Original Article

Body Mass Index and its Correlation with Arterial Pressure in Pregnant Women

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Objective: High Body Mass Index (BMI) contributes towards the pregnancy related complications and is also associated with many comorbidities. The main objective of present study was to observe the correlation between body mass index and the arterial pressure levels during different time intervals of pregnancy.

Methods: This study was carried out in Shaikh Zayed Hospital, Lahore. In this cross sectional analytical study 121 pregnant women were included. Women with hypertension prior to pregnancy, and those with diabetes, renal, hepatic, cardiac and any other systemic diseases were excluded. The BMI of all the subjects was calculated and arterial pressures were recorded.

Results: Among all the women, 35 were found out to be hypertensive whereas 86 were normal. The results showed that BMI was significantly higher in hypertensive group than those of normal pregnant women. Pearson coefficient of correlation was calculated between age, height, weight, BMI, systolic and diastolic blood pressure. Again BMI showed significant positive correlation with systolic blood pressure and diastolic blood pressure in hypertensive women.

Conclusions: The results indicated that high BMI levels correlate closely with the development of hypertension. Therefore it may be concluded from this study that high BMI may be one of the risk factors of hypertension in pregnancy.

Keywords: arterial pressure, body mass index, pregnancy induced hypertension.

Introduction

Hypertension is one of the complications during pregnancy worldwide and hypertension related complications are major causes of maternal and perinatal morbidity and mortality.[1] Hypertension in pregnancy is defined as blood pressure more than or equal to 140/90 mm Hg recorded on at least two occasions four hours or more apart. Pregnancy imposes a substantial systemic inflammatory stress on all pregnant women in the second half of pregnancy. The inflammatory stimulus may arise from debris shed into the maternal circulation from the syncytiotrophoblast. Cardiac Output increases and is maintained for the rest of pregnancy. Total peripheral vascular resistance decreases 25% whereas in gestational hypertension it increases. This increase in peripheral vascular resistance appears to be the main cause of hypertension.[2] Weight gain and high BMI is a result of sedentary life style, lack of exercise, over-eating, depression during pregnancy and other comorbidities.[2] Increased weight and therefore high BMI levels are strongly associated with hypertension and preeclampsia. Moreover, increased body weight and high BMI also contributes towards the pregnancy related complications and is also associated with many comorbidities.[3] Pregnant women who have high BMI are more prone to develop preeclampsia during gestation and untoward pregnancy outcomes at the completion of pregnancy. The rationale for the study was to assess the relationship of high BMI in pregnant women with development of hypertension and preeclampsia during pregnancy.

Methods

women after sixteen weeks to thirty five weeks of gestation attending the ante natal clinic of Sheikh Zayed Hospital from October to December 2012. During pregnancy, a woman with BMI level of 25 to 29.9 was considered over-weight and one with BMI of 30 or more was considered obese. The criteria for inclusion were all the women of child bearing age who gave consent to be a part of the study. Exclusion criteria was hypertension prior to pregnancy, diabetic, renal, hepatic, cardiac and any other systemic diseases. The pregnant women were selected from the obstetrical clinic of Shaikh Zayed Hospital Lahore. History of the subjects, demographic information and biochemical findings were recorded in the prescribed proforma. For anthropometric measurements, height was measured in centimetre (cm) on a standard height scale and weight was measured in kilograms (Kg) on Camry weight scale.

The body mass index in Kg/m2 was then calculated for each individual by the following formula:

Body Mass Index (BMI) = Weight in Kilogram / (Height in meter)2

Blood Pressure (BP) was measured by mercury sphygmomanometer after the patient rested for five minutes in sitting position. First reading was taken during 18th week, second reading was taken during 24th week and third reading was taken during 35th week of gestation. Statistical Analysis was conducted on SPSS version 21. Simple bar charts were used to compare the arterial pressure in three trimesters of pregnancy. Student t-test was used for comparison between hypertensive and normal pregnant women. Repeated measure ANOVA was used for comparing BMI levels in development of hypertension in different trimesters of pregnancy. The correlation between BMI with blood pressure in different time intervals was calculated using Pearson coefficient of correlation 'r'. A 'p' value of less than 0.05 was considered statistically significant.

Results

A study of arterial pressure was carried out on 121 pregnant women in three time intervals i.e. 18th week, 24th week and 35th week of gestation. Among all the women, 35 were found out to be hypertensive whereas 86 were normal. The comparison of age, height, weight and BMI in three time intervals in hypertensive and normal women was done. There was no significant difference between the mean ages, weight, height and BMI of hypertensive and normal women **(Table-1).** The comparison of systolic and diastolic blood pressure in three time intervals of pregnancy in hypertensive and normal women was done **(Table-2).** The systolic blood pressure in normal women in first, second and third time interval of pregnancy was 123.80±5.08 which was significantly lower ($p<0.01$) as compared to that in hypertensive women which was 127.73±6.44 in first time interval (18th week), 128.27±5.54 in second time interval (24th week) and 130.37±15.19 in third time interval (35th week). Similarly diastolic blood pressure in normal.

