



**IGNITED MINDS**  
Journals

*International Journal of  
Physical Education and  
Sports Sciences*

*Vol. 10, Issue No. 17,  
July-2016, ISSN 2231-3745*

**A RESEARCH UPON SPORTS FITNESS AND  
PHYSIOLOGICAL OUTLINE OF ELITE PLAYERS**

AN  
INTERNATIONALLY  
INDEXED PEER  
REVIEWED &  
REFEREED JOURNAL

# A Research upon Sports Fitness and Physiological Outline of Elite Players

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**Abstract – The current study aimed to gain insight into the physiological profile of elite basketball players in Belgium in relation to their position on the field. The current study showed that the physiological profile of elite players first division differs by player position. More specifically, guards were characterized by high endurance, speed, and agility, whereas centers and power forwards had higher muscle strength than the other positions. There is a scarcity of descriptive data on the physiological characteristics of elite players. The purpose of this study was to evaluate the physiological profile and sports specific fitness of elite players. A total of sixty male inter-university squash players from India were selected for the study. All subjects were examined for selected physiological variables namely vital capacity (VC), Systolic Blood Pressure (SBP), Diastolic Blood Pressure (DBP), Heart Rate (HR), Peak Expiratory Flow Rate (PEFR), Positive Breath Holding Capacity (PBHC) and Negative Breath Holding Capacity (NBHC). On the basis of the performance of the teams only forty subjects were retained for the final study in such an approach that twenty squash players were from the first four teams and twenty subjects were from the last four teams. The data was analyzed with the help of discriminant analysis using the SPSS version 19.0.**

**There is a scarcity of descriptive data on the performance capacity of elite players, whose fitness requirements are quite specific. The purpose of this paper is to investigate the physiological response of elite players in a sport-specific fitness test.**

## INTRODUCTION:-

It has been established that no single variable measures physical fitness, which is a composite factor varying with each sport. Badminton at the elite level requires a combination of the aerobic and anaerobic systems and the involvement of these systems depends on the nature of the rally (short or long) and the duration of the game (short set or long match). Apart from the demands of high levels of technical skill and mental acuity, essential requirements for badminton fitness include stamina, speed, endurance, strength, and physical agility. Badminton is growing in popularity and according to recent surveys there is an ever increasing number of players (approaching 200 million) worldwide. In the 1992 Barcelona Olympic Games, badminton was included as one of the official events for the first time. Despite the large number of badminton players internationally, research dealing with the performance capacity of elite badminton players in the English scientific literature has been scarce." Most previous physiological studies of elite badminton players originate from researchers in China.

Investigations by Mader<sup>1</sup> and Keul<sup>1</sup> showed that the customary standardized cycle treadmill ergometry is not sufficient for an unequivocal prediction of successful performance in sport. Sport specific laboratory tests, such as rowing ergometry for rowers

or cycle ergometry for cyclists, show deficiencies with respect to their capacity to forecast performance in competition. In addition, for sports involving non-rhythmic movements- such as in handball, squash, and badminton sport specific testing is either impossible or may be performed only with the help of elaborate and expensive technical equipment. Such conclusions have prompted further research on possible means of obtaining valid estimations of the competition fitness of athletes in specific sports such as squash. A specific programming device that controlled the intermittent flashes of light bulbs, designed to represent the offensive shots of an opponent in a squash game, was devised by Steinger and Wodick<sup>13</sup> and tested in a squash court. A high correlation between subjects' rank-order and field test ( $r = 0.90$ ,  $P < 0.001$ ) was found. This correlation was higher than that between subjects' rank-order and fitness level as determined by a treadmill running protocol ( $r = 0.52$ ,  $P > 0.05$ ). The researchers concluded that this sport specific test provides reliable estimates of squash players' fitness levels. Since badminton is an indoor game comparable to squash.

The champion needs both a wide range of skills and a high standard of fitness. Essentially squash fitness calls for stamina, strength, and physical agility

besides the demand of high technical skill, good match temperament, and mental agility.

