Sushanta Pal
Assistant Professor,
Government Physical Education
College for women, Rice
Research Station, Chinsurah,
Hooghly, West Bengal, India

Dr. Susanta Sarkar
Associate Professor,
Department of Physical
Education, University of
Kalyani, Nadia, West Bengal,
India

A study on movement with holding a hockey stick of a hockey player during running

Sushanta Pal and Dr. Susanta Sarkar

Abstract
The main purpose of this study was to observe the difference between the velocity difference in two different conditions i.e. with and without holding a hockey stick. For this study only twenty y (20) male state level hockey players were performed with and without equipment condition. A digital video graphic, camera (Nikon D3300 with 60 FPS) were used for recording of motion. The subject s was performed 30m running in two different condition. The velocity was without equipment condition 3.65m/s at 2.5m, 3.70m /s at 5m, 4.77m/s at 10m, 5.39m/s at 15m, 5.81 m/s at 22.5m and 6.04m/s at 30m position. With equipment condition was 3.4m/s at 2.5m, 3.47m /s at 5m, 4.51m/s at 10m, 5.14m/s at15m, 5.55m/s at 22.5m and 5.78m/s at 30m position. i.e. with holding a hockey stick condition velocity was significantly decreased. This study would help to guide clear direction for coaches and athletes.

Keywords: hockey stick, velocity

Introduction
The fundamental movement activity of running is used in most of the games and sports as an element of basic skills. Thus games like soccer, hockey, cricket, handball etc. and sport like gymnastics involve running. Again it is the fact that all individuals are not same in style and efficiency of running. This individual difference has made this process an important event in competitive Track and Field Athletics. In National and International track and field competitions running occupies an important place. Thus, running is performed in daily living, general game and sports and egocentric competitive situations

Methods
Twenty state level male hockey player (average age, height and weight of the hockey players were 19.5 year, 166.4 cm and 54.2kg) was considered for the present study. All players were selected from Nadia District Hockey Association., West Bengal. The players were performed 30 m running in without holding a hockey stick and with holding a hockey stick condition. Recording of the movement was completed in two times in the same day. Total running of both condition was recorded by the three video cameras (Nikon D 3300, 60FPS). At the same time different running position's time also recorded. After capturing of video the recorded video was analysed the movement analysis software (Klnovea 0.8.1.5) after kinematic analysis obtained data was analysed through statistical
procedure.

Results
Among selected kinematic parameters the data regarding linear velocity of the Hockey players in normal and holding a hockey stick (constraint) conditions have been presented. The linear velocity was calculated as the first derivative from displacement-time (d-t) information of running. Mean values displacement, time and calculated velocity at different phases of running have been presented in Table-1.

Corresponding Author:
Sushanta Pal
Assistant Professor,
Government Physical Education
College for Women, Rice
Research Station, Chinsurah,
Hooghly, West Bengal, India

Table 1: Mean values of time, and velocity in normal and constraint conditions for hockey group

Distance from start (m)	Time			Velocity		
	Time taken (s)		% increase of time for running with equipment C = (B -A)*100/A	Velocity (Δd / Δt) (m/s)		% decrease of velocity for running with equipment G=(E-F) *100/E
	In normal condition (A)	With equipment (B)		In normal condition (E)	With equipment (F)	
2.50	0.69 ± 0.06	0.74 ± 0.05	5.80	3.65 ± 0.27	3.42 ± 0.24	6.30
5.00	1.38 ± 0.11	1.52 ± 0.11	10.14	3.70 ± 0.24	3.47 ± 0.25	6.22
10.00	2.11 ± 0.17	2.22 ± 0.14	5.21	4.77 ± 0.36	4.51 ± 0.27	5.45
15.00	2.80 ± 0.25	2.93 ± 0.20	4.64	5.39 ± 0.44	5.14 ± 0.33	4.64
22.50	3.90 ± 0.33	4.07 ± 0.27	4.36	5.81 ± 0.48	5.55 ± 0.36	4.48
30.00	5.0 ± 0.44	5.23 ± 0.45	4.60	6.04 ± 0.51	5.78 ± 0.48	4.30

Linear Velocity of hockey players

From the table values it is seen that the mean velocities for hockey players for running without and with holding a hockey stick was increased, and rate of increase became gradually slower with increase of distance and time. However, it is evident from the above table values that the velocity without hockey stick remained from larger start and this difference gradually increased with respect to time and distance.

From the above table it is also seen that the percentage of time increased due to sports equipment for hockey players and similarly the rate of change of velocity was decreased for running with equipment.

