

# Impact of Treadmill and Resistance Training Packages on Selected Motor Fitness Components and Performance Variables among Hockey Players

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DOI: <https://doi.org/10.36348/jaspe.2026.v09i04.001>

| Received: 04.02.2026 | Accepted: 28.03.2026 | Published: 01.04.2026

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## Abstract

The present study examined the impact of treadmill and resistance training packages on selected motor fitness components and skill performance variables among hockey players. A pre-test and post-test randomized group design was employed. Forty-five male hockey players (aged group 19–25 years) were selected from affiliated colleges of Bharathidasan University, Tiruchirappalli, Tamilnadu, India. They were randomly assigned into three groups: group I Treadmill Training Group (TTG), group II Resistance Training Group (RTG) and group III Control Group (CG), with fifteen participants in each group. The TTG and RTG underwent their respective training interventions on alternate days for twelve weeks, while the control group followed their regular academic routine without additional training. Motor fitness variables such as cardiovascular endurance and agility, along with performance variables including stick control and passing accuracy, were assessed. Statistical analysis was conducted by using paired sample t-tests and analysis of covariance (ANCOVA) at a 0.05 level of significance. The results revealed significant improvements ( $p \leq .05$ ) in all selected motor fitness and performance variables for both experimental groups compared to the control group. The findings indicate that treadmill training and resistance training packages are effective methods for enhancing physical fitness and skill performance among university hockey players.

**Keywords:** Treadmill Training, Resistance Training, Motor Fitness and Skill Performance.

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## INTRODUCTION

Field hockey is a physically demanding team sport requiring a high level of motor fitness, technical proficiency and physiological efficiency. Players are required to perform repeated high-intensity movements such as sprinting, rapid directional changes, tackling and stick handling throughout the match. Consequently, structured conditioning programs focusing on aerobic capacity, muscular strength, agility and sport-specific skills are essential for optimal performance (Bompa & Buzzichelli, 2019).

According to the International Hockey Federation (FIH), "the roots of hockey are buried deep in antiquity. There are historical records which suggest early forms of hockey were played in Egypt and Persia c. 2000 BC and in Ethiopia c. 1000 BC. Later evidence

suggests that the ancient Greeks, Romans and Aztecs all played hockey-like games. In Ancient Egypt, there is a depiction of two figures playing with sticks and ball in the Beni Hasan tomb of Khety, an administrator of Dynasty. In East Asia, a similar game was entertained, using a carved wooden stick and ball, prior to 300 BC. In Inner Mongolia, China, the Daur people have for about 1,000 years been playing beikou, a game with some similarities to field hockey. A similar field hockey or ground billiards variant, called suigan, was played in China during the Ming dynasty, post-dating the Mongol-led Yuan dynasty. A game similar to field hockey was played in the 17th century in Punjab state in India under name refers to the woolen ball, and khundi to the stick. In South America, most specifically in Chile, the local natives of the 16th century used to play a game called which also shares common elements with hockey (Chetwynd, 2018). Treadmill training has been widely

used to enhance aerobic endurance, running economy, and cardiovascular efficiency through controlled intensity and progressive overload. Similarly, resistance training is recognized as an effective method for improving muscular strength, power, neuromuscular coordination, and injury prevention in athletes (Brown & Ferrigno, 2015). Despite substantial evidence supporting these training modalities independently, limited research has directly compared the effects of treadmill and resistance training packages on combined motor fitness and skill performance variables among hockey players (Cormie, *et al.*, 2011). Therefore, the present study aimed to address this research gap. The treadmill training provides a structured aerobic workout, enabling athletes to maintain consistent running speed and monitor intensity through controlled settings (Helgerud, *et al.*, 2001). It enhances aerobic endurance, running economy, and cardiorespiratory efficiency. Progressive overload on the treadmill helps improve the players' recovery between sprints and increases overall stamina, the treadmill has the advantages of ease running or walking and of positioning so as to obtain various cardio pulmonary measures reported that treadmill-based aerobic training significantly improved cardiovascular endurance, oxygen uptake and recovery efficiency among field sport athletes (Longo, *et al.*, 2022 and Kraemer & Ratamess, 2004). In the field of fitness and exercise science, resistance technology represents an innovative advancement in equipment design. It utilizes a smooth, resistance-based movement that offers a low impact, weight-bearing form of exercise that is both engaging and easy to learn (Sheppard & Young, 2006 and Koca & Revan, 2023). The primary distinction of resistance exercise machines lies in their design while

