Turkish Online Journal of Qualitative Inquiry (TOJQI)
Volume 12, Issue 9, August 2021: 7954 - 7958

Profile Of Maximal Aerobic Power And Resting Heart Rate Of National Male Badminton Players

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Abstract

Sports has gotten significantly more scientific during the last three decades. Previous performance barriers have been surpassed repeatedly as our understanding of technique and technology has improved. In contrast, our increased physiological capacity and technical knowledge has resulted in massive advancements in athletic performance. So the study aims to determine the maximal aerobic power and resting heart rate of National male Badminton players of Manipur. The study involved thirteen male national badminton players from Manipur Badminton Association, Manipur (age: 18.30 ± .48 years; height: 168.92± 4.7 cm; body weight: 58.61± 5.81kg). Maximal aerobic power (MAP) was determined using the Multistage Fitness Test, and the radial pulse method assessed resting heart rate(RHR). Descriptive statistic (mean, standard deviation, minimum and maximum)was used for data analysis using IBM SPSS 20. The study's findings can assist coaches in identifying and selecting new badminton players and designing a training program to improve badminton performance.

Keywords: maximal aerobic power, resting heart rate, badminton, multistage fitness, palpatory

Introduction

Badminton is a highly demanding sport that requires high power of explosive sports, quick movement (Phomsoupha & Laffaye,2014), and high intensity combining 60-70% aerobic and 30% anaerobic system with almost 80% of rallies lasting less than 10 sec(Faude et al.,2007). However, several studies show that the percentage of playing time in elite badminton players can reach as high as 45% of total playing time. Moreover, a scientific approach may be required and influential in determining the traits and level of success (R, Pate & J.L, Durstine,2004). The quality of an athlete's endurance performance is to look at the capacity of maximal aerobic power or the more we know the term VO_2 max.

Badminton is an intermittent sport that demands excellent aerobic qualities. Chin et al. (1995 as cited in Faccini and Dal Monte, 1996)) conclude that 60-70% of energy in-game badminton is derived from the aerobic system, enabling the player to sustain both the intensity and length of the match as well as have a faster recovery rate. Maximal aerobic power or VO_{2max} refers to the functional capabilities of the cardiorespiratory system. VO2max is the fastest rate at which oxygen can be consumed in a given amount of time, usually during strenuous activity. The most significant ability to remove and utilize oxygen from the blood and cardiorespiratory performance are used to determine it. VO_{2max} is an essential factor in determining an athlete's cardiorespiratory fitness. The game of badminton necessitates long periods of exercise with constant or high-system intensity movements. Badminton players necessitate a high capacity for maximal oxygen consumption, or VO_{2max} (Wee et al.,2017).

Heart rate (HR) monitoring has been well established as an economical, time-efficient, and non-invasive tool for many studies. HR measurement, which has been claimed to indicate the health of the cardiac autonomic nervous system and cardiovascular fitness, can provide helpful information on athletes' training responses to be used as a part of comprehensive athletes monitoring (Aaron et al.,2018; Buchheit,2014). A well-conditioned heart and well-functioning pulmonary system are necessary for high aerobic fitness levels because they allow the body to react and recover faster from the effect of exercise and work(Van Leishout,2014).In addition, the heart rate monitoring and blood lactate test determinations, gas exchange measurement provide a direct way to assess the physiological profile of specific- discipline performance(Faude et al.,2007). Since many scientific studies have been conducted, but there is a lack of descriptive data on maximal aerobic power and resting heart rate of badminton players; therefore the present study aims to measure and describe the maximal aerobic power and resting heart rate of national male badminton players.

Materials and methods

Participants

Thirteen male national single players (age: 18.30 ± .48 years; height: 168.92± 4.7 cm; body weight: 58.61± 5.81kg) of Manipur participated in this study. Before participating in this study, individuals were fully informed about the methodology. The coach and each of the subjects signed an informed consent form before the test began.

