INTRAINDIVIDUAL VARIATION ON BLOOD PRESSURE COMPONENTS MAY AVOID THE RISK FACTORS OF CARDIOVASCULAR DISEASE IN YOUNG ADULTS

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Abstract Background: A repeated measurement (in stable conditions) of the components of Blood Pressure is ideal for tracking modifications of the clinical state to avoid the risk of cardiovascular events. It is also an essential tool in the investigation of cardiovascular disease. **Aims and objectives:** The aim of the present study is to examine the diurnal variation of the components of Blood Pressure at the different time of the day. **Methods:** The study was conducted at Clinical laboratory, Department of Physiology, SBKS medical institute and research centre SVU, Vadodara, India. The total number of students included in the study was one hundred. The components of blood pressure including Systolic Blood Pressure, Diastolic Blood Pressure, Pulse Pressure, Mean arterial pressure, Rate Pressure Product have been measured. **Results:** The diurnal variation of these parameters was significantly greater in men than in women. The differences in the parameters were in its maximum level during afternoon. **Conclusion:** Diurnal variability of blood pressure components may determine the risk factors of cardiovascular disease

Key words: Diurnal, Variation, Blood Pressure, Pulse Pressure, Rate Pressure Product, cardiovascular diseases.

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Introduction:

In recent times, the global environmental changes are apparent and this environmental change may effect on the cardiovascular parameter in many individual. Therefore, the study of Physiological parameters in normal individual at different times of the day is important. However, the diurnal pattern of BP may vary among different populations due to differences in ethnicity,[1,2] daily activities, sleep patterns, or environmental factors [3] and age.

It is well established that differences in blood pressure (BP) levels among individuals (i.e., intra individual BP variation) are associated with differences in risk for cardiovascular disease events.[4] The cardiovascular parameters like Systolic Blood Pressure (SBP), Diastolic Blood Pressure (DBP), Pulse pressure (PP), Mean arterial Pressure (MAP), and Rate Pressure Product (RPP) facilitate in diagnosing Cardiovascular diseases. Elevated blood pressure (EBP) is a key risk factor serious complication, such as stroke, heart attack, and kidney failure etc. There is an increasing amount of evidence that not only the average level of BP, but particularly an abnormal circadian BP rhythm with a decreased fall in night BP determines the development of diabetic complications.[5] recently, focus has been directed toward PP as a predictor of cardiovascular risk in nondiabetic subjects.[6-12]

Moreover, increased PP has recently been associated with microalbuminuria in nondiabetic subjects.[13] However, the reason for diurnal changes in HR and BP are far more complicated and is the result of the influence of both external stimuli and endogenous homoeostatic control mechanisms.

Materials and methods:

The Cross sectional study was carried out at the Department of Physiology, S.B.K.S Medical Institute and Research Centre, Vadodara. Hundred young adults both male and female with age group of twenty to thirty years were recruited as the subjects. Subjects had completed questionnaires with personal information including health history and physical activity habits. Before testing, the subjects with recent history of any acute / chronic cardiovascular disease at the time were excluded from the study. The anthropometry including height, weight and Body mass index (BMI) were measured. A sphygmomanometer (GB120) was used to measure blood pressure. Systolic blood pressure had been determined upon hearing the first of two or more Korotkoff sounds. Diastolic blood pressure has determined before the disappearance of Korotkoff sounds. These parameters have used to calculate the other components of BP such as pulse pressure (PP), mean arterial blood pressure (MAP), and rate pressure product (RPP).[14] PP is the difference between SBP and DBP; computed as SBP- DBP. Mean BP was computed as Diastolic BP+ 1/3 of PP and RPP was calculated as SBP × heart rate (HR). Blood pressure had been recorded at different times of the day (morning, afternoon, evening) in each individual. Measurement had been taken at sitting position after at least 10 minutes of rest, each time. Minimum 3 measurements at 2 minutes interval had been taken for each parameters and mean of three were considered as final data.

Data was analyzed using appropriate statistical tests, using frequencies and percentages for categorical variables and central tendency and dispersion measures (Standard Deviation [SD]) for quantitative variables. All statistical parameters were done using of SPSS 20 and Microsoft Office Excel®. P-value < 0.05 was considered to be statistically significant. The Pearson correlation was applied for finding out any correlation between anthropometric parameters and cardiovascular parameters. ANOVA and Post hoc test for the significances was applied.

