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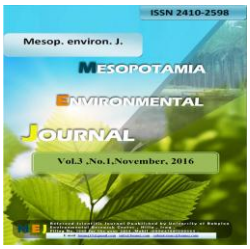

Environmental temperature variation and blood pressure of young normotensive students in college of science for women

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Abstract

outdoor temperature variation to month's changeshave been shown to affect blood pressure (BP) in adults. The aim of present study was to indicate whether BP value in collegian young women were influenced by environmental outdoor temperature. This study was carried out in academic year (2014-2015) in Science College for women .The population of this study were composed of 120 women ,age ranged (18-28yrs) who followed for six months whereas BP routinely measured during (October-November)months, and through (December-January)months as well as in(February - march)months. The height and body weight were measured for subjects and the body mass index (BMI)was calculated, data analysis were carried out on SPSS software package(version 18),data are expressed mean±SD, a NOVA test used and p value < 0.05 were considered statistically significant, post hoc test was applied to multiple comparison among subjects to determine if any statistical difference in blood pressure whether systolic blood pressure(SBP) or diastolic blood pressure(DBP) based on environmental outdoor temperature or on BMI variation. The data of SBP and DBP based on variation of outdoor temperature through the months exhibited there were highly significant increase in systolic pressure (115.4±13.5mmHg)during cold months compared with the worm temperature months at significant difference (p<0.005) as well there were highly significant increase (p<0.05) in systolic pressure in moderate temperature months (February-march) versus in the worm temperature months , but there were non-significant difference in mean of systolic blood pressure between thecold and moderate temperaturemonths. The mean of DBP showed a highly significant increase (p<0.05) in cold temperature month (80.7±1.5mmHg) compared with hot temperature month but there non-significant difference in the mean of DBP (78.6±9.7mmHg), (77.3±4.5mmHg) for women between worm and moderate temperature months respectively. The results of multiple comparison of BP

across BMI variation among the months study showed that overweight subjects have higher significant mean of SBP than normal and underweight subjects in moderate temperature (February-march) months, while normal weight subjects exhibited highly increase in SBP versus those women in underweight group in higher temperature months(October-November)months, but the subjects with normal weight exhibited highly increase in DBP(77.2±9.3 mmHg) versus those obese and underweight women (66.8±5.2 mmHg), (70.4±9.8 mmHg) respectively in low temperature months Thus, the blood pressure in young normotensive women was not only affected by the variation in the outdoor temperature of the air during the months study but there could be other influenced factors like BMI, life style, nutrition pattern and emotional stress status.

Introduction

Incidence of blood pressure variation due to environmental conditions such as tempreture,relative humidity of the air, whereas [1] describe the factors have influence in blood pressure variation such as level of activity, exercise or rest, degree of wakefulness or sleep, moreover psychological factor that reflect a person's mood may have effect on status of blood pressure. Numerous physiological parameters have been related to the effects of heat and cold, prominent among them where the increased sympathetic system activity manifest by increased urinary and plasma catechol amines [2] that were implicated in the rise in blood pressure during winter season, or often complained off prominent symptoms like giddiness, dizziness, fainting and weakness among young women during summer months [3] one of hypothesis put for explain these symptoms is due to electrolyte imbalance[4] ,so taking seasonal variation in blood pressure into account will increase the meaningful information collected in population surveys and mass screening [5]. Blood pressure were recorded in a number of countries owing to seasonal variation, one of them in Montreal [6]. where SBP varied as much as 7 mm Hg and DBP varied 3 mm Hg within the 24 °C to 27 °C temperature range and reported by [7], who measured BP in inhabitants of Hirosaki in winter and summer over a 5-year period. Another study was consider that seasonalin BP among children and adolescents in central Europe could be of clinical interest [8]. Variability that occurs in BP last from a few seconds or minute (short-term variability)to 24 hours (long-term variation) or 1-year i.e. Seasonal variability [9] ,however despite abundant literature on the phenomenon, the effect of temperature changes on risk factors such as hypertension is often disregarded [8] In addition, other literature focus on the role of BMI level that contributor in blood pressure variation as reported by [10] when conducted his study on northern Norway community, found that increase BMI for obese women induced greater increase in SBP compared with men. In that manner , the increase in mean blood pressure in female for a 1-unit increase in body mass index (kg/m2) was 0.95, 0.57, 0.46 and 0.43 mm Hg in the 6-14, 15-34, 35-54 and 55-74 year age groups as recorded by [11] when conducted his study on Caucasian origin community however the same researcher established the significantly of relations of BMI with mean BP in both sex. Accordingly, the purpose of the present study attempts to evaluate whether that BP variation among normotensive healthy females studentswere result in the outdoor temperature changes or the BMI levels variation.

