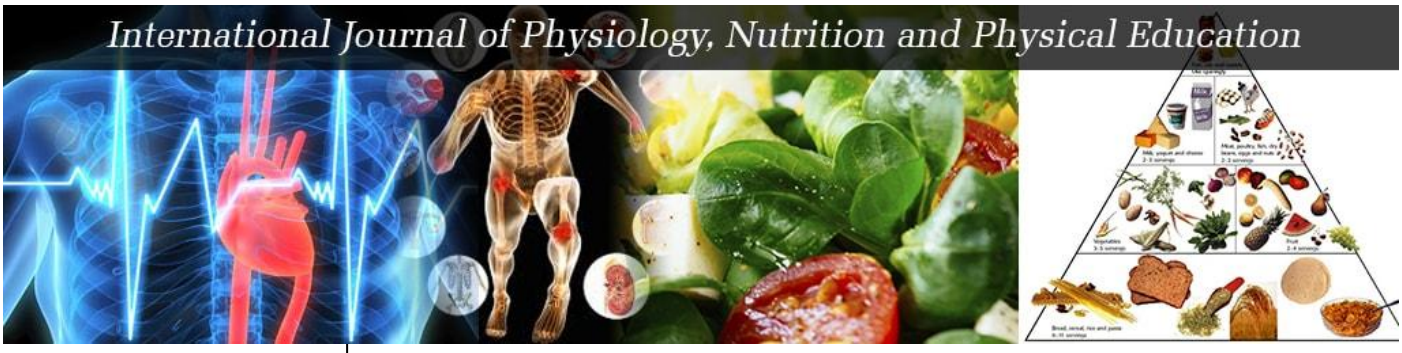


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# Development of norms of resting heart rate as an indicator of fitness of high altitude habitat of male youth of Kashmir

**Sajjadh Ahmad Bhat and Dhananjoy Shaw**

**Abstract**
The aim of the study was to develop norms in regard to the resting heart rate of male youth habitat of Kashmir valley. The study was conducted on two hundred forty two healthy male youth of Kashmir (attitude: 6070 feet/1850 meters). The age of the subjects ranged from 18 to 23 years. A heart rate monitor with chest strap was fixed on the subject and the wrist watch was tied after calibration to check the heart rate of the subjects. The subjects were then asked to lay down in savasana (corpse pose) for twenty minutes. The resting heart rate were noted at 20$^{th}$ minute, 22$^{th}$ minute and at 24$^{th}$ minute. The average was calculated to determine the resting heart rate of the subjects expressed as HR rest. The other selected supportive variables were age, body weight and height. The collected data was computed with mean, standard deviation, six sigma scale and chi square using SPSS. The study concluded that the developed scales are good normative in references to Kashmir youth in regard to their resting heart rate which ultimately is a valued estimator of the cardiovascular fitness/health.

**Keywords:** Resting heart rate, high altitude, norms, six sigma scale, Kashmir

## Introduction

Heart rate is the number of cardiac contractions in one minute. The number of contraction range from 60-80 bts/min. The rate and intensity of the cardiac contractions is affected by exercise, long term training, age, sex, disease, stress, environmental temperature, altitude etc. However 72 beats per minute (bts/min) in is generally considered as a normal heart rate, however a lower resting heart rate is recorded in trained individuals then that of untrained. Autonomic Nervous System controls the working of heart during exercise. It is known that increase in heart rate during mild to moderate level of exercise is due to withdrawal of Parasympathetic nervous system activity (PNS). The rise in heart rate during strenuous exercise is mediated through sympathetic activity. Although one of the hallmark of the endurance athlete is a slower heart rate at rest (Bradycardia). The lower heart rate may be caused by any combination of three factors, a reduction in the intrinsic rate of heart, decreased sympathetic tone and increased parasympathetic tone (Lewis 1980) [7].

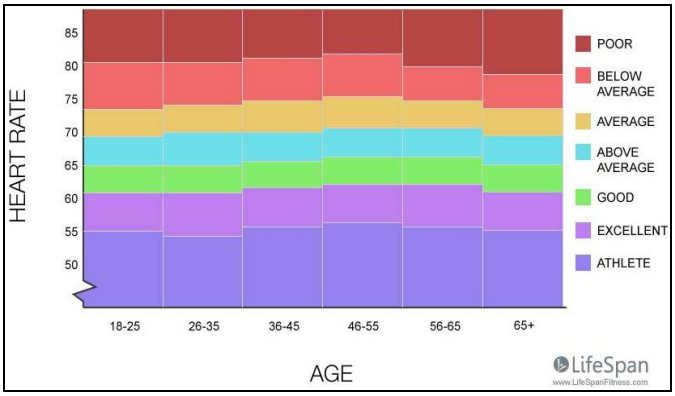
Resting bradycardia is a well-known phenomenon in endurance trained athletes or sportspersons, however the mechanism responsible for this phenomenon have not been conclusively elucidated. In humans an increase in cardiac parasympathetic activity is a major contributor for training induced bradycardia (Coote, 2015) [3]. Other investigators suggested that an increased parasympathetic influence in the trained individuals is accounted for the resting bradycardia (Tipton, 1977) [2].

