Abstract

Introduction: Blood pressure usually increases in winter and decreases in summer i.e., shows seasonal variation. In a tropical country like India, women often complain of prominent symptoms like dizziness, giddiness, fainting, and weakness during summer months. The objective was to study the prevalence of above symptoms which are common during summer and its association with variation in blood pressure among normotensive healthy females aged 18-40 years.

Methods: The present study was carried out on 132 women as a prospective observational study which included 2 home visits to the participants in the two different seasons in the months of May-June (summer) and December-January (winter) based on the data provided by the meteorological department of Government of India. Blood pressure and pulse rate (hemodynamic variables) was measured in these seasons and information was collected on the occurrence of the symptoms in these seasons.

Results: There was a mean decrease of 11.07 ± 10.29 mm of Hg in systolic blood pressure & 6.79 ± 6.88 mm of Hg in diastolic blood pressure in summer as compared to winter. The symptoms in the form of weakness, dizziness, and blackout which are generally perceived by women in this area to be due to low blood pressure were observed in 32.6% of the study subjects in summer compared with 2.3% in winter. The difference was statistically highly significant (p<0.001). There was no significant difference between the mean value of electrolytes, creatinine and urea in the cases and the controls.

Conclusion: Thus the seasonal variation in blood pressure rather than electrolytes abnormality may be responsible for these symptoms.

Introduction

Blood pressure is influenced by level of activity, exercise or rest, degree of wakefulness or sleep, environmental factors such as temperature, mood (friendly or hostile) and a multitude of other emotional and psychological factors that reflect a person's response to internal and external milieu. Blood pressure variability has a time course ranging from a few seconds or minutes (short-term variability) to 24 hour (long term variation) or 1-year i.e. seasonal variability.

Blood pressure usually increases in winter and decreases in summer. The suggested etiology is that cold increases sympathetic tone, evidenced by elevated blood pressure and plasma and urinary nor adrenaline concentrations. The lower blood pressure in warm temperature is attributed to cutaneous vasodilatation and loss of water and salt from sweating. In a tropical country like India, women often complained of prominent symptoms like dizziness, giddiness, fainting, and weakness during summer months. Often these ladies present with these symptoms to the physician attributing them due to low blood pressure. Many hypotheses have been put forward to explain these symptoms and one of them is that the occurrence of the symptoms is due to electrolyte imbalance.

The residents of the study area reside in a pucca house of 26.25 m² area. The area is marked by poor living conditions including inadequate ventilation and poor clothing among women. The present prospective study attempts to find out the prevalence of above symptoms and its association with variation in blood pressure among normotensive healthy females aged 18-40 years.

Materials and Methods

Study setting: The study was carried out in an urban slum located in eastern part of Delhi, the capital of India which is the field practice area of the department of Community Medicine, Maulana Azad Medical College. The area has four blocks with 19,316 populations living in 3672 households.

The city was hottest in the month of May and June (mean maximum and minimum temperature was 39.4±2.15°C & 26.6±2.27°C). The coolest months were reported to be December and January (mean maximum and minimum temperature was 20.45±2.36°C & 7.12±2.51°C) as provided by the Indian meteorological department.

Study subjects

Females who were residents of Gokulpuri, New Delhi, aged 18-40 years, were eligible to participate in the study. The inclusion criteria were premenopausal females between the age of 18 to 40 years. The exclusion criteria were defined as: 1) Hypertensives (known or detected on first observation i.e., blood pressure ≥ 140/90 mmHg), 2) taking tobacco (smoking, or taking Gut, Gutka, Khaini), 3) taking oral contraceptives or steroids on the first or follow up visits, 4) taking alcohol daily/ regularly, 5) suffering from chronic/debilitating disease (cancer, renal disease, heart failure, TB), 6) known diabetics 7) pregnant on first or
follow up visits.

Sample size and sampling

Since the incidence of symptoms was not known, it was decided that about 200 subjects will be contacted initially. Women in the age group of 18-40 years residing in the 4 service blocks of Urban Health Center (UHC) formed the universe of the study which is approximately 3670 in number. All the households in this area constituted the sampling frame. It was assumed that study which is approximately 3670 in number. All the households

A total of 215 individuals were sampled and contacted to determine their interest in study participation. From this sample, 159 met initial eligibility criteria and consented to making a baseline appointment. But only 132 were able to complete the interview and the examination in both the seasons.

Although those who were detected to be hypertensive on the first visit were excluded from the study, they were informed about the benefits of antihypertensive treatment and were advised to get treatment either from the health center under the department or any source of their choice. Similarly medical advice was given for other conditions if treatment was not being taken.