Materials and methods

Study design and sample features: The current study Conducted at the Faculty of Science for women in University of Babylon and population study were included 120 college students their age were ranged from (18-25) years.Blood pressure were performed by using digital fully automatic device BP monitor (china origin) based on the cuff-oscillometric in sitting position and placed arm on an elevated surface so the blood pressure was recorded as an average of two measurements. Should be noted here thatblood pressure was recorded at fixed time, i.e.in the morning by 10 am and 12 noon at least once per two consecutive months for subject start from October 2014 until 2015 March months. Females were sampled in our study not taking oral contraceptives or steroid drugs, also free from chronic disease, not pregnant whereas these factors may have impact on blood pressure, to investigate the influence of environmental temperatures and BMI on SBP and DBP variability, categorizing temperatures and BMI has been done. Body mass index (BMI) were calculated for subjects depending on the procedure which conducted by the Airlie conference

[12]. A females who have BMI<18.5 kg/m^2 considered underweight ,while females within BMI arranged 18.5-24.99 kg/m^2 considered normal weight , overweight subjects when they had BMI 25-29,9 kg/m^2,women were defined obese if they hadBMI ≥30 kg/m^2.

Measurement of outdoor temperatures: Data on outdoor temperatures were obtained by using device (AcuRite digital outdoor and indoor thermometer, no model 6801) china origin; daily outdoor temperatures were recorded throughout the six months during the study period, a maximum and minimum temperature were recorded, data on mean monthly temperatures for the two consecutive months were collected and monthly comparisons has been done such as (October-November) and (December-January) as well (February-march) which resemble to autumn, winter and spring in Iraq country.

Statistical analysis: Data analysis were carried out on SPSS software package(version 18),data are expressed as mean ±SD, a NOVA test used and(p value < 0.05) were considered statistically significant, post hoc test was applied to multiple comparison among subjects to determine if any statistical difference in blood pressure whether systolic blood pressure (SBP) or diastolic blood pressure (DBP) result from environmental outdoor temperature or from BMI variation.

The results

Subjects characteristics: The study subjects were have mean age (25.4±4.5) years. Most of the study population account (58%) 70 women belonged to normal weight category of BMI,out of 24(20%)individuals were considered overweight and about of(8.3%)10 subjects defined obese women while nearly 16(13.3%) of the women belonged to underweight class of BMI status.

Outdoor temperatures variation: The lower mean maximum and minimum outdoor temperature was showed in (December-January) months(17.0±1.7°C, 7.2± 3.0°C) respectivelywhich corresponding to winter season and the relatively highmean maximum and minimum outdoor temperature(30.0±3.0 °C , 18.1±5.1°C) was noted in(October-November) months which corresponding autumn season while the moderate mean maximum and minimum temperature (20.0±2.6°C , 10.2±4.1°C) were observed in(February-March) months which corresponding spring season as exhibited in (table 1).

Table 1: mean of outdoor temperature among the season variation

Variables	Months		
	October-November Autumn	December-January Winter	march-April Spring
Outdoor temperature			
Minimum (mean±SD)	18.1±5.1°C	7.2±3.0°C**, †	10.2±4.1°C
maximum(mean±SD)	30.0±3.0°C	17.0±1.7°C ˣˣ,ˣ	20.0±2.6°C

* * p<0.01 vs. autumn, †p<0.05 vs. spring, ˣˣp<0.01 vs. autumn, ˣp<0.05 vs. spring.