users remain standing and bearing weight which is vital for improving bone density, their feet do not leave the footpads. Consequently, unlike traditional treadmill running or jogging, these exercises minimize stress on joints and muscles, providing a comprehensive, low impact, total body workout (Asaithambi, *et al.*, 2012).

## MATERIALS AND METHODS

To achieve this purpose of the study to find out the impact of treadmill and resistance training on selected motor fitness components and performances variables among hockey players, to achieve the purpose of forty-five hockey players were randomly selected from affiliated colleges of Bharathidasan University, Tiruchirappalli, Tamil Nadu and their group aged between 19–25 years. The selected players were assigned into three groups. Group I - Treadmill Training Group (TTG), Group II - Resistance Training Group (RTG) and Group III acted as Control Group (CG), with fifteen participants in each group. The experimental groups underwent structured training programs for six weeks on alternate days while the control group followed their regular academic routine without additional training. Motor fitness variables such as cardiovascular endurance and agility along with performance variables including stick control and passing accuracy, were assessed with session durations ranging from 60 to 90 minutes for a period of twelve weeks. Pre-and post-tests were conducted on selected motor fitness and performance variables. The collected data were analyzed using paired sample t-tests and ANCOVA to determine the effectiveness of the training interventions.

**Table 1: Selection of Test Items**

S. No.	Parameters	Tests	Unit
<b>Motor Components and Performance Variables</b>			
1.	Agility	Illinois Agility Test	In Seconds
2.	Cardio Vascular Endurance	Yo-Yo Intermittent Recovery Test	In Meters
3.	Stick Control	Dribbling Time Test	In Points
4.	Passing Accuracy	Target Passing Test	In Counts

## RESULTS

The influence of independent variables on each criterion variables were analyzed and presented below,

the analysis of paired sample 't' test on the data obtained for the agility of the pre-test and post-test means of the treadmill training, resistances training and control groups have been analyzed and presented in table 2.

**Table 2: The Summary of Mean and Paired Sample 't'-Test for the Pre and Post Tests on Motor fitness and Performance Variables of Treadmill Training, Resistances Training and Control Groups**

Variables	Groups	Pre-test Mean	Post-test Mean	't' test
Agility	TTG	19.64	17.39	12.19*
	RTG	19.57	18.53	8.01*
	CG	19.69	19.65	0.87
Cardiovascular Endurance	TTG	2021.28	2358.11	12.58*
	RTG	2045.39	2264.29	16.31*
	CG	2019.24	2028.47	1.24
Stick Control	TTG	5.06	6.87	11.45*
	RTG	5.11	6.04	6.80*

Variables	Groups	Pre-test Mean	Post-test Mean	't' test
	CG	5.09	5.13	0.39
Passing Accuracy	TTG	6.84	8.09	11.26*
	RTG	6.71	7.86	10.01*
	CG	6.79	6.95	0.37

\*Significant at 0.05 level table value with df 14 was 2.145.

Table 2 shows the mean values and paired sample t-test results for selected motor fitness and performance variables of the treadmill training group (TTG), resistance training group (RTG), and control group (CG). For agility, both experimental groups showed a significant improvement from pre-test to post-test. The TTG demonstrated a substantial reduction in mean agility time from 19.64 to 17.39 seconds ( $t = 12.19$ ,  $p < 0.05$ ), while the RTG also showed a significant improvement from 19.57 to 18.53 seconds ( $t = 8.01$ ,  $p < 0.05$ ). In contrast, the control group showed no significant change ( $t = 0.87$ ).