Despite the growing popularity of squash, with increasing numbers of International Squash Racquets Federation (ISRF) members (from 67 to 100 in 1992), and a possible bid for participation in the Olympic Games for the year 2000, studies of physiological characteristics of elite squash players are scarce." To the best of the authors' knowledge, there has only been one physiological study on Asian squash players which examined physiological alterations and leg strength following a three month training programme.

### PHYSIOLOGICAL VARIABLES OF VOLLEYBALL PLAYERS

Among all the factors, the physiological variables play an important role for the attainment of high level sports performance. Physiological variables may be defined as those variables which are directly linked with various physiological systems such as heart rate, blood pressure, vital capacity, respiratory rate and hemoglobin.

Physiological variables such as cardiovascular efficiency, percentage of fat, reaction time, vital capacity and other should be taken into consideration while selecting volleyball players. Cardio-respiratory endurance denoted capacity of individual to work effectively with the help of oxygen which is collected, transported and utilized by lungs, blood and muscles respectively. Any work as daily task or form of physical activity is directly related to energy supplying system which in turn is the cardiorespiratory endurance. Cardio-respiratory endurance varies from individual to individual and one of the important variables for establishing top class performance in the game involves work of long duration/endurance type.

Several studies have documented the physiological and anthropometric characteristics of players), with the fitness of players typically increasing as the playing standard is raised (Gabbett & Georgieff, 2007). Smith et al. (1992) compared physical, physiological, and performance characteristics of national and college standard players.

The physiological variables involved in sports performance have long been of interest to players, coaches, sport physiologists and sports scientists. From a physiological point of view, the lung function tests, like other physiological tests must be of the utmost importance for measuring the fitness of an athlete. There is also a need to develop respiratory capacities, which pertains to the ability of the body to supply the oxygen. Respiratory parameters vary from individual to individual and one of the important variables for establishing top class performance as the game involves work of long duration.

### PHYSIOLOGICAL PROFILES OF ELITE PLAYERS

**Physiological Profile of Squash Players** – Squash at the elite level is primarily aerobic in nature, with intermittent bursts of activity being supplied from anaerobic energy sources. Elite level squash is predominantly a moderate to high-intensity aerobic activity with intermittent bursts of energy supplied by anaerobic energy sources. It is a fast paced game of skill, speed, agility and concentration. The ability to change the direction of the ball at the last instant is an important skill as it leaves the opponent off balance. Other physiological characteristics, such as the ability to maintain high percentages (80-90%) of maximum heart rate during long intermittent periods (>30-40 minutes), play a more relevant role in squash.

Physiological variables may be defined as those variables which are directly linked with the functioning of various organs and systems such as heart rate, blood pressure, vital capacity, respiratory rate and peak flow rate. Physiological adaptation occurs in response to repeated stress application. Acute environmental stress, of either external (exogenous) or internal (endogenous) origin, disturbs the internal environment. Such stresses (forcing functions) displace physiological variables from one steady state towards another, typically in an exponential fashion. For example, the heart rate and ventilatory responses to an increase in exercise intensity display an exponential rise, to ensure oxygen supply matches elevations in metabolic demand.

**Physiological Profile of Elite Basketball Players** - Basketball is an internationally played team sport of which the outcome is determined by a variety of performance determinants. In addition to technical and tactical skills, basketball players need a high level of endurance, strength, speed, power, explosiveness, and agility. Time-motion analyses during a basketball game showed that on average 1000 movements were made by basketball players, with an average duration of shorter than 3 seconds. On average, every 2 seconds a different movement was initiated, indicating the importance of agility in basketball. Measurements of the metabolic load during a basketball game have shown that players had an average oxygen consumption of  $64.7 \pm 7.0\%$   $VO_{2peak}$  and that in 75% of the playing time the players had a heart rate above 85% HRmax and even for 30% to 50% above 90% HRmax. As for the contribution of aerobic and anaerobic metabolism during a game, average lactate concentrations of 4 to 6 mmol/L are reported, with peaks ranging from 8 to 12 mmol/L. In addition, it has been shown that repeated-sprint ability is essential in team sports (eg, soccer and basketball). Therefore, elite basketball players should have a high  $VO_{2peak}$  to maintain

performance for intrasession and intersession recovery and preservation of performance.