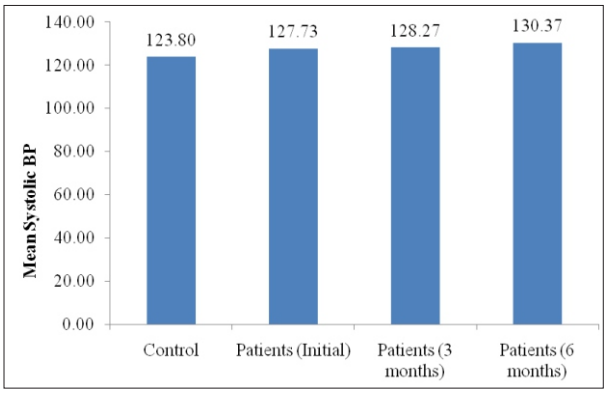

Fig-1: Comparison of systolic blood pressure between hypertensive and normal women with respect to different time intervals of pregnancy.

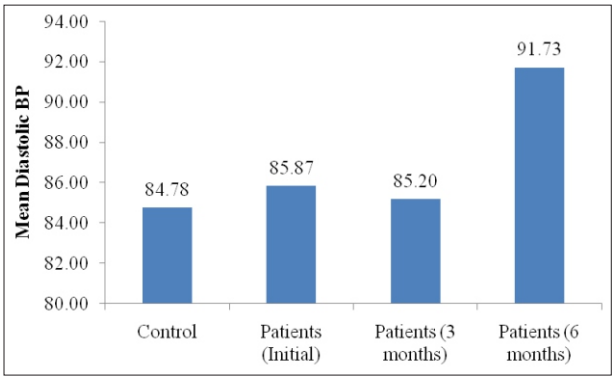

Fig-2: Comparison of diastolic blood pressure between hypertensive and normal women with respect to different time intervals of pregnancy.

Table-1: Comparison of age, height, weight and BMI in three time intervals of pregnancy in hypertensive and normal women.

Groups at Different Time Intervals of Pregnancy	Normal (86)	Hypertensive (35)
Age (years)	24.80± 4.77	26.09± 4.75
Height (m)	1.60 ± 0.05	1.61 ± 0.06
Weight (Kg) (1st time interval)	66.98 ± 4.54	67.49 ± 4.46
Weight (Kg) (after 2nd time interval)	-	70.46 ± 4.76
Weight (Kg) (after 3rd time interval)	-	73.35 ± 5.30
BMI (kg/m2) (1st time interval)	26.17 ± 1.87	26.05 ± 1.82
BMI (kg/m2) (after 2nd time interval)	-	27.19 ± 1.87
BMI (kg/m2) (after 3rd time interval)	-	28.30 ± 2.04

Table-2: Comparison of systolic blood pressure with diastolic blood pressure, in hypertensive pregnant women in three time intervals of pregnancy.

		Systolic BP			Diastolic BP	
Blood Pressure (mm Hg)	(I) 1st time interval (16th to 18th week)	(II) 2nd time interval (22nd to 24th week))	(III) 3rd time interval (35th week)	(I) 1st time interval (16th to 18th week)	(II) 2nd time interval (22nd to 24th week))	(III) 3rd time interval (35th week)
Normal	123.80±5.08	123.80±5.08	123.80±5.08	84.78±5.05	84.78±5.05	84.78±5.05
Hypertensive	127.73±6.44	128.27±5.54	130.37±15.19	85.87±4.82	85.20±5.29	91.73±7.28
ANOVA	I vs II	Non-significant			Non-significant	
	I vs III	Non-significant			Highly significant	
	II vs III	Non-significant			Highly significant	
	F	1.44			27.89	

Table-3: Correlation of systolic and diastolic blood pressure with BMI in hypertensive women during different time intervals.

Blood Pressure (mm Hg)	Systolic BP 1st	Systolic BP 2nd	Systolic BP 3rd	Diastolic BP 1st	Diastolic BP 2nd	Diastolic BP 3rd
BMI (1st time interval) (kg /m2)	0.342	0.300	-0.084	0.390	0.026	-0.200
BMI (2nd time interval) (kg /m2)	0.288	0.254	-0.254	0.345	0.028	-0.179
BMI (3rd time interval) (kg /m2)	0.278	0.233	-0.047	0.388	0..88	-0.182

women in third time interval (35th week) was significantly lower ($p<0.01$) as compared to that in hypertensive women which was 91.73±7.28. Comparison of mean systolic, diastolic blood pressure, between three time intervals of pregnancy in hypertensive women was done and illustrated in **Table-2.** There was no significant difference in systolic blood pressure in three time intervals of pregnancy. Diastolic blood pressure in first time interval (18th week) of pregnancy was 85.87±4.82 which was significantly lower ($p< 0.01$) as compared to that in third time interval (35th week) which was 91.73 ±7.28. Diastolic blood pressure in second time interval (24th week) of pregnancy was 85.20±5.29 which was significantly lower ($p < 0.01$) as compared to that in third time interval (35th week) which was 91.73±7.28. Comparison of mean systolic and diastolic blood pressure in hypertensive and normal women at different time intervals of pregnancy has been illustrated in **Fig-1 & 2** respectively. Pearson coefficient of correlation was calculated for age, height, weight, BMI, systolic, diastolic blood pressure during the three time intervals of pregnancy in hypertensive and normal women**.** A significant correlation was found between BMI and arterial pressure in preeclamptic women **(Table 3).**