In terms of cardiovascular endurance, significant improvements were observed in both experimental groups. The TTG increased from 2021.28 m to 2358.11 m ( $t = 12.58$ ,  $p < 0.05$ ), whereas the RTG improved from 2045.39 m to 2264.29 m ( $t = 16.31$ ,  $p < 0.05$ ). The control group did not exhibit a significant improvement ( $t = 1.24$ ). For stick control, the post-test mean values of both TTG and RTG were significantly

higher than their respective pre-test means. The TTG improved from 5.06 to 6.87 seconds ( $t = 11.45$ ,  $p < 0.05$ ), and the RTG improved from 5.11 to 6.04 seconds ( $t = 6.80$ ,  $p < 0.05$ ). However, the control group showed no statistically significant change ( $t = 0.39$ ). Similarly, passing accuracy showed significant enhancement in the experimental groups. The TTG improved from a mean score of 6.84 to 8.09 ( $t = 11.26$ ,  $p < 0.05$ ), and the RTG improved from 6.71 to 7.86 ( $t = 10.01$ ,  $p < 0.05$ ). The control group did not demonstrate any significant improvement ( $t = 0.37$ ). Overall, the findings clearly indicate that both treadmill training and resistance training packages produced significant improvements in agility, cardiovascular endurance, stick control, and passing accuracy among university hockey players, whereas no significant changes were observed in the control group. This confirms the effectiveness of structured treadmill and resistance training interventions in enhancing motor fitness and skill performance variables in hockey players.

**Table 3: Summary of Adjusted Post-Test and F Ratio Tests on Selected Motor fitness and Performance Variables of Treadmill Training, Resistance Training and Control Groups**

Component	Adjusted Post-test Mean Values			SV	SS	df	MS	F
	TTG	RTG	CG					
Agility	17.35	18.54	19.63	BG	55.78	2	27.89	<b>20.81*</b>
				WG	54.94	41	1.34	
Cardiovascular Endurance	2383.44	2291.35	2057.18	BG	1010046.56	2	505023.28	<b>55.29*</b>
				WG	374497.28	41	9134.08	
Stick control	6.92	6.09	5.14	BG	28.92	2	14.46	<b>19.02*</b>
				WG	31.16	41	0.76	
Passing Accuracy	8.14	7.89	6.83	BG	6.84	2	3.42	<b>51.04*</b>
				WG	2.75	41	0.067	

\*Significant at 0.05 level ( $F = 2.145$ ). (The table value required for a significant difference with df 14 at 0.05 level with df2 and 41 was 3.23).

Table 3 - the table presents the adjusted post-test mean values and analysis of covariance (ANCOVA) results for selected motor fitness and performance variables of the treadmill training group (TTG), resistance training group (RTG), and control group (CG), after adjusting for pre-test differences. For agility, the adjusted post-test mean value was lowest for the TTG (17.35), followed by the RTG (18.54) and the CG (19.63), indicating superior agility performance in the treadmill training group. The obtained F-ratio value of 20.81 was statistically significant at the 0.05 level, as it exceeded the required table value. This result confirms that there was a significant difference among the three groups in agility after the training intervention.

In the case of cardiovascular endurance, the adjusted post-test mean values showed that the TTG (2383.44 m) and RTG (2291.35 m) performed considerably better than the CG (2057.18 m). The F-ratio value of 55.29 was significant at the 0.05 level, indicating a significant difference among the groups. This finding demonstrates that both treadmill and resistance training were effective in improving cardiovascular endurance, with treadmill training showing a marginally greater effect.

