International Journal of Physiology, Nutrition and Physical Education

Vivek Pandey
Professor, H.O.D Exercise
Physiology at LNIPE, Gwalior,
Madhya Pradesh, India

Mukesh Kumar
Research Scholar at LNIPE,
Gwalior, Madhya Pradesh, India

Deepak Sharma
Associate Professor, LNIPE,
Gwalior Madhya Pradesh, India

Physiological variables as a predictor for hockey performance

Vivek Pandey, Mukesh Kumar and Deepak Sharma

Abstract
The study aims to see the relationship between various independent variables with the dependent variable, and 2nd objective of the study is to see the most contributing variable to the performance in hockey. To fulfil the purpose of the study, the investigator has collected the data on 148 samples of 12-14 years of age from north zone India. The raw data obtained from the samples was analyzed with the help of the SPSS 22 version by applying multiple correlations. In the output, it was clear that except BMI, all the variables have shown a significant relationship with the dependent variable performance. The results indicate that the independent variable body fat percentage is negatively associated with hockey performance which means if the value of one variable increases, then the value of another variable will automatically decrease and vice versa. In contrast, aerobic capacity and skeletal muscle mass are positively associated with performance which means if the value of one variable increases other will follow the same trend. Hence the null hypothesis there is no relationship between the dependent variable (performance) with the independent variable is rejected for body fat percentage, skeletal muscle mass, and aerobic capacity. In contrast, the null hypothesis fails to reject BMI as BMI's value doesn't show a significant relationship with the dependent variable. However, aerobic capacity was the most contributing physiological predictor to classify the performance as the variable that has shown the highest amount of relationship out of all selected variables. Hence, it is concluded that body fat percentage, skeletal muscle mass and aerobic capacity can be used as representative for physiological factor in future researches.

Keywords: physiological variables, performance, independent variables, body composition and predictors

Introduction

With improved sports participation in recent years, the performance standard has also increased, which led sports scientists to think about the various possible ways to improve performance further. In competition difference between the winner and the loser can be a matter of not more than a few centimetres or a fraction of a second. Therefore, at all levels, sports scientists try to leave nothing to chance. However, sports performance depends on many factors. The percentage contribution of various performance factors is a complex combination, which depending upon the nature of the activity.

The hockey game at the top level is essentially a low-intensity activity, interspersed with varying bouts of high-intensity activity (Lythe and Kilding, 2011) [1]. The successful player requires muscular endurance, strength, power, skill, psychomotor attributes and cardiovascular fitness (Reilly & Borrie, 1992) [2]. Hockey has high demands in all three energy systems. The aerobic system is important during prolonged intermittent exercise. High-intensity efforts rely on the anaerobic energy systems, adenosine triphosphate phosphocreatine for the intermediate and anaerobic glycolysis for the short term.

The introduction of artificial turf has transitioned the game to be more physiologically demanding (Reilly & Borrie, 1992) [2]. With quicker ball movement play accelerates (Malhotra *et al.*, 1983), more touches per possession and greater time dribbling lead to increased skill level and tactical play. The rule changes of unlimited interchange and no off-side have led to less disruption in play and greater player movement (Reilly & Borrie, 1992) [2], requiring a greater fitness level.

Correspondence
Vivek Pandey
Professor, H.O.D Exercise
Physiology at LNIPE, Gwalior,
Madhya Pradesh, India

The introduction of artificial turf has transitioned the game to be more physiologically demanding (Reilly & Borrie, 1992) [2]. With quicker ball movement play accelerates (Malhotra *et al.*, 1983), more touches per possession and greater time dribbling lead to increased skill level and tactical play. The rule changes of unlimited interchange and no off-side have led to less disruption in play and more significant player movement (Reilly & Borrie, 1992) [2], requiring a greater fitness level.

Infield hockey, physical fitness and body composition are crucial (Montgomery *et al.*, 2006; Quinney *et al.*, 2008; Tarter *et al.*, 2009) [6, 7, 8]. Excess body fat is thought to be linked to poor performance: Hence body composition is measured. It's partly based on Newton's second law, which states that increasing fat mass without increasing muscle force causes acceleration to decrease. Furthermore, the displacement of greater fat mass necessitates additional energy, increasing the relative cost of exercise (Duthie *et al.*, 2006).

Objectives of the study
- To see the relationship between various independent variables with the dependent variable.
- To see the most contributing variable to the performance in hockey.

The hypothesis of the study
- There will be a significant relationship between predictors and dependent variable.

Significances of the study
The study will be helpful for future researchers, physical educationists, scholars and players to give the idea about the essential variables which can have untimely effects the performance of an individual.
This study will also help identify the most suitable physiological predictor for future research.