Study followed a protocol observed by Sumandeep Vidyapeeth Institutional Ethics Committee (SVIEC) of University and all study was in accordance with the approval of the Committee for the Purpose of Human Research Review Panel (HRRP). The ethical approval code of this project was SVIEC/ON/medi/BNPG-12/D13376.

Result:

Means for all anthropometry including height, weight, BMI were significantly greater in men than in women (Table 1). On stratification by gender the mean with standard deviation for SBP, DBP, PP, MAP, RPP were comparable and significantly higher in male (Table 2). In morning, the mean within individual coefficient of variation for SBP, MAP and RPP were less in male than female but the mean within individual coefficient of variation for DBP was less in female than male. There was slightly difference of PP between male and female. In afternoon, the mean within individual coefficient of variation of SBP, DBP, PP, and MAP were greater in male than female subjects (Fig. 1, 2).

Table 1: Description of different physical characteristics of sample (n= 100)

Trait	Male(n=50)	Female(n=50)	T value	P value
Age(yr)	23.14±1.03	23.30±1.39	-.654	0.51
Height(cm)	177.92±4.43	139.36±10.36	24.21	.001
Weight(kg)	67.22±10.53	48.86±4.97	11.14	.001
BMI(kg/m2)	21.27±3.50	25.57±4.48	-5.33	.001

Table 2: On stratification by gender mean with standard deviation (Mean ± SD) of cardiologiccal parameters in study population. df= 98, p-value < 0.05 was considered significant. Each value is expressed as the mean of triplicate measurement.

Parameters	Male	Female	T value	P value
SBP(mmHg)	123.51±9.33	116.88±5.93	4.236	0.001
DBP(mmHg)	77.04±4.47	76.47±4.87	.613	0.541
PP(mmHg)	46.47±9.14	40.41±8.02	3.521	0.001
MAP(mmHg)	92.53±4.88	89.94±3.64	3.010	0.003
RPP(bpm × mmHg)	10677.27±1415.82	10346.38±861.50	1.412	0.162

There was an exception for RPP and it was less in male. In morning SBP(r=0.42), PP (r=0.39) and MAP (r=0.27) were positively correlated with height. SBP(r=-0.35), PP(r=-.03) showed a negative correlation as indicated by Pearson correlation coefficient (r) with BMI in the study group. DBP M was positively correlated with age (r= 0.08), height (r= 0.01), weight (r= 0.06) and BMI (r= 0.04) in all participants. Other relations were not significantly correlated. In afternoon cardiological parameters, all the relations were not significantly correlated except SBP and MAP. These were positively correlated with height and weight. In evening all the relations between anthropometric parameters and cardiological parameters were not significantly correlated. As expected, mean levels of SBP, DBP, PP, MAP, and RPP were significantly lower in morning than in afternoon in both male and female. Also as expected, mean levels of SBP and DBP were significantly higher in men than in women during three times. In evening, the mean with standard deviations for SBP and DBP were 123.58±6.11 and 77.24±3.31. The mean with standard deviations for PP was 46.34±5.51. The mean with standard deviations for MAP was 92.68±3.61. The mean with standard deviations for HR were 86.86±6.91 (Fig. 3).

Figure 1: Showing mean with standard error of mean (Mean ± SEM) of morning cardiological parameters in both male and female. Error bars indicate standard error.

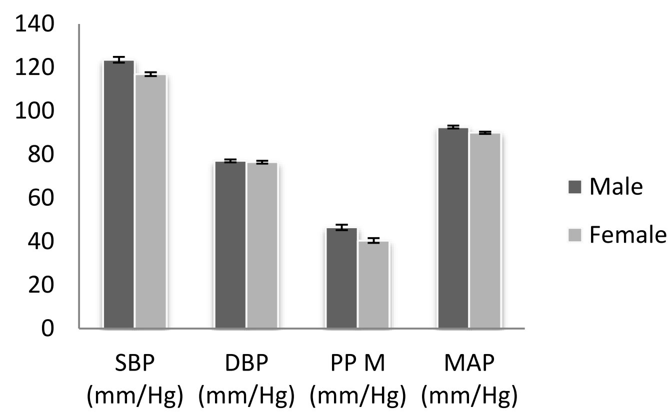


Figure 2: Showing mean with standard error of mean (Mean ± SEM) of afternoon cardiological parameters in both male and female. Error bars indicate standard error.