For stick control, the adjusted post-test mean scores were highest for the TTG (6.92), followed by the RTG (6.09) and the CG (5.14). The obtained F value of 19.02 was statistically significant, indicating that the

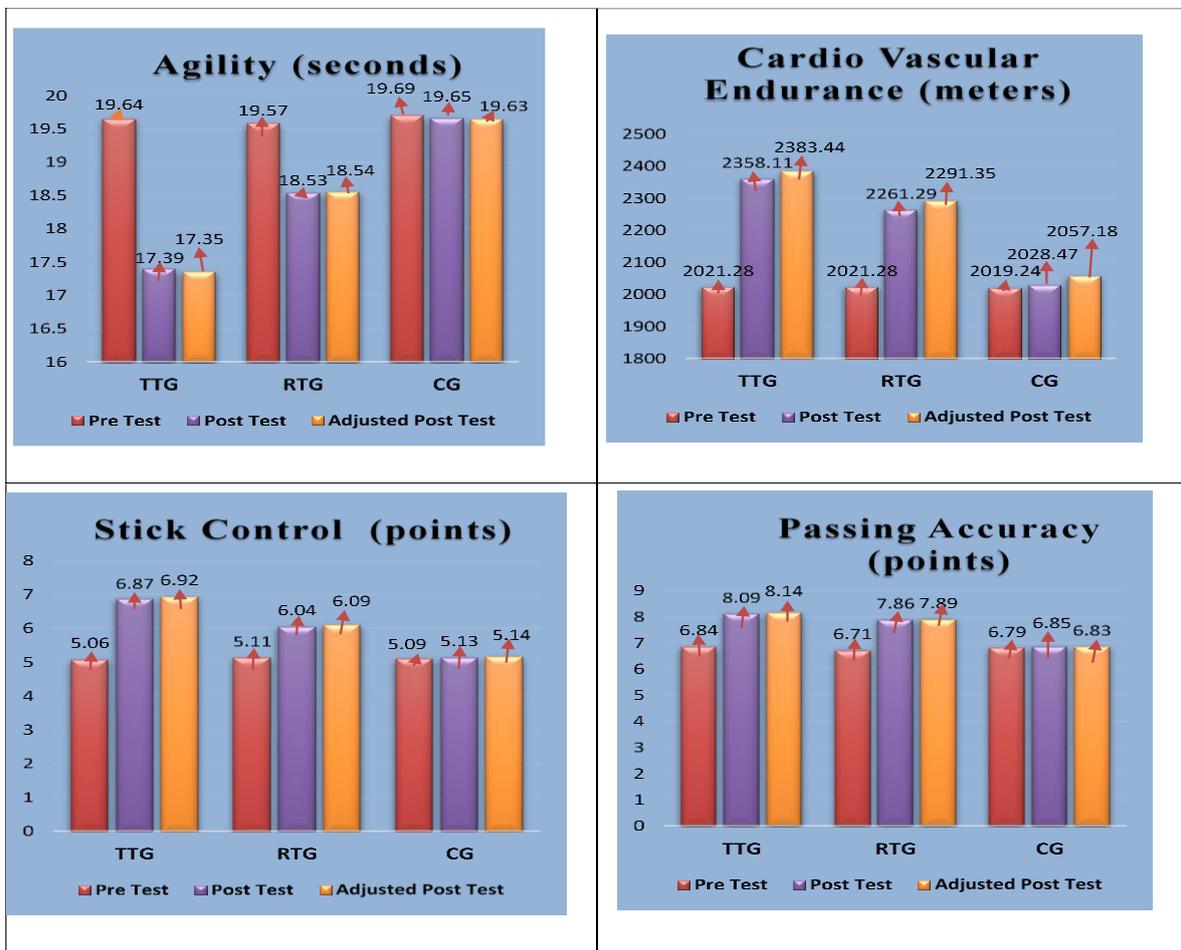
differences among the groups were not due to chance. This suggests that the training interventions significantly enhanced stick control performance, particularly in the treadmill training group.

Regarding passing accuracy, the adjusted post-test mean values revealed that the TTG (8.14) achieved the highest performance, followed closely by the RTG (7.89), while the CG recorded the lowest mean (6.83). The obtained F value value of 51.04 was statistically significant at the 0.05 level, confirming a significant difference among the three groups. This indicates that both experimental training packages effectively improved passing accuracy compared to the control condition.

