Relationship of Aerobic Capacity and Anaerobic Power with Body Fat of Field Hockey Players

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ABSTRACT

The unique requirements of field Hockey, including dribbling the ball and moving quickly in a semi-crouched posture, superimpose the workload demanded by the game. Therefore, the Hockey player is required to have a large aerobic capacity and anaerobic power, in addition to ball and stick skills. Twenty-seven Hockey players undergoing training at Sports Training Centre, Patiala, were subjects for assessment of maximum aerobic capacity, anaerobic power index, peak power output and body fat status. Body fat was calculated by body density. Skin fold thickness was measured to calculate body density. Aerobic capacity was directly assessed by metabolic gas analyzer (Cosmed K4). Anaerobic power was calculated by De Bruyn Provost Test (1974). Peak power was calculated by the maximum RPM reached. Correlation coefficient was computed between body fat percentage and aerobic capacity, anaerobic power output and peak power output. Results indicated that body fat percentage was significantly and negatively correlated with anaerobic power index and peak power output but no significant relationship was observed in case of maximum aerobic capacity.

INTRODUCTION

Field Hockey is a sport widely played in India. Game of Hockey comprises two 45-minute halves and players perform repeated sprint efforts with a high level of sport specific skills. The unique requirements of field Hockey, including dribbling the ball and moving quickly in a semi-crouched posture, superimpose the workload demanded by the game (Reilly & Seaton, 1990). Therefore, the Hockey player is required to have a large aerobic and anaerobic capacity in addition to ball and stick skills.

Elite Hockey players are not identified by specific physical characteristics. Generally, back line players require power and may therefore tend towards a heavier weight in comparison to a midfield players who are required to perform frequent repeated sprint efforts. However, these characteristics are not indicators of Hockey skill potential; and as such, the physical profile of elite Hockey players varies between individuals (Rechichi, 1998).

Critical components of game performance are both the aerobic and anaerobic capacity of the Hockey players.

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The duration and the pace of Hockey requires a high aerobic fitness level for players (Cibich 1991, Rechichi 1998). Cibich (1991) found that in game situations, Hockey mid field players performed at or above their anaerobic threshold for 70% of the game time on average. Sustained high intensity is necessary with recovery time being only 12.25% of total game time (including warm up and half time) for centre half and inside forward players and 20% for backs (Cibich 1991). It is also recognized that Hockey involves multiple sprint repetitions throughout a game and as such there is a large anaerobic component of the sport (Fitzsimons et al, 1993; Dawson et al, 1991).

Hockey game involves intermittent running the alternation of accelerating and decelerating, and changes of direction while sprinting (Spencer et al, 2005). Although, great anaerobic capacity is needed during the many brief bursts of high-energy release, aerobic capacity is also needed for efficient recovery during the short rest periods (Bhanot & Sidhu, 1983; Boyle et al, 1994; Lothian & Farrally, 1994).

For a sportsperson, there is nothing more detrimental than carrying dead weight. Many studies have shown that the higher the percentage of body fat the poorer the person's performance. This is applicable in all activities in which the body weight must be moved through space such as running and jumping.

Therefore, with this understanding, the study has been designed to find out the relationship between anaerobic power, peak power output and maximum oxygen consumption with body fat percentage, in male Hockey players.

METHODOLOGY

Participants

The study was conducted on 27 male field Hockey players, aged between 15-19 years, from the Sports Training Center, Patiala. Body fat was calculated by body density. The body density was calculated with the help of Durnin and Womerseley's (1974) equations. And then, the body fat is calculated by body density by Siri's equations (1956).

Thereafter, the volunteers were subjected to cardiopulmonary exercise testing (CPET), in a manner described below, to Assess their aerobic capacity. Exercise test were performed on an electronically operated computerized bicycle ergometer (ER 900: Erich Jaeger, Germany), using a test protocol that consisted of graded cycle ergometry. The athletes were first asked to warm up and cycle at 60 RPM, for 2 minutes, without any load. This constituted the reference phase. The test phase followed next. The initial load, in the test phase, was fixed at 60 watts; and increased by 30 watts every 2 min, till exhaustion; consequent to which, the volunteers were asked to cycle briskly at a rate of 60 RPM, without any load, during the entire period of recovery, for a total period of 3 minutes.

Anaerobic power was calculated by De

Bruyn Prevost Test (1974) by using Bicycle Ergo Meter (ER _900, Erich Jaeger, Germany) and stopwatch. The subject was asked to first perform a cycling warm up, at 1 and 2 Watt, for 2 minutes, at each load. After the initial warm-up the load was fixed at for male 400 watts, pedal rhythm 124-128.

The subject was asked to pedal explosively and maintain pedal rhythm with the quickest time possible. Time required reaching the required pedal rhythm was called delay time. When the subject was not able to maintain the required rhythm the test was ended, called total time.

Statistical Analysis

The means and standard deviations of the physical as well as physiological characteristics were calculated by the Statistical Packages of Social Sciences (SPSS version 10). Correlation was also computed, using the software packages of the SPSS version 10, between all the aerobic anaerobic and body fat under study, to elucidate whether, and if, the different physical and physiological values are related.

RESULTS & DISCUSSION

Table-1:Physical and physiological parameters of field Hockey players

Age (yr)	Weight (kg)	Height (cm)	VO2 max (ml/kg/min)	Anaerobic power Index	Peak power output	Body fat (%)
17.26 ±1.78	51.17 ±8.65	164.9 ±7.97	49.84 ±4.48	5.89 ±2.48	143.96 ±13.62	13.62 ±4.33

The mean age of the players was 17.26 (± 1.78) years; with the mean height and weight, 164.9 (±7.97) cm, 51.17 (±8.65) kg, respectively. The mean Vo2 max of the present players was found to be 49.84 (±4.48), which is less than the value (54.4 ml/kg/min) reported by Ghosh et al (1991). The mean value of anaerobic power index and peak power found in the present players was 5.89 ± 2.48 and 143.96 (±13.62), respectively. The mean percentage body fat was found to be 13.62 (±4.33).

Table 2 depicted the correlation between the % body fat and maximum oxygen consumption, anaerobic power index and peak power. Non-significant

Table-2: Correlation of the body fat with maximum oxygen consumption, peak power output and anaerobic power index

	Vo2 max	Anaerobic Power Index	Peak Power
% Body fat	0.183	0. -514*	-0.400*

*Significant at the 0.05

relationship was observed between the % body fat and maximum oxygen consumption (Vo_2 max). Negative but significant relationship was observed between anaerobic power index and peak power out put with body fat %.

The present study indicated that the percentage body fat of Hockey players was significantly and negatively correlated with anaerobic power output and back peak power output. This finding is supported by Riendeau at al (1958) which showed that lower the body fat, higher the anaerobic performance. Excessive body fat is associated with decreased athletic performance. Willmore and Costill (1999) reported that speed; endurance, balance agility and jumping are all negatively affected by a high level of fatness. In the present study, it has been found that there was no significant correlation ship between body fat and Vo_2 max. This may be due to lower level of Vo_2 max of present Hockey players.

From the study, it can be concluded that the Hockey players have desired level of anaerobic quality, which is one of the important prerequisite for the game of Hockey; which is intermittent in nature. But, to maintain the pace throughout seventy minutes, the players need to have optimum level of Vo_2 max.

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