Design & Procedures

Maximal aerobic power or $VO_{2\ max}$ is the maximum quantity of oxygen that the body can use during strenuous activity while breathing air at sea level(Astrand and Rodahl, 1986). $VO_{2\ max}$ is the gold standard and the most significant measure of aerobic ability. It is one of the most extensively used aerobic power and metabolism(Howley et al,1995) and it is commonly used to measure aerobic performance. The Multistage fitness test (MST) or 20-meter shuttle run test has been proven to be the best indirect approach for determining VO_{2max} (Heller,2010;Jemni,2018). Leger and Lambert created the multistage shuttle run test (MST), which was later updated(Romsbottom et al,1988). MST involves running back and forth between two lines separated by 20 meters, with speed increases per minute controlled by tape recorder audio bleeps. If the subjects fail to reach the end line in the shuttle by each beep, they will be cautioned, and if they fail to reach the end line in two consecutive shuttles, they will be disqualified. The total number of completed shuttles is usually used as the test score. After the test the estimate VO_{2max} is calculated using the formula Y= 31.025 + 3.238 X -3.248A +0.1536AX(Leger et al., 1988). (Y= VO_{2max}, X= player completes test level, A= age)

Resting Heart rate (RHR) was collected in a sitting position by placing the index and middle fingers of one hand slightly below the base of the thumb on the opposing wrist, called the radial pulse method. Pulse was counted in 60 sec of three trials, and the average of three trials was the score of the test.

Statistical Analysis

Statistical Analysis was performed using the IBM SPSS program (Version 20). The descriptive statistics (mean, standard deviation, minimum and maximum) were computed to describe the maximal aerobic power and resting heart rate of Badminton players.

Result and Discussion

All thirteen players undertook the test, and none reported any injuries that may have hampered their performance. All players were given a comprehensive set of data on a test item, as seen in the tables below.

Table: Descriptive Statistic of Maximal Aerobic Power and Resting Heart Rate of Manipur Male Badminton Players

	Min	Max	Mean	SD
MAP (Estimated VO_{2max} **ml/kg/min)**	*45.5*	*54*	*47.5538*	*2.13370*
RHR **(beats/min)**	*57*	*65*	*60.1538*	*3.15822*

Note: N=13, Min= Minimum, Max=Maximum, MAP=maximal aerobic power, RHR=resting heart rate

The national male Badminton player of Manipur had an estimated MAP(VO_{2max}) of 47.55±2.13 ml/kg/min. The obtained values of estimated $VO2_{max}$from the present is relatively low when compared to the value obtained from the studies performed by Akinbiola et al.(2017); Ooi et al.(2009) and Majumdar et al.(1997). The mean value of the national male players in these studies closely corresponds with the mean value for the national sub-junior male players in a study performed by Compos et al. (2009) of 49.68±2.48. The greatest maximal oxygen consumption value in endurance sport is due to a combination of genetic endowment and training(Bassett,2000). For a game like badminton, a higher VO_{2max} is essential to sustain the length of the play (Docherty,1982). A prolonged training cease may lead to deformation, with cardiorespiratory system alterations and metabolism.The lowest estimated VO_{2max} value found in these studies might be due to the low intensity of the training.

The mean RHR of male national badminton players in this study was 60.15±3.15(beats/min). Lower resting heart rates are associated with greater heart function and cardiovascular fitness(Christy,2015), whereas higher values of resting heart rate have been associated with lower physical fitness, as well as higher blood pressure and body weight(Magutah,2013). Several studies and scientific evidence have shown that normal resting HR rates in adults range from 60 to 90 beats per minute (bpm) and the American Heart Association defines normal HR levels from 60 to 100 and for athletes have an RHR of 30 to 40 bpm(Mason et al.,2007) Thus, the value of RHR of this study indicated that the Badminton players of Manipur have low cardiovascular fitness levels.

Conclusion

In conclusion, this study shows that the National male Badminton of Manipur have low VO_{2max} and higher RHR than that of the desirable athlete RHR(30 to 40 bpm). The obtained data of the present study may be a potential detraction indicator or a negative adaptation to training. In this case, further training tolerance measures may be required to determine physiological changes in greater detail to improve the performance level of athletes. The result of this study served as a good baseline and reference for coaches, trainers, athletes, and future researchers, selecting new badminton players and designing a training program to improve badminton performance.

Acknowledgment

The author would like to thank the coaches and Badminton players of the Manipur Badminton association for immense help in data collection. There was no financial assistant with research work.

Informed Consent

All the participants gave their written informed consent for inclusion before participation in the study.

Conflict of Interest

The authors declare no conflicts of interest

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