Variation in blood pressure based on the outdoors temperature : There was significantly an increase (p<0.005) in mean systolic blood pressure(115.4± 13.5 mmHg) in coolest months (December January)as compared with mean systolic blood pressure (108.5 ±9.9 mmHg)in October-november months ,and the mean systolic blood pressure were decreased from(114.2±11.7mmHg) in spring season to (108.5±9.9 mmHg) in autumn season, this difference was statistically significant at (p value =0.01) as displayed in (figure1) Mean diastolic blood pressure were lowered in coolest months (december-january)

from (80.7 ±1.5 mmHg) to (77.3±4.5mmHg) in February-marchmonths. This monthly outdoor temperature variation of DBP was statistically significant at($p<0.05$) as showed in (figure 2),

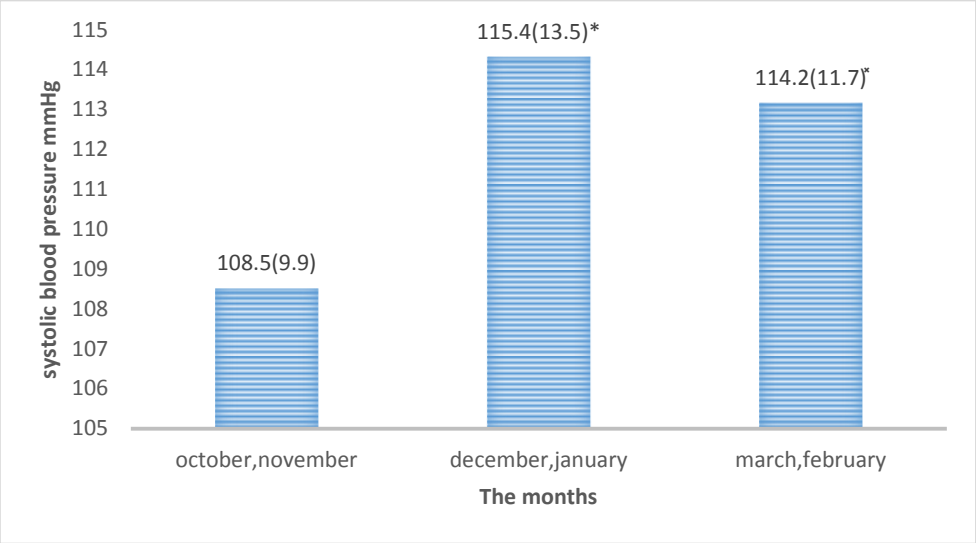

Figure 1: distribution of female systolic blood pressure as presented; mean (SD) across months.

p<0.005 vs. October-November, p<0.05 vs. October-November.