### **Physiologic Characteristics of Elite Soccer Players**

- Soccer is the world's most popular sport, being played in every nation without exception. In recent years, there has been a remarkable expansion of sport science. The subject area is now recognized both as an academic discipline and a valid area of professional practice. Coaches and soccer players are more open to contemporary scientific approaches to prepare for competitions.

One of the problems scientists have to deal with when investigating problems concerning a game of soccer is sample size. The number of participants who are involved in the studies are mostly under 30. In soccer science, we still have a problem with a lack of descriptive data concerning the characteristics of elite soccer players that are achieved using large samples. During the last 10 years, Croatian soccer players have established a well-known and successful style of play. The Croatian National team won the third place at the World Championship in France and was able to qualify for the World Championship in Japan and South Korea and Germany. They played in the European Championship in Portugal, and they recently qualified for the European Championship in Switzerland and Austria, being first in their group. According to International Federation of Association Football world ranking, the Croatian National team is in 10th place. The physique of the soccer players may be one of the essential factors that have contributed to the success of the Croatian national team in international competition. Aspects such as experience, body composition, endurance, and balance between aerobic and anaerobic power are important in evaluating elite soccer players. Even though soccer is dominantly an aerobic game, the anaerobic component is of high importance for the overall performance of an elite soccer player. Anaerobic energy is essential to perform sprints, high-intensity runs, and duel plays, all of which may contribute to the final result. The term "anaerobic threshold" (AT) is defined as the level of work or oxygen consumption just below that at which metabolic acidosis and the associated changes in gas exchange occur. The AT has been shown to be highly correlated to performance in aerobic events and is valuable in the determination of optimal training loads and the fitness level of the soccer players. Previous studies have determined a correlation between maximal oxygen uptake ( $VO_2\max$ ) and the distance run during a match. Positional differences have been the subject of interest of sport scientists for years.

**Physiological Profiles of Elite Judo Athletes** - Judo is a dynamic, high-intensity intermittent sport that requires complex skills and tactical excellence for success. As judo athletes have to perform a great number of actions during each match, the physical demand of a single match is high. Typically, judo medalists perform five to seven matches during

international competitions, with each match having a 5-minute time limit. If a judo athlete obtains an ippon (full point), the match ends. On the other hand, since 2003, when the time allotted for the contest finished and the scores/penalties are equal for both athletes (i.e. the match draws), the result of the contest is decided by a 'Golden Score'. If neither athlete obtains any score in the Golden Score period the match continues for another 3 minutes and is decided by the referees (Hantei decision). Thus, a judo match may last from a few seconds to 8 minutes, depending on the scores obtained by the contestants. However, a typical high-level judo match lasts 3 minutes, with 20- to 30-second periods of activity and 5–10 seconds of interruption. Moreover, a significant portion of the matches last 3–4 minutes.

To be effective, judo techniques should be applied with accuracy, within a good 'window of opportunity', with strength, velocity and power.

This short burst of energy is supplied mainly by anaerobic metabolism. In contrast, the maintenance of the intermittent work performed during a match, as well as the recovery process during the short intervals, are mainly supported by aerobic metabolism. Additionally, aerobic metabolism is especially important for an effective recovery between matches.

### **METHODOLOGY**

A total of sixty male inter university squash players from all India squash racket intervarsity tournament held at Lakshmibai National Institute of Physical Education. India was selected for the present study. All subjects were examined for selected physiological variables namely vital capacity (VC). Systolic Blood Pressure (SBP). Diastolic Blood Pressure (DBP). Heart Rate (HR). Peak Expiratory Flow Rate (PEFR), Positive Breath Holding Capacity (PBHC) and Negative Breath Holding Capacity NBHC). On the basis of the performance of the teams only forty subjects were retained for the final study in such an approach that twenty squash players were from the first four teams and twenty subjects were from the last four teams in then rank. Thus, in this manner the players were classified into high-and low-performance groups.

