOYO test shows resemblance with the earlier studies done on it for hockey players. They test hockey players for YOYO test and it comes to be 13.59±0.69. This increasing trend is significant and correlate with findings of present results. Positive trend in players run for YOYO test to access the speed endurance production and speed endurance maintenance was found in a study which correlated with current research parameters [19].

CONCLUSIONS

In conclusion, the study's findings showed that both speed endurance production (SEP) and speed endurance maintenance (SEM) training approaches significantly improve intermittent exercise capacity and fatigue index among hockey players. These improvements were observed in both groups, suggesting the efficiency of each training strategy in improving players' physical performance during high-intensity periods of play.

Authors Contribution

Conceptualization: AK, SHA
Methodology: MK
Formal analysis: HA
Writing-review and editing: TG, QA, HABA, MHR,

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All authors have read and agreed to the published version of the manuscript.

Conflicts of Interest

The authors declare no conflict of interest

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