Data collection : Data was collected from individual study participants at their homes using a pre-designed and pretested semi-structured proforma containing the items of socio-demographic data viz. (age, religion, marital status, literacy status, and occupation), presence or absence of symptoms of weakness, giddiness, dizziness and blackout. If any of these symptoms was present the person was considered symptomatic.

Blood pressure and pulse rate (hemodynamic variables) was measured in two seasons, May-June (Summer) and December-January (Winter) based on the data provided by the meteorological department of Government of India. Blood pressure was measured thrice in right arm at one minute interval using adult cuff size in sitting position & arm comfortably placed on an elevated surface/table so that it was on the level of heart. Finally mean of second and third observations was considered and the first measurement was discarded.

The venous blood samples of the symptomatic study participants were taken from the antecubital vein for estimation of blood urea, serum creatinine, serum sodium, Potassium, Chloride and Calcium. These samples were collected at the residence of the study subjects at the time of home visit during summer. Out of total 43 symptomatic study participants 27 consented for taking the blood sample. The blood samples were also collected from an equal number of controls i.e., women not having the symptoms randomly. The study participants were informed about their reports.

Data Analysis

Data was entered and analyzed in SPSS version 11.01 for Windows. Paired t test was used to determine the variations in hemodynamic variables in different seasons. For differences in the categorical variable X2 and McNemar test was used. Independent samples t-test was used to calculate the significant difference between the mean values of biochemical parameters. A value of p < 0.05 was considered statistically significant.

Table 1: Seasonwise distribution of environmental, haemodynamic variables and prevalence of symptoms(N=132)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Seasons</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Summer</td>
</tr>
<tr>
<td>Outdoor Temperature (°C)</td>
<td></td>
</tr>
<tr>
<td>Maximum</td>
<td>39.43(2.15)</td>
</tr>
<tr>
<td>Mean(SD)**, Range</td>
<td>39.43(2.15)</td>
</tr>
<tr>
<td>Minimum</td>
<td>26.60(2.27)</td>
</tr>
<tr>
<td>Mean(SD), Range</td>
<td>26.60(2.27)</td>
</tr>
<tr>
<td>Indoor Temperature (°C) Mean(SD), Range</td>
<td>33.18(1.41)</td>
</tr>
<tr>
<td>Haemodynamic variables Mean(SD)*</td>
<td></td>
</tr>
<tr>
<td>Systolic blood pressure (mm of Hg)</td>
<td>114.35(11.74)</td>
</tr>
<tr>
<td>Diastolic blood pressure (mm of Hg)</td>
<td>75.78(9.47)</td>
</tr>
<tr>
<td>Mean blood pressure(mm of Hg)</td>
<td>113.51(12.51)</td>
</tr>
<tr>
<td>Pulse rate (/min)</td>
<td>79.88(7.63)</td>
</tr>
<tr>
<td>Prevalence of symptoms*** n (%)</td>
<td>43(32.60)</td>
</tr>
</tbody>
</table>

*Significant difference in the mean value of the all hemodynamic variables between summer and winter (p<0.001)
**S.D- Standard deviation
***McNemar Test(p<0.01)

Results

Socio-demographic profile

About half of the study subjects (51.5%) were in the age group of 25-34 years. The mean age of the subjects was 28.11 years (±5.50 years).

Majority (61.4%) of them belonged to upper-lower class of socio-economic status. The per capita income of study subjects ranged from Rs. 250 to Rs. 2500 per month with a mean of Rs. 698.82±381.26.

Variation in temperature (Table 1)

Mean indoor temperature decreased from 33.18±1.41°C in summer to 17.83±1.85°C in winter.

The mean maximum outdoor temperature in summer was 39.4±2.15°C & in winter it was 20.45±2.36°C, which showed a decrease of 18.95°C. The highest minimum temperature was observed in the month of May-June (26.6±2.27°C) & the lowest minimum outdoor temperature in the month of December-January (7.12±2.51°C).

Variation in hemodynamic variables (Table 1)

Systolic blood pressure (SBP) decreased from 125.42±11.29 mm Hg in winter to 114.35±11.74 in summer and this difference of blood pressure was statistically significant (p<0.001).

Mean diastolic blood pressure (DBP) it has decreased from 82.57±8.13 mm Hg in December-January to 75.78±9.47 in May-June. This seasonal variation of DBP was statistically significant (p<0.001).