Consent was taken from each subject willing to participate before the start of study. Before administering the tests, the age in completed years, height hi cm and weight in kg of the sportsmen were measured and recorded. The vital capacity (VC) of the subjects was measured with the help of dry spirometer in litres/minute, systolic, diastolic blood pressure (mmHg) and heart rate (beats/minute) was measured with the help of automatic blood pressure monitor, peak expiratory flow rate was measured with the help of peak flow meter in milliliter and Positive



and Negative Breath Holding Capacity was measured with the help of stop watch hi seconds.

On the basis of the performance of the teams only forty subjects were retained for the final study in such an approach that twenty squash players were from the first four teams and twenty subjects were from the last four teams.

**RESULT AND DISCUSSION**

Firstly, the result was expressed in descriptive statistics as mean and standard deviation depicted in Table 1 and 2. Further, a comparison between high-performing and low-performing squash teams was made 011 selected physiological variables with the help of independent t-test. The data was also analyzed by using discriminant analysis for developing discriminant function for classifying individuals into high and low performance groups. The whole data was analyzed with the help of SPSS software package (ver. 19.0). The results so obtained are discussed in this section.

Table 1 reveals the comparison of mean values between high and low performance groups in all seven physiological variables. There was a significant difference found between high performance and low performance groups in case of vital capacity, systolic blood pressure and resting heart rate while insignificant difference was found in rest of the variables. Furthermore, it may be concluded that the mean scores of all three significant variables were significantly higher in the high performance group than in the low performance group.

Thus, it may be interpreted that the cardiorespiratory adaptation was superior among the high performing squash players. This is true also because success to a great extent in the squash game depends upon the proper functioning of the cardiorespiratory system of the players.

Variable	High Performer	Low Performer	Mean Difference
Vital Capacity	3.59 ± .41	3.0950±.55	.50*
Systolic Blood Pressure	136.75±13.05	126.95±15.99	9.80*
Diastolic Blood Pressure	83.60±12.38	81.60±9.91	2.00
Resting Heart Rate	67.30±5.03	75.30±11.15	-8.00*
Positive Breath Holding Capacity	34.10±9.74	37.35±13.23	-3.25
Negative Breath Holding Capacity	21.30±6.61	19.35±6.40	1.95
Peak Flow	530.50±58.44	518.50±57.33	12.00

\* Significant at 0.05 level

**Table 1: Descriptive Statistics (Means ± SD) for Data on All Physiological Variables of Squash Players.**

	Function
Vital Capacity	1.451
Resting Heart Rate	-.074
(Constant)	.446

**Table 2: Unstandardized Canonical Discriminant Function Coefficients.**

The obtained results showed that only two physiological variables namely vital capacity and resting heart rate significantly differ high from low performance male squash players.

Thus, it may be interpreted that the cardiorespiratory adaptation was superior among the high performing squash players. This is true also because success to a great extent in the squash game depends upon the proper functioning of the cardiorespiratory system of the players.

**CONCLUSION**

In conclusion, more research work has to be done before definitive inference can be made; however, On the basis of the results of the study. It might be concluded that physiological variables namely vital capacity and resting heart rate play an important role in discriminating high and low performer squash players. Within the limitations of the study, results also showed that out of all the selected physiological variables, only vital capacity had highest discriminating power. A model so developed in this study to classify the high and low performer squash player was efficient as percentage of correct classification of cases was 77.5%.

Such qualities are prerequisite and advantageous for playing game on elite levels. From a practical standpoint, this information is important for coaches and trainers to adjust training regimes and concentrate on the variables that are specific to improve performance and achieve success in game.

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