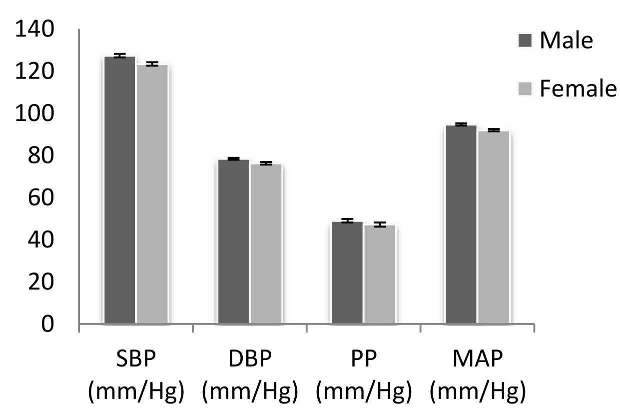
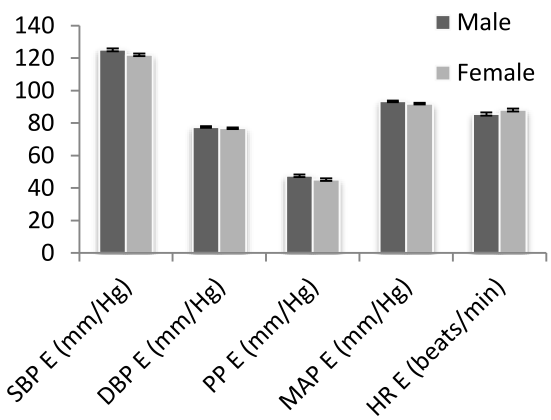


Figure 3: Showing mean with standard error of mean (Mean ± SEM) of evening cardiological parameters in both male and female. Error bars indicate SE. Showing mean with standard error of mean (Mean ± SEM) of evening cardiological parameters in both male and female. Error bars indicate standard error.



Discussion:

The cardiovascular parameters of young and healthy adults were more evident in the diurnal function, including the post lunch period. In healthy subjects, blood pressure maintains a higher level during afternoon, with peak values between 12.30 to 2 PM. Similarly, increases in systolic were larger than in diastolic BP. We found that intraindividual variation of SBP was grater in male. It may be temporary increase in blood pressure because high levels of stress can leads to hypertension. Certain chronic conditions also may increase risk of high blood pressure, such as kidney disease and sleep apnea. Recently poor lifestyle habits, such as an unhealthy diet, obesity and lack of exercise, contribute to high blood pressure. While high blood pressure is most common in adults. Current recommendations from WHO refer to < 120/ < 80 mmHg as optimal BP.[15] The circadian rhythm of blood pressure follows the diurnal variation of autonomic neural function. The clinical importance of the circadian character of blood pressure has been well established. [16] Moreover, a number of sleep disorders and acute and chronic medical conditions can alter BP and cause hypertension. [17] According to Yamasaki et al. [18] ambulatory BP monitoring indicated that BP variations were based on their physical activity levels, not on the clock time.

Conversely, the reason for diurnal changes in blood pressure and pulse pressure was far more complicated and was the result of the influence of both external stimuli and endogenous homoeostatic control mechanisms. [19,20]

Besides blood pressure and pulse pressure, many other cardiovascular parameters have circadian rhythms. Other cardiovascular parameters have a similar cycle with blood pressure, levels rising during afternoon. We found that increase the variation of PP with in male individuals. Until recently focus has been directed toward increments in diastolic rather than systolic BP. Systolic BP often increases with age, whereas diastolic BP remains unchanged or declines, [21] causing a widening of the PP.

Conclusion:

The diurnal variability of physiological parameters in the cardiovascular system maintains cardiovascular function to costume the needs of different levels of daily activities at different times of the day. However, physiological circadian rhythm determines the circadian feature of cardiovascular risk.

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