Discussion

In the current study we evaluated BMI levels in three different time intervals of pregnancy and established their correlation with blood pressure in pregnant women. This study was conducted in pregnant women from 18th week till 35th week of gestation, attending the antenatal clinic of Shaikh Zayed Hospital Lahore in 2012. A total number of 121 study subjects were taken out of which 35 developed hypertension during gestation. They were considered as core subjects of our study. The diagnosis of hypertension was made on the basis of blood pressure more than or equal to 140/90 mmHg recorded at least on two occasions four hours or more apart.[2] The statistical analysis of current study shows significant correlation between the age, weight, height and BMI of the normal and hypertensive group. Significant correlation of systolic blood pressure in first time interval of pregnancy with age, height, weight and BMI in non preeclamptic women was not found, however systolic blood pressure of first time interval of pregnancy when compared with BMI of first time interval of pregnancy in preeclamptic women showed a significant correlation ($p < 0.001$, $r = 0.342$).

Similarly it showed a significant correlation with BMI in second time interval of pregnancy ($p < 0.001$, $r = 0.288$) and significant correlation with BMI in third time interval of pregnancy ($p < 0.001$, $r = 0.278$). Systolic blood pressure of second time of pregnancy interval.

When compared with BMI of first time interval of pregnancy in preeclamptic women showed a significant correlation ($p < 0.001$, $r = 0.300$). Similarly it showed a significant correlation with BMI in second time interval of pregnancy ($p<0.001$, r=

0.254) and significant correlation with BMI in third time interval of pregnancy ($p < 0.001$, $r = 0.233$). Diastolic blood pressure of first time interval of pregnancy when compared with BMI of first time interval of pregnancy in preeclamptic women showed a significant correlation ($p < 0.001$, $r = 0.390$). Similarly it showed a significant correlation with BMI in second time interval of pregnancy ($p < 0.001$, $r = 0.345$) and significant correlation with BMI in third time interval of pregnancy ($p < 0.001$, $r = 0.338$. This finding in the current study is in agreement with many previous studies.[3,4] Although the natural trend of homeostatic mechanism tend to maintain arterial pressure but still the presence of high BMI in pregnant women may indicate poor health status which may be a positive factor for the occurrence of the disease in hypertensive women. In an Indian study, both SBP and DBP were found to be significantly higher among study population with high BMI levels.[5] Many studies have reported greater prevalence of high blood pressure in those with high BMI.[6,7] Some studies have demonstrated the association of unhealthy life style factors to an increasing trend of hypertension especially among urban population.[8] The risk of getting hypertension exists with the high BMI in the prepregnancy period. O'brien et al identified thirteen cohort studies, comprising nearly 1.4 million women. The risk of preeclampsia typically doubled with each 57 kg/m^2 increase in prepregnancy body mass index.[9] Frederick also suggested that adult weight gain and prepregnancy overweight and obesity status are associated with an increased risk of preeclampsia. The risk ratios increased monotonically with increasing prepregnancy body mass index greater than 19.8 kg/m^2.[10] Bodnar et al in two different studies reported that the risk of preeclampsia rises with increasing prepregnancy body mass index.[11,12] Thadhani et al confirmed 216 cases of gestational hypertension and 86 cases of preeclampsia. The risk of gestational hypertension increased as pregravid BMI increased.[13] Sohlberg described that the risks of all preeclampsia types increased with BMI, but seemed higher for milder than more severe types of preeclampsia.[14] The relative risk of recurrent preeclampsia increases with earlier gestational age at delivery of the first pregnancy that was complicated by preeclampsia. Significant risk factors for preeclampsia in a second pregnancy include longer birth interval, previous preterm delivery, previous small-for-gestational-age newborn, renal disease, chronic hypertension, diabetes mellitus, obesity, black race, and inadequate prenatal care.[15] Wolf et al associated inflammatory process responsible for preeclampsia in women with increased BMI.[16] A significant increased risk of a wide variety of pregnancy, birth, and neonatal complications have been seen in overweight, obese, and severely obese women.[17] Obesity and overweight have shown to contribute independently to the risk of pre-term preeclamsia.[18]

Conclusion

From this study, it may be concluded that body mass index values are correlated with the blood pressure and increased BMI may be a risk factor for development of preeclampsia in pregnant women. Therefore this study may alert obstetrician and patients to the harmful effects of high BMI on obstetric outcome. It also emphasizes the need of monitoring BMI during antenatal period and appropriate measures such as weight reduction and exercise may reduce the incidence of hypertension.

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