THE EFFECT OF AGE, OBESITY AND PARITY ON BLOOD PRESSURE AND HYPERTENSION IN NON-PREGNANT MARRIED WOMEN

Mohammed E.M. Khalid, MBBS, PhD(UK)
Department of Physiology College of Medicine, King Khalid University, Abha, Saudi Arabia

Objective: To assess the effect of age, body mass index (BMI) and parity on systolic and diastolic blood pressures (BPs) and hypertension.

Subjects and Methods: A cross-sectional prospective study of 441 non-pregnant married women ranging in age from 15-60 years. For each woman selected, a detailed questionnaire dealing with sociodemographic profile including reproductive data was completed. Systolic and 5th phase diastolic BPs were measured using a standard mercury sphygmomanometer. Body weight and height were measured using an Avery Beam weighing scale and a stadiometer respectively.

Results: In this study sample, the overall prevalence of hypertension was 4.3%. Statistical analysis showed that age and BMI were positively and significantly associated with BPs (p<0.0001 for systolic BP & <0.002 for diastolic BP and p<0.0001 for systolic BP & <0.005 for diastolic BP respectively) and positively and significantly (p<0.0001 & <0.003 respectively) associated with an increase in the risk of hypertension (Odds ratio, 95% confidence interval: 1.53 (1.1-1.2) and 1.11 (1.04-1.19) respectively) while parity was negatively and insignificantly associated with BPs (p<0.4 and <0.1 for systolic and diastolic BPs respectively) and negatively and insignificantly (P<0.1) associated with an increase in the risk of hypertension (Odds ratio, 95% confidence interval: 0.87 (0.74-1.03).

Conclusion: Age and BMI were significant contributors to BPs and hypertension rather than parity. The negative association between parity and hypertension, although insignificant, implies that nulliparity rather than multiparity imposed an important effect on hypertension.

Key Words: Parity, BMI, blood pressures, hypertension.
INTRODUCTION

Hypertension is considered one of the common causes of cardiovascular morbidity and mortality. Therefore, