

## **RELATIONSHIP OF PACE AND HEART RATE IN MIDDLE DISTANCE RUNNING**

**Dr. Dalveer Singh Kaunteya**, Assistant Professor, KR PG Degree College, Mathura U.P., India.

**Dr. Hiralal Yadav**, Assistant Professor, Department of Physical Education, Birla Campus, H.N.B.Garhwal University, Srinagar Garhwal Uttarakhand, India.

### **Abstract:**

*Middle distance running involves popular race distances with performance dependent on a number of physiological factors. The physiological characteristics of successful runners are different from those of sprinters and long distance runners. The purpose of the study was to find out the relationship of Pace and Heart rate in Middle Distance running. For the purpose of this study 30 male athletes belonging to state and Inter-University level 800mts runners from sports hostel, stadium and Universities were selected as the subjects of the study. The age of the subjects ranged between 17-30 years The study was delimited to state and Inter-university level athletes. The study was further delimited to middle distance runners. viz. 800mts only. The variable under investigation was Heart rate at Rest and Heart rate After the completion of the 800 mts. Race. The study was delimited to male athletes of age ranging 17-30 years. It was hypothesized that there is no significant relationship of pace and Heart rate in middle distance running. The purposive sampling technique was employed as the study was based on middle distance runners of state and Inter-University level belonging to 800mts event. Co-efficient of correlation of Resting Heart Rate is 0.208, which was not significant at 0.05 level of significance with 28 degree of freedom. As the coefficient of correlation 0.208. Which is lesser than the tabulated value 0.361. Co-efficient of correlation of Post Heart Rate is 0.371, which was significant at 0.05 level of significance with 28 degree of freedom. As the coefficient of correlation 0.371. Which is more than the tabulated value 0.361. There is no significant relationship of Resting Heart Rate with the performance of 800mts runners. There is significant relationship of Post Heart Rate with the performance of 800mts runners.*

**Key words: - Heart rate, Middle Distance Running, Pace, etc.**

### **Introduction**

Middle distance running involves popular race distances with performance dependent on a number of physiological factors. The physiological characteristics of successful runners are different from those of sprinters and long-distance runners. Maximal oxygen uptake ( $V. O_2max$ ), running economy and the anaerobic threshold are variables that have been shown to limit performance during long distance running, and rapid velocity and anaerobic variables have been shown to limit performance during sprinting. Success with middle distance running is dependent on an integrative contribution from aerobic and anaerobic variables which allows a runner to

maintain a rapid velocity during a race. The relative contributions of the 2 energy systems are functions of distance, intensity and the physiological abilities of the runner. Middle distance runners can be successful with physiological profiles that include a variety of aerobic and anaerobic capabilities, and this characteristic separates them from long distance runners. (Brandon, L. Jerome)<sup>1</sup> (John A. Vachon, David R. Bassett Jr., and Stephen)<sup>2</sup>

The heart is at the center of the cardiovascular system. It is the force that sends blood through the arteries and capillaries to all parts of the body, where the veins return the used blood to the heart. Development of the total cardiovascular system is the only way to improve the supply of oxygen to the muscles. The muscles of the body do the work that allows us to run. The more oxygen that a muscle can get the more work it can do, and the faster a person can cover a designated distance. The ultimate purpose of distance training is the improvement of oxygen delivery to the muscle tissue. Running increase the heart rate as the rate increases the stroke volume, there by increasing the total blood flow, frequently up to 5 or 6 times its resting rate. This overload on the heart causes its muscle fiber to become stronger and more efficient. (Jim Hunt, 1989)

During an incremental run test, some researchers consistently observe a heart rate (HR) deflection at higher speeds, but others do not. The present study was designed to investigate whether differences in test protocols could explain the discrepancy. Additionally, we sought to determine whether the HR deflection point accurately predicts lactate threshold (LT). Eight trained runners performed four tests each: 1) a treadmill test for maximal O<sub>2</sub> uptake, 2) a Conconi test on a 400-m track with speeds increasing ~0.5 km/h every 200 m, 3) a continuous treadmill run with speeds increasing 0.5 km/h every minute, and 4) a continuous LT treadmill test in which 3-min stages were used. All subjects demonstrated an HR deflection on the track, but only one-half of the subjects showed an HR deflection on the treadmill. On the track the shortening of stages with increasing speeds contributed to a loss of linearity in the speed-HR relationship. Additionally, the HR deflection point overestimated the LT when a continuous treadmill LT protocol was used. In conclusion, the HR deflection point was not an accurate predictor of LT in the present study. The purpose of the study was to find out the relationship of Pace and Heart rate in Middle Distance running.

## **Methodology**

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<sup>1</sup> Brandon, L. Jerome, “**Physiological Factors Associated with Middle Distance Running Performance**”, Sports Medicine:(April 1995) - Volume 19 - Issue 4, Retrived on 17-11-12  
[http://adisonline.com/sportsmedicine/Abstract/1995/19040/Physiological\\_Factors\\_Associated\\_with\\_Middle.4.aspx](http://adisonline.com/sportsmedicine/Abstract/1995/19040/Physiological_Factors_Associated_with_Middle.4.aspx)

<sup>2</sup> John A. Vachon, David R. Bassett Jr., and Stephen Clarke, “**Validity of the heart rate deflection point as a predictor of lactate threshold during running**,”(1998),<http://jap.physiology.org/content/87/1/452.long>

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It was hypothesized that there is no significant relationship of pace and Heart rate in middle distance running. The purposive sampling technique was employed as the study was based on middle distance runners of state and Inter-University level belonging to 800mts event. Physiological variable was Resting Heart Rate and Heart Rate after completion of race. Considering the primary purpose of the present study the variables to be assessed in relation to middle distance running were :- Performance of 800mts Run and it was recorded in nearest Secs. , Heart Rate was measured using Palpation Methods and recorded in beats/minute.

The data on Resting Heart rate, was taken prior to the actual event i.e. 800mts at resting condition. The subjects were then asked to run exact distance of their event like a competition in a trial run. Heart Rate after completion of race was taken. The testing programme was planned for three days and only ten subjects were taken each day. Immediately after the finish of the respective races their data were collected. All the data were taken in the afternoon session. In order to find out the relationship of pace and Heart rate in middle distance running Pearson's product moment correlation was applied and Level of significance was set at 0.05 level.

## Results

**Table -1 CO-EFFICIENT OF CORRELATION OF HEART RATE WITH THE PERFORMANCE OF 800MTS RUNNERS**

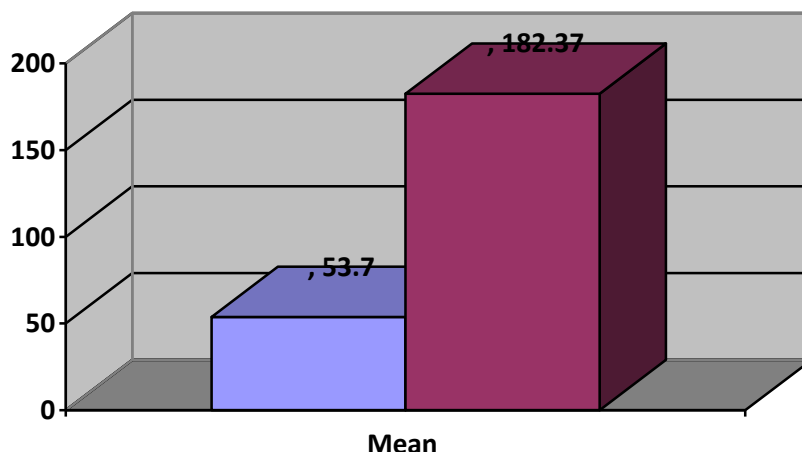
SNo.	Variables	Mean	Standard Deviation	Co-efficient of Correlation
1.	Resting Heart rate	53.70	3.94	0.208
2.	Heart rate after completion of race	182.37	7.31	0.371*

\* Significant at 0.05 level

$r_{0.05}(28) = 0.361$

It was evident from table- 1 that Co-efficient of correlation of Resting Heart Rate is 0.208, which was not significant at 0.05 level of significance with 28 degree of freedom. As the coefficient of correlation 0.208. Which is lesser than the tabulated value 0.361. It indicates that there is no significant relationship of Resting Heart Rate with the performance of 800mts runners.