Methodology
In the present study, the investigator adopted the purposive sampling procedure to select the samples from different academies of north zone India. This study was delimited to selected physiological variables, i.e. Percent body fat, body mass index, aerobic capacity and skeletal muscle mass. The data was collected on 148 male field hockey players between the age group of 12-14 years of age with the help of body composition analyzer "maltron bio scan 916". The beep test was used to get the data for aerobic capacity. Further, the data were analyzed through SPSS 22 version of drawing inferences.

Table 1: Descriptive statistics for all the variables

	N	Range	Mean		Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Std. Error	Statistic	Statistic	Std. Error	Statistic	Std. Error
Total Body Fat		15.70	13.4207	.28555	3.47384	-.381	.199	-.495	.396
Body Mass Index	148	11.00	18.8753	.16705	2.03228	.252	.199	-.161	.396
Skeletal Muscle Mass		23.10	37.3196	.25092	3.05253	.192	.199	1.378	.396
Aerobic Capacity		43.70	59.6332	.75361	9.16801	-.230	.199	-.473	.396

The above table depicts the value of the mean, standard deviation, skewness and kurtosis for all the selected variables along with their standard error. The standard error of mean is least for body mass index whereas maximum for aerobic capacity. For applying any parametric statistics, certain assumptions need to be fulfilled; the first assumption is normality. The normality of data can be checked by skewness and kurtosis. Skewness shows the symmetry city of the data, whereas kurtosis shows the spread of scores. The above table shows the value of skewness and kurtosis, which is less than twice its standard error, indicating the data was normal for applying the multiple correlations.

Table 2: Pearson product moment correlation between independent and dependent variables

	Performance	Total Body Fat	Body Mass Index	Skeletal Muscle Mass	Aerobic Capacity
Performance	1.000	-.487	-.059	.495	.632
Total Body Fat	-.487	1.000	.267	-.692	-.400
Body Mass Index	-.059	.267	1.000	-.307	.075
Skeletal Muscle Mass	.495	-.692	-.307	1.000	.335
Aerobic Capacity	.632	-.400	.075	.335	1.000
Performance		.000	.240	.000	.000
Total Body Fat	.000		.001	.000	.000
Body Mass Index	.240	.001		.000	.183
Skeletal Muscle Mass	.000	.000	.000		.000
Aerobic Capacity	.000	.000	.183	.000	

The above table shows the statistical values of multiple correlations between all the variables selected in the study. The statistical value of the relation between the dependent variable performances with the independent variables (Total Body Fat, Body Mass Index, Skeletal Muscle Mass and Aerobic Capacity) is -.487, -.59, .495 .632, respectively. The results showed that Aerobic Capacity is highly associated with performance, i.e. .632 and the associated P-Value for the variable is found significant. Similarly, Total Body Fat and Skeletal Muscle Mass are significantly correlated with the performance in hockey as their associated p-value is less than 0.05 level of significance.

Conclusion
The study aims to see the relationship between various independent variables with the dependent variable and see the most contributing variable to the performance in hockey. After analyzing the data through SPSS 22 version, it was clear that except BMI, all the variables have shown a significant relationship with the dependent variable. The independent variable body fat percentage is negatively associated with hockey performance, which indicates that if one variable's value increases, then the value other will automatically decrease vice versa. In contrast, aerobic capacity and skeletal muscle mass are positively associated with performance,

which means that others will follow the same trend if one increases.

References
1. Lythe J, Kilding AE. Physical demands and physiological responses during elite field hockey. International Journal of Sports Medicine 2011;32(7):523-528.
2. Reilly T, Borrie A. Physiology Applied to Field Hockey. Sports Medicine 1992;14(1):10-26.
3. Malhotra MS, Joseph NT, Gupta JS. Body composition and endurance capacity of Indian hockey players. Journal of Sports Medicine 1974;14:272-277.
4. Wilmore JH. Training for sports and activity- The physiological basis of conditioning process. Allyn and Bacon Inc 1982;2:119-137.
5. Verma JP. Data Analysis in Management with SPSS Software. Springer New Delhi Heidelberg New York Dordrecht London ISBN 978-81-322-0785-6 DOI 0.1007/978- 81-322-0786-3. 2013, 105.
6. Montgomery DL. Physiological profile of professional hockey players –A longitudinal comparison. Applied Physiology Nutrition Metabolism 2006;31:181-185.
7. Quinney HA, Dewart R, Game A, Snydmiller G, Warburton D, Bell G. A 26 year physiological description of a National hockey league team. Applied Physiology Nutrition Metabolism 2008;33:753-760.
8. Tarter C, Kirisci L, Tarter RE, Weatherbee S, Jamnik V, McGuire EJ *et al.* Use of aggregate fitness indicators to predict transition into the National Hockey League. Journal of Strength Conditioning Research 2009;23:1828-1832.