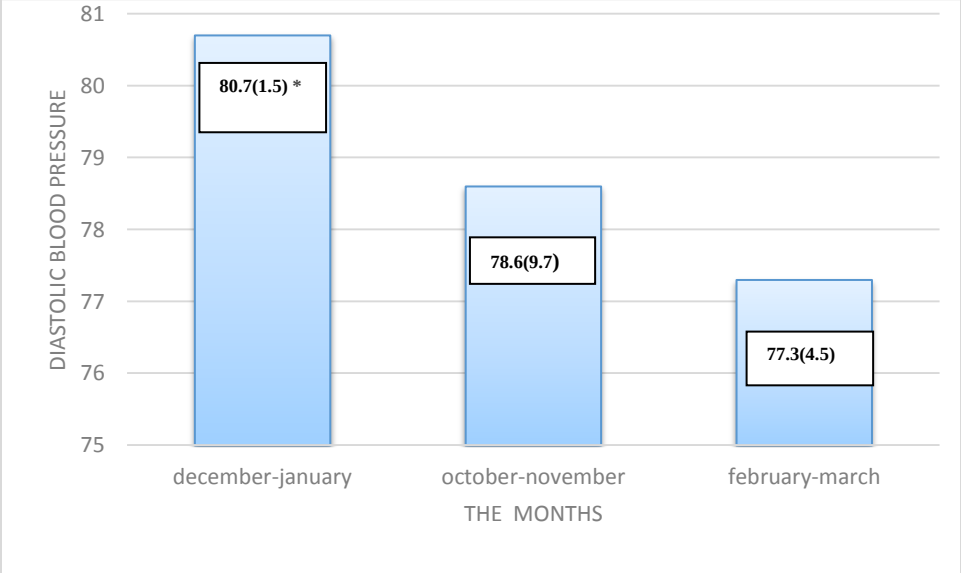

Figure 2: distribution of female diastolic blood pressure as presented; mean (SD) across months

*P< 0.05 vs. February-March.

Variation in blood pressure based on difference in BMI categories: As showed in table 2 the mean blood pressure were varied among months when controlled for difference in BMI levels ,whereas that mean systolic pressure were higher in overweight young women versus normal and underweight women in((February-march)months and these difference with statistically significance at ($p<0.05$,$p<0.01$) respectively. In addition, the results showed that normal weight women had higher mean systolic BP but it statistically non-significant $p>0.05$ than women in each of other BMI categories groups in the coolest (December-January) months, but subjects with normal weight were appeared significantly increase systolic BP versus those underweight subjects in autumn months. As well, the our results showed that was statistically significant increase($p<0.05$) in mean diastolic BP was observed in normal weight women compared with both of obese and underweight women throughout coolest months (December-January).furthermore, the results showed that overweight women were recorded higher mean values of diastolic BP than other participants in spring by BMI levels, but these difference was statistically non-significant ($p>0.05$).

Table 2: Months- wise systolic blood pressure variation in women by BMI.

Classes of BMI	Systolic blood pressure mmHg presented by; mean±SD			
	Number	December-January winter	February-march spring	October-November autumn
Normal weight	70	115.8±11.2	112.6±10.2	110.0±11.4†
underweight	16	109.7±13.8	109.4±16.9	103.2±10.2
overweight	24	112.2±17.5	119.9±13.2*,**	107.1±14.3
obese	10	108.2±6.3	110.6±12.8	103.4±9.6
total	120	115.4±13.5	114.2±11.7	108.5±9.9

*P<0.05 vs. Normal weight in (February-march) months,**p<0.01 vs. underweight in (February-march), †p<0.05 vs. underweight in (October-November) months.

Table 3: Months- wise diastolic blood pressure variation in women by BMI

Classes of BMI	Diastolic blood pressure mmHg presented by; mean±SD			
	Number	December-January winter	February-march spring	October-November autumn
Normal weight	70	77.2±9.3*,†	72.3±8.17	72.8±8.1
underweight	16	70.4±9.4	69.1±13.3	72.0±8.4
overweight	24	74.0±10.9	77.0±12.3	70.6±9.9
obese	10	66.8±5.2	71.2±8.0	69.4±8.1
total	120	80.7±1.5	77.3±4.5	78.6±9.7

*p<0.05 vs. obese, †p<0.05 vs. underweight in (january-december) months.