If one had a normal core temperature, a normal cardiac conduction system and electrolyte homeostasis, it is reasonable to assume that resting HR would be a function of intrinsic HR and the net influence of the parasympathetic and sympathetic NS. Therefore the changes in the intrinsic heart rate, resting parasympathetic and sympathetic activity or the balance of parasympathetic and sympathetic activity would affect the resting heart rate.

Heart rate is arguably a very easy cardiovascular measurement, especially in comparison to the invasive or noninvasive procedures used to estimate stroke volume and cardiac output. Consequently, measurement of heart rate is routinely used to assess the response of the heart at rest, to exercise, or the recovery from exercise, as well as to prescribe exercise intensities

(Froeliche, 2000) [4]. Given that the increase in heart rate during incremental exercise mirrors the increase in cardiac output, maximal heart rate is often interpreted as the upper ceiling for an increase in central cardiovascular function. Indeed, research for the last 100 years has demonstrated that heart rate does in fact have a maximal value; one that cannot be surpassed despite continued increases in exercise intensity or training adaptations. The regular exercise leads to adoptive changes in cardiac and physical performance and oxygen uptake capacity and ultimately the onset of slower resting heart rate medically called as Bradycardia. (Robert 2008) [6].

There are numerous studies which documents the norms of Resting Heart Rate (HRrest), which is missing in India particularly for high altitude Kashmiri youth. The findings of one of the study have been illustrated vide Figure-1 below:




**Source:** www.LifeSpanFitness.com

**Fig 1:** The Resting Heart Rate Chart (Pulse Rate Chart) Shows the Normal Range According to Age

The Purpose of the study was to develop norms in regard to resting heart rate (HRrest) of high altitude Kashmiri male youth, which will be useful for evaluation, grading, grouping and monitoring the aerobic fitness.

## Methodology

The study was conducted on two hundred and forty two healthy male subjects of Kashmir valley (altitude: 6070 feet/1850 meters). The age of the subjects ranged from 17 to 23 years. A heart rate monitor with chest strap was fixed on the subject and the wrist watch was tied after calibration to check the heart rate of the subjects. The subjects were then asked to lay down in savasana (corpse pose) for twenty minutes. The resting heart rate were noted at 20$^{th}$ minute, 22$^{th}$ minute and at 24$^{th}$ minute. The average was calculated to determine the resting heart rate (HRrest) of the subjects.

The statistical analysis was descriptive statistics (Mean and standard deviation), 6 sigma scale, chi-square and standard scores using SPSS.

## Findings

**Table 3:** Descriptive Statistics of Physical Data of the Subjects (High Altitude Kashmiri Male Youth)

| Age (Yrs)* | Weight(Kg)* | Height(cm)* |
|---|---|---|
| 18.75±1.01 | 54.53±6.88 | 171.97±6.02 |

N=242* the numbers are expressed as Mean±SD

**Table 4:** Descriptive Statistics of Resting Heart Rate of High Altitude Kashmiri Male Youth

| Variables | Gender | Mean | SD |
|---|---|---|---|
| Resting Heart Rate (RHrest)* | Male | 63.25 | 10.10 |

N=242, * RHrest is expressed in bts/min.