Overall, the ANCOVA results demonstrate that significant differences existed among the treadmill training, resistance training and control groups in agility, cardiovascular endurance, stick control and passing

accuracy after adjusting for pre-test scores. The treadmill training group consistently showed superior performance across all selected variables, followed by the resistance training group, while the control group exhibited the least improvement. These findings clearly establish the effectiveness of structured treadmill and resistance training programs in enhancing motor fitness and skill performance variables among university hockey players.

Hockey is a popular and highly demanding team sport that requires a high level of motor fitness and technical skill performance. University-level hockey players are exposed to repeated bouts of high-intensity activities such as sprinting, rapid changes of direction, tackling and continuous stick handling throughout match play. Therefore, motor fitness components such as speed, agility, cardiovascular endurance, muscular strength and flexibility play a crucial role in determining overall hockey performance and competitive success.



**Figure 1: The Pre, Post and Adjusted Post-Test Means Values of Treadmill Training Group, Resistances Training and Control Groups on Agility, Cardio Vascular Endurance, Stick Control and Passing Accuracy**

In addition to physical fitness, skill-related performance variables are equally essential in hockey. Skills such as stick control, reaction time, dribbling, passing accuracy and shooting power directly influence

game effectiveness, decision-making and scoring opportunities. Efficient execution of these skills under match conditions requires a combination of neuromuscular coordination, physical conditioning and

sport-specific training. Hence, the selected motor fitness and performance variables were considered appropriate and relevant for evaluating the effectiveness of treadmill and resistance training packages among university hockey players.

## DISCUSSION ON FINDINGS

These findings emphasize the effectiveness of treadmill and resistance training packages in enhancing both physical fitness and skill-related performance in hockey players and support their inclusion in systematic training programs at the university level. The findings of the present study clearly support the formulated hypotheses. Both treadmill training (TTG) and resistance training (RTG) packages were found to be effective in significantly improving selected motor fitness components and skill performance variables when compared with the control group (Ashokan & Abraham, 2022).

The resistance training packages produced comparatively greater improvements in agility and cardiovascular endurance, which may be attributed to enhanced muscular strength, neuromuscular efficiency and improved movement mechanics developed through structured resistance-based exercises (Thomas, et. al, 2023 and Kuriakose & Abraham, 2015). These findings are in line with previous research indicating that functional resistance training leads to substantial gains in agility, strength and endurance among hockey players (Koca & Revan, 2023). On the other hand, the treadmill training package resulted in greater improvements in speed and agility, supporting the concept that treadmill-based interval and endurance conditioning enhances sprint performance, running economy and change-of-direction ability (Kundukulam & Abraham, 2020). Treadmill training provides controlled intensity and progressive overload, which are essential for improving aerobic capacity and repeated sprint ability, both of which are critical for hockey performance. Previous studies have also reported significant improvements in running speed and agility following treadmill-based training interventions among field sport athletes (Koca & Revan, 2023 and Kuriakose & Abraham, 2020).

Overall, the results indicate that both training modalities positively influenced motor fitness and skill performance; however, the magnitude of improvement varied depending on the nature of the training stimulus. This highlights the importance of incorporating both aerobic and resistance-based training methods in hockey conditioning programs to achieve optimal performance outcomes (Rajesh & Abraham, 2017 and Thomas, et al., 2023).

## CONCLUSIONS

There was a significant improvement in selected motor fitness components, namely, agility and cardiovascular endurance, as a result of twelve weeks of

treadmill and resistance training packages among university hockey players. Significant improvements were also observed in selected performance variables such as stick control and passing accuracy, following the treadmill and resistance training interventions.

A significant difference existed among the treadmill training group, resistance training group and control group with respect to selected motor fitness and performance variables, indicating the effectiveness of structured training programs over regular activity alone. The treadmill training group demonstrated superior performance compared to the resistance training and control groups in key dependent variables such as agility, cardiovascular endurance, stick control and passing accuracy among male hockey players.

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