Mean values of velocities (v) in normal running and running with equipment has been shown in the Fig.1
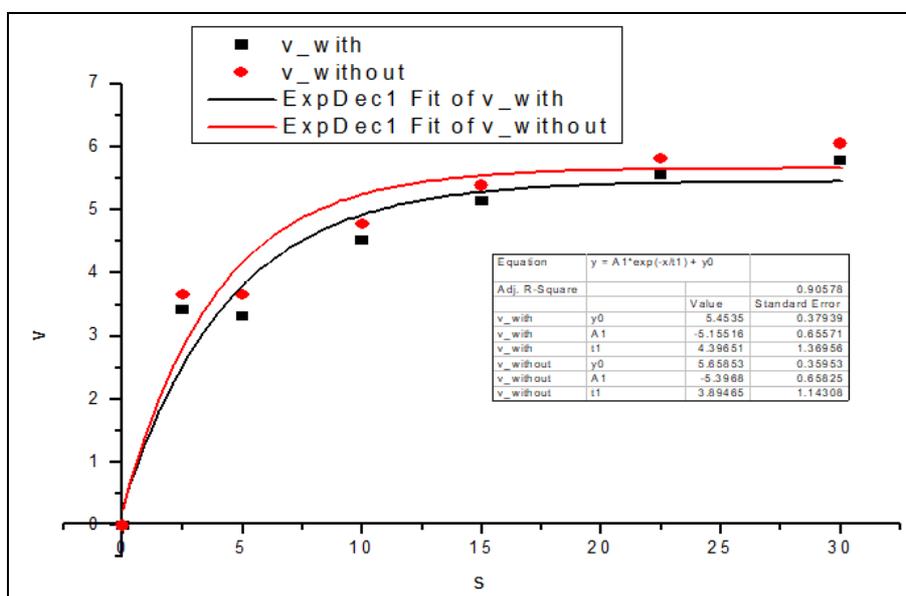

Fig 1: Mean velocities with respect to distance for without and with equipment for hockey group of subjects

From the Fig-1 it is seen the nature of velocity – distance curve for hockey group of subjects without and with equipment was similar. From start the velocity increased rapidly and the rate of increase became gradually slower with increase of distance and time.

It was also understood that there was a decrease in mean velocity for the condition of running with equipment. The percentage (%) loss in velocity due to equipment for hockey group has been shown in Fig. 2.
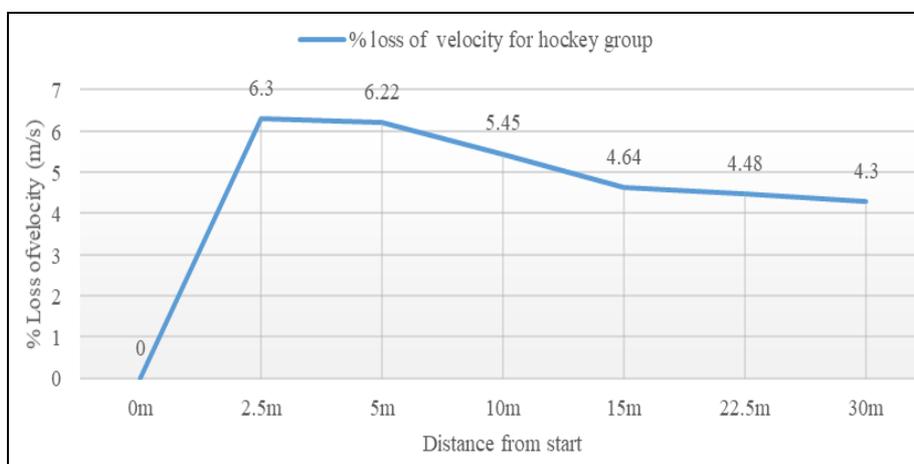

Fig 2: Percentage (%) loss in velocity due to equipment for hockey group of subjects

In Fig.2 exhibits that there was a sudden increase in percentage loss in velocity with equipment in the beginning of running up to 2.5 meters there after the percentage loss in velocity slightly decrease for the remaining path.

After observing decrease in velocity for running with equipment, the statistical significance of such decrease was tested using t- test. The results have been shown in following Table-15.

Table 2: Testing of significance for reduction in mean velocities for running with and without equipment for hockey group

Distance from start (m)	Mean velocity(m/s)		Decrease In velocity (m/s) (a-b)	Standard Error (SE$_d$)	t - value	p - value	Remark
	Without equipment (a)	With equipment (b)					
2.5	3.65 ± 0.27	3.42 ± 0.24	0.23	0.033	7.109	0.000	Sig.
5.0	3.70 ± 0.24	3.47 ± 0.25	0.23	0.049	4.765	0.000	Sig.
10.0	4.77 ± 0.36	4.51 ± 0.27	0.26	0.043	6.099	0.000	Sig.
15.0	5.39 ± 0.44	5.14 ± 0.33	0.25	0.065	3.901	0.001	Sig.
22.5	5.81 ± 0.48	5.55 ± 0.36	0.26	0.076	3.411	0.003	Sig.
30.0	6.04 ± 0.51	5.78 ± 0.48	0.26	0.012	2.630	0.016	Sig.

For df =19, t value at 0.05 level = 2.09

Table values reveal that the decrease in velocity was statistically significant for running with Hockey gear than that of without gear for all the phases.

Conclusion
In running with holding a hockey stick the player consumed more time therefore the velocity also be reduced due to hockey stick when compared with free condition. It may cause of other responsible factor like arm amplitude, push off angle, body lean etc will be changed. This type to guide for further analyse the supporting parameter and helps to coaches and players.

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