There was mean decrease of 11.07±10.29 mm of Hg in SBP & 8.13 ±9.12 in summer as compared to winter (p<0.001).

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The study done by T Sauchihasi et al (1995) and Izzo et al (1990) in SBP, which ranged from 2 mm to 13.2 mm of Hg. However, the study done by T Sauchihasi et al20 and Izzo et al21 reported no seasonal variation. In other studies9-19 decrease in DBP, which ranged from 2 to 7 mm of Hg. However, the study done by T Sauchihasi et al20 and Izzo et al21 reported no seasonal variation.

<table>
<thead>
<tr>
<th>Blood Pressure(mm of Hg)</th>
<th>SBP Present</th>
<th>SBP Absent</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>90-99</td>
<td>05 (45.45)</td>
<td>06 (54.55)</td>
<td>11(100)</td>
</tr>
<tr>
<td>100-109</td>
<td>11 (29.73)</td>
<td>26 (70.27)</td>
<td>37(100)</td>
</tr>
<tr>
<td>110-119</td>
<td>15 (38.88)</td>
<td>28 (61.12)</td>
<td>43(100)</td>
</tr>
<tr>
<td>120-129</td>
<td>10 (37.04)</td>
<td>17 (62.96)</td>
<td>27(100)</td>
</tr>
<tr>
<td>130-139</td>
<td>02(14.28)</td>
<td>12(85.72)</td>
<td>14(100)</td>
</tr>
<tr>
<td>Total</td>
<td>53(32.60)</td>
<td>89(57.40)</td>
<td>132(100)</td>
</tr>
</tbody>
</table>

The pulse rate was low in summer than winter (p<0.001).

**Prevalence of Symptoms**

The symptoms in the form of weakness, dizziness and blackout which are generally perceived by women in this area to be due to low blood pressure were observed in 32.6% of the study subjects in summer compared with 2.3% in winter(Table 1). The difference was statistically highly significant (p< 0.001).

**Relationship of symptoms with blood pressure**

The prevalence of symptoms was higher at SBP of 90-99 mm of Hg compared to 100-139 mm of Hg (Table 2) but the difference was statistically not significant (p>0.05). The symptoms were higher in the individuals in lower quintiles of SBP than the higher quintiles of systolic blood pressure.

Almost three fifth of the study subjects experiencing symptoms were having diastolic blood pressure levels 70 to 89 mm of Hg (Table 2). The symptoms were higher in the individuals in lower quintiles of DBP than the higher quintiles of diastolic blood pressure.

However, the difference was statistically not significant (p>0.05).

Among the forty three symptomatic study subjects only 27 consented to give their blood samples for testing of serum electrolytes. Table 3 shows electrolyte, blood urea, serum creatinine and estimated Glomerular Filteration Rate(EGFR by CG Equation) in symptomatics and an equal number of controls i.e the females who were not having the symptoms. Both the groups showed no significant difference between the mean levels of these variables.

**Discussion**

**Systolic blood pressure**

The mean decrease in SBP in the current study was 11 mm of Hg in summer. Similarly, other studies18,19 also revealed a decrease in SBP, which ranged from 2 mm to 13.2 mm of Hg. However, the study done by T Sauchihasi et al (1995)20 and Izzo et al (1990)21 reported no seasonal variation.

**Diastolic Blood Pressure**

The mean decrease in DBP in the current study was 7 mm of Hg in summer. In other studies18,19 decrease in DBP, which ranged from 2 to 7 mm of Hg. However, the study done by T Sauchihasi et al20 and Izzo et al21 reported no seasonal variation.

No significant changes in SBP and DBP in the latter studies may be due to the small sample size taken as well as less marked variation in seasonal temperatures.

In the current study 32.6% study subjects had symptoms like giddiness, dizziness, weakness or fainting during summer months.

Prevalence of symptoms in 32.6% study subjects during summer compared to 2.3% in winter (p<0.001) indicates an association of these symptoms with summer

On the basis of the results of the current study, these symptoms can be attributed to either absolute value of SBP/DBP in summer or relative decrease in the SBP or DBP in summer as compared to winter. There was no significant difference between the mean value of electrolytes, blood urea, serum creatinine and EGFR in the cases and the controls which shows the normal electrolyte and kidney function of the two groups.

Thus the seasonal variation in blood pressure rather than electrolytes abnormality may be responsible for these symptoms.

**References**

1. An epidemiological approach to describing risk associated with blood pressure levels; final report of the working group on risk and high blood pressure. Hypertension1985; 7:641-651.