The discussion

In this population study we have found that highest SBP recorded in cold temperature months and the lowest SBP recorded in relative warm temperatures months, so the higher DBP recorded in coolest months compared with in warm and moderate temperature months, similarly this results agreements with other studies [13, 14]. Mechanism that could explain the association between BP and temperature remain undetermined, activation of the sympathetic nervous system and secretion of catecholamine are increased in respond to cold temperatures [15]. this could results in an increase in BP through increased heart rate and peripheral vascular resistance[16] on the other hand ,that alteration in temperature might also influence vascular function through an effect of endothelium-dependent mechanisms which concluded within the relationship between temperature and vasodilation as supposes by a recent study [17]. Another mechanisms which may contributed in an increase arterial BP significantly that activation of thermoregulatory vasoconstriction to maintain temperature in cold weather (non shivering thermogenesis and increased metabolic rate) as suggested by [18,19]. According to Collins et al[20], whom reported that young person have higher capacity to protect either their internal temperature or that of their extremities against an assault of cold and have exhibited a moderate rise in blood pressure than did the elderly,that confirm with our observation there were non-significant difference in coolest months as comparison with the moderate temperatures (February-march) months in systolic blood pressure values among this study population. As regarded with our observation that diastolic blood pressure were higher in relative worm temperature (October- November) months than in lower temperature months(February-march) may explained that changes in blood pressure remained significantly increased in young individuals to vasoconstriction upon rewarming [21],in view of study by [22], reported by repeated examination in spring,summer,autumn and winter to only 10 young normotensive women there were non- seasonal difference in blood pressure (systolic and diastolic) although their pulse rate during night time was significantly higher in winter . While another study which conducted by [23] in Iraq country with its hot, dry summer and cold-humid winter demonstrated thata small significant difference in the only systolic blood pressure in normotensive subjects between those season. Our data did not show anabsolute association of seasonal variation for blood pressure with anthropometric variable (BMI) for participants in our study.In other word, if environmental temperature and BMI the sole factor involved in regulating the seasonal variation in BP,the highest BP values(systolic and diastolic) should appear in obese subjects and in winter and the lowest BP should appear in wormer months season (autumn) and in normal weight subjects, but our results Relatively have compatible with those hypothesis so likely Other factors can be influenced. Systolic blood pressure showed a significant increase among overweight subjects in spring months compared with leaner participants in the same months, this related with that biological mechanisms could be responsible that elevated free fatty acids, not only increase vasoconstriction by increasing vascular sensitivity to a-adrenergic stimuli, but also blunt the reflex vasorelaxation by inhibiting nitric oxide production [24]. however ,the hypothesis that more body fat provides better insulation and therefore leads to smaller changes in BP with exposure to low temperatures, could not be supported [25].

It was noted from the results in(table 2) there were non-significant higher systolic blood pressure among normal weight subjects than other groups according to quartiles of BMI divided in the coolest months ,this consistent with the hypothesis that increase BP from summer to winter perhaps inversely associated with body mass index because of the increased thermoregulatory requirements of leaner individuals[26]. Significantly higher blood pressure did not appear across our obese subjects in comparison with other groups ,this result confirm previous suggestion of the effect of BMI on blood pressure levels diminishes as BMI increases [27] as a complex relationship among excess body weight,adiposity,and energy expenditure as suggested by the same researchers. A wide variation in seasonal blood pressure in related with BMI could help to explain that BMI is also directly related to lean mass and therefore we cannot distinguish which component (increased adiposity or increased lean mass) is more important in determining the level of BP [28] as the changed in the adiposity distribution of individuals might underlie differences in the BMI-

BP relationship [29]. In view of previous study [30] which suggested a appositive correlation was found between BMI and both diastolic and systolic blood pressure in elderly population ,however this discordance with our results to not corresponding in age population. Therefore, our results gave rise to question of whether other factors have role in determining of BP status among persons, which related with increased sympathetic activity during emotional situations as students experience stress while trying – getting ready for exam, perhaps completing an important paper [31]

To our knowledge it is unclear whether BP response by variation in BMI to weather parameters is similar in every body[32] .previously ,it has been difficult to assess the influence of climate or BMI alone on BP variability because of the life style factors (sedentary and physical activity life) ,environmental stresses, degree education and job of persons may be have influenced in the pattern of responses to whether temperature changes. It is noteworthy that a potential limitation of the present study is the lake of information on the factors influencing on BP seasonal variation, further studies including such factors would be useful.

Conclusion

In conclusion,the blood pressure in normotensive subjects was not only affected by the variation in the outdoor temperature of the air and BMI categories, but can be other agents can play augmented role in this respect such as; sunshine, environmental stress, race, age and life style pattern as well as the job of personit can have an important role in this regard.

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