**Table 5:** Six Sigma Scale of Resting Heart Rate (RHrest) of Habitat of High Altitude Kashmiri Male Youth

| Six Sigma Scale | RHrest | Six Sigma Scale | RHrest | Six Sigma Scale | RHrest | Six Sigma Scale | RHrest |
|---|---|---|---|---|---|---|---|
| 100 | 94.25 | 75 | 78.25 | 50 | 63.25 | 25 | 48.25 |
| 99 | 93.65 | 74 | 77.65 | 49 | 62.65 | 24 | 47.65 |
| 98 | 93.05 | 73 | 77.05 | 48 | 62.05 | 23 | 47.05 |
| 97 | 92.45 | 72 | 76.45 | 47 | 61.45 | 22 | 46.45 |
| 96 | 91.85 | 71 | 75.85 | 46 | 60.85 | 21 | 45.85 |
| 95 | 91.25 | 70 | 75.25 | 45 | 60.25 | 20 | 45.25 |
| 94 | 90.65 | 69 | 74.65 | 44 | 59.65 | 19 | 44.65 |
| 93 | 90.05 | 68 | 74.05 | 43 | 59.05 | 18 | 44.05 |
| 92 | 89.45 | 67 | 73.45 | 42 | 58.45 | 17 | 43.45 |
| 91 | 88.85 | 66 | 72.85 | 41 | 57.85 | 16 | 42.85 |
| 90 | 88.25 | 65 | 72.25 | 40 | 57.25 | 15 | 42.25 |
| 89 | 87.65 | 64 | 71.65 | 39 | 56.65 | 14 | 41.65 |
| 88 | 87.05 | 63 | 71.05 | 38 | 56.05 | 13 | 41.05 |
| 87 | 86.45 | 62 | 70.45 | 37 | 55.45 | 12 | 40.45 |
| 86 | 85.85 | 61 | 69.85 | 36 | 54.85 | 11 | 39.85 |
| 85 | 85.25 | 60 | 69.25 | 35 | 54.25 | 10 | 39.25 |
| 84 | 84.65 | 59 | 68.65 | 34 | 53.65 | 9 | 38.65 |
| 83 | 84.05 | 58 | 68.05 | 33 | 53.05 | 8 | 38.05 |
| 82 | 83.45 | 57 | 67.45 | 32 | 52.45 | 7 | 37.45 |
| 81 | 82.85 | 56 | 66.85 | 31 | 51.85 | 6 | 36.85 |
| 80 | 82.25 | 55 | 66.25 | 30 | 51.25 | 5 | 36.25 |
| 79 | 81.65 | 54 | 65.65 | 29 | 50.65 | 4 | 35.65 |
| 78 | 81.05 | 53 | 65.05 | 28 | 50.05 | 3 | 35.05 |
| 77 | 80.45 | 52 | 64.45 | 27 | 49.45 | 2 | 34.45 |
| 76 | 79.85 | 51 | 63.85 | 26 | 48.85 | 1 | 33.85 |

According to table-5,the 100 point of six sigma scale documented 94.25 bts/min, the 90 point documented 88.25 bts/min, the 80 point documented 82.25 bts/min, the 70 point documented 75.25 bts/min, the 60 point documented 69.25 bts/min, the 50 point documented 63.25 bts/min, the 40 point documented 57.25 bts/min, the 30 point documented 51.25 bts/min, the 20 point documented 45.25 bts/min, the 10 point documented 39.25 bts/min and at 01 point documented 33.85 bts/min.

**Table 6:** Grading of Resting Heart Rate (RHrest) in Six Sigma of Habitat of High Altitude Kashmiri Male Youth

| Grade | Minimum Value | Maximum Value | Frequency Distribution | Chi-square |
|---|---|---|---|---|
| Excellent | 33 | 45 | 6 | 37.14* |
| Good | 46 | 57 | 68 | 7.93* |
| Average | 58 | 69 | 114 | 88.91* |
| Bad | 70 | 81 | 46 | 0.11* |
| Poor | 82 | 94 | 8 | 32.07* |

According to table-6, a subject score RHrest between 33 bts/min and 45 bts/min will be considered as Excellent, a subject score between 45 bts/min and 57 bts/min will be considered as good, a subject score between 57 and 69 will be considered as Average, a subject score between 69 bts/min and 81 bts/min will be considered as Bad and a subject score between 81 bts/min and 94 bts/min will be considered as poor. The chi-square ($X^2$) demonstrated asymmetric distribution among the grades. Highest frequency was observed at average grade followed by below average, above average, poor and excellent thus supporting normal distribution (Figure-2).

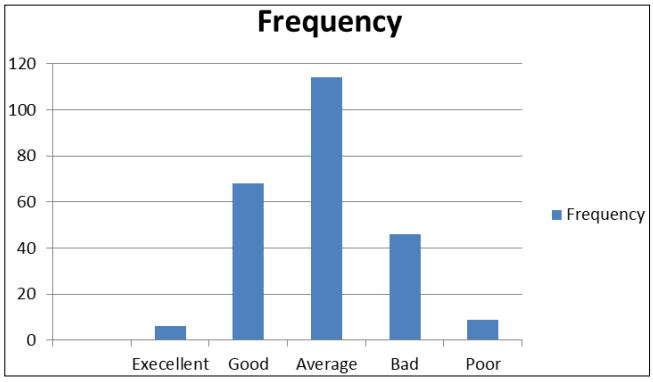



**Fig 2:** Plotting of Resting Heart Rate (HRrest) Frequency in Selected Grades

## Conclusions

- A 100 point 6 sigma scale has been developed in reference to Resting Heart Rate (RHrest) for habitat of high altitude Kashmiri youth.
- A grade scale with grades as Excellent, Good, Average, Bad and Poor has been developed for Kashmiri youth in reference to their Resting Heart Rate (RHrest).
- The developed scale and norms are good normative reference to Kashmir youth in regard to their Resting Heart Rate which ultimately is a physiological parameter in predicting the cardio vascular fitness of an individual.

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