

# Demographic Characterization of Heart Rate Variability (HRV)

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## INTRODUCTION

The rate and modulation of the heart beat i.e. heart rate variability (HRV) are controlled by the autonomic nervous system. Sympathetic activation decreases and parasympathetic action of the heart increases HRV. Measurement of heart rate variability (HRV) provides a non-invasive method to obtain reliable and reproducible information on the autonomic modulation of heart rate and has become an important tool for risk assessment. Other than relating to various physiological and clinical correlations, HRV has been found to correlate with, e.g., age, mental and physical stress, and attention, sees, geographical locations, altitude, racial differences, etc. The Article is focused on demographic characterization of the Heart Rate Variability parameters. A short term (5 minutes) recording is performed on the subjects selected randomly in the plains (reference data) and hills (research data). HRV analysis is performed in three domains and statistically analyzed for characterization.

The objective being, to characterize the population of the north eastern hilly regions of West Bengal and to have a comparison with the population residing in the plains of the region using different analysis methods. Thus both male and female subjects from different parts of hills and plains of the region were selected for the present study. Five hundred (500) subjects were selected on stratified random selection basis from 2007 to 2010. The population is divided into two groups, viz.

1. The hill population (400 healthy subjects): The sample of four hundred subjects representing the hill population has 262 males and 138 females aged from 17 to 76 with a mean age of  $34 \pm 13.07$  and 17 to 86 years with a mean age of  $34.1 \pm 11.4$  respectively.
2. The plains population (100 healthy subjects): The sample of one hundred subjects representing the plains population has 66 males and 34 females aged from 17 to 56 with a mean age of  $27.68 \pm 9.394$  and 18 to 81 years with a mean age of  $28.1 \pm 12.2006$  respectively.

The data collection was done in two steps, viz. Schedule by asking questions and noting down the same in one part and physiological data (Heart Rate parameters) collected from the subjects under various conditions by using Suunto T6 Heart Rate Monitor. Analysis of the parameters was carried out using KUBIOS HRV 2.0 software. Entire statistical analyses were performed using SPSS 13.0. An ANN has been designed using MATLAB R2009b neural network toolbox to characterize a person whether he belongs to hill or plains. The network has been trained on a test population and has been validated with another set of data in both categories of population.

## BACKGROUND

An extent of experimental works emphasize that various cardiovascular variables like heart rate and blood pressure fluctuate from beat-to-beat. Ancient Physicians noted the temporal fluctuations in cardiovascular signals but overlooked the possible significance of the beat-to-beat fluctuation. The variability was treated as noise and it was either ignored or averaged out. Stephen Hales (1733) became the pioneer to report beat-to-beat heart rate variability to be synchronous with respiration and obstetrics became the maiden field in which the potential clinical significance of beat-to-beat variability in cardiovascular signals was recognized. The importance of sinus arrhythmia was described in relation to fetal monitoring in 1965 (Heart rate variability, 1996; Bernston et al., 1997). The variability correlated with fetal viability as step down of beat-to-beat variability indicated fetal compromise (Heart rate variability, 1996). Earlier studies indicate HRV measurements to be based on simple measurements of RR intervals in diabetic studies.

An in depth research have shown that decreased fluctuation of RR interval is not noise, but implicates an increased risk for arrhythmic events and an increased mortality rate in patients with a previous myocardial infarction. Time - frequency domain measures and nonlinear studies of heart rate variability have provided portent information and increased possibilities to perform noninvasive studies on the significance of changes in the regulation of heart rate behavior.

Demographic studies on HRV shown to be least handled and experimented with. Characterizations due to demographic variability's of race, geographical locations, habitation, workability, etc. are yet to be done.

The demographic zone that is chosen for research, i.e. the north eastern hilly regions of West Bengal mainly comprises of Darjeeling, Jalpaiguri and Coochbehar districts. Situated at altitudes of higher elevation and bounded by Himalayas in the north and exotic dooars forest presents a wide variety of population and geographical variations, the golden cause which attracted the research. As autonomic activity of the heart is greatly affected by geographical, racial, habitation, habits, the research will draw a characterization of the entire region based on a group of population.

The original inhabitants of the Darjeeling Hills were Lepchas or Rongpa (the ravine folks) as they prefer themselves to be known as. Though their origin

is obscure, they are decidedly Mongolian in feature. The Khampas, another branch of the Lepchas, are warrior-like and more dashing than their docile cousins. The Khampas are recent immigrants from Tibet. The greater bulk of the people in the Hills are Gorkhas. They are industrious and enterprising as a race and speak various dialects. The short Mongolian type Nepalese, the Gorkhas, renowned for their military prowess the world over, and the first to be decorated with the coveted Victoria Cross, finds jobs and security both in the British and Indian armies. They carry the traditional weapon, the Khukri-a curved ornamental knife. Among the population are also the Newars or best known, the world over as the Sherpa's. They are well known for their courage, stamina and surefootedness and for their immeasurable contributions to Mountaineering. Also much in evidence in the Hills is the Bhatia's and they are divided into Tibetan, Bhutan, Dharma and Sikkimese Bhatia's and a greater bulk of Bengali from Siliguri subdivision.

From referred research the area seems to comprise of nearly 273 tribes in addition to the races like Bengalis, Rajasthanis, Biharis, Gujratis, Punjabis, etc. who migrated from different parts of India at different points of time due to various causes and facts (Biswas, 2001).

The present work attempts to ascertain and characterize the HRV in the North Eastern Hilly Regions of West Bengal as no prior attempts in this field and this region is made till date.

Thereby an attempt is being carried out identifying the various shortcomings to investigate and characterize the population of the particular region keeping its mind the strong diversity of population and wide geographical variation of the same. In a way it is a virgin attempt to adopt for.

## Methodology

The data collection was done in two steps, viz. *Schedule* by asking questions and noting down the same in one part and physiological data (Heart Rate parameters) collected from the subjects under various conditions by using Suunto T6 Heart Rate Monitor.

Height is recorded using "Harpender" Anthropometer and weight is calculated by using clinical balance (digital). Humidity and room temperature is recorded using Hygrometer (Metravi - TH-103). Altitude recordings are available from Suunto T6 HRM.

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