Co-efficient of correlation of Post Heart Rate is 0.371, which was significant at 0.05 level of significance with 28 degree of freedom. As the coefficient of correlation 0.371. Which is more than the tabulated value 0.361. It indicates that there is significant relationship of Post Heart Rate with the performance of 800mts runners.



**Fig-1 Graphical Representation of Resting Heart rate and Heart rate after the completion of the race.**

## **Discussion of Findings**

An understanding the relationship of pace and heart rate in middle distance running is utmost necessity for understanding in depth about the pace training as well as performance implications for middle distance runners. The fact is that the selected physiological parameter i.e heart rate provides basis for performance as well as are significant indicator of performance capacity.

After going through various critical literatures in this respect of pace in middle distance running and felt there is a need to understand the importance of economy of pace and also to analyze the effect of even pace and uneven pace on energy system.

The findings as established from factual and statistical analysis showed the status and intricacies of physiological parameter of 800mts running events in relation to 800mts Performance, Heart Rate. A low resting heart rate and maximal aerobic power has quite modest association and may be due to higher resting vagal activity. A lower resting heart rate can also be consequence of other derived from training programme, such as increase of venous return and systolic volume. Another very important aspect address by literature over last few years is post exercise maximal and submaximal heart rate recovery the heart rate behaves at the final transit of exercise is another indicator of Vegas nerve integrates.

In response to physical activity, heart rate increases in a predictable manner. In fact, the relationship between exercise intensity and heart rate is an extremely linear one-the greater the intensity, the higher the heart rate, with the relationship becoming more curvilinear (heart rate begins to plateau) at very high intensities. Because of its predictability, you can use heart rate to prescribe running intensities. It can also be used to monitor your athletes' progress over time. For example, as your athletes get in better shape, they will be running at a faster pace when at the same heart rate and their heart rate will be lower when running at the same pace. The lower resting heart rate in endurance- trained runners results from a combination of an increased stroke volume (the volume of blood pumped by the heart's left ventricle with each beat) and an increased activity from the parasympathetic nervous system. (Jason R. Karp. M.S.)<sup>3</sup>

The major determinant of successful endurance performance is VO<sub>2</sub> max. And the percentages of VO<sub>2</sub> max. that an athlete can maintain for a prolonged period. The later is probably related to the lactate threshold because the lactate threshold is likely the major determinant of the pace that can be tolerated during a long-term endurance event. So, the ability to perform at a higher percentage of VO<sub>2</sub> max. probably reflects a higher lactate threshold. Consequently, lactate thresholds at 80% VO<sub>2</sub> max. Suggests a greater aerobic exercise tolerance than a threshold at 60 % VO<sub>2</sub> max. Generally, in two individuals with the same maximal oxygen uptake, the person with the highest lactate threshold exhibits the better endurance performance.( Wilmore H. Jack and Costill L.David, 2008)<sup>4</sup>

The post exercise heart rate depicts that athletes are running with heart rate ranging between 170 to 190 for 800mts runners which is obviously the Heart rate beyond the anaerobic threshold (AT).In general 800mts runners are usually having higher speed endurance, pace judgment and higher anaerobic threshold (AT) level. Thus , it is evident by the fact that Post Exercise heart rate with mean 182 beats/min is comprehensive factor for better performance in 800mts running. On the basis of research findings, the hypothesis stated earlier that there is no significant relationship of pace and heart rate in middle distance running was accepted in resting heart rate(0.208) as the values were lesser than required tabulated value 0.361 and rejected in case of Heart rate after completion of race (0.371) as the values were greater than required tabulated value 0.361.

## **Conclusions**

Based on the Statistical Findings and Results of the study and further discussion based on the review of related literature following conclusions have been drawn:-

1. There is no significant relationship of Resting Heart Rate with the performance of 800mts runners.

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<sup>3</sup>"Heart Rate Training for improved running performance", Retrieved on 29-08-12

[http://www.coachr.org/heart\\_rate\\_training\\_for\\_improved.htm](http://www.coachr.org/heart_rate_training_for_improved.htm)

<sup>4</sup> Jack H. Wilmore. and.David L.Costill , (2008), "**Physiological of sports and exercise**,"human kinetics,third edition, printed in hong kong , p. 274

2. There is significant relationship of Post Heart Rate with the performance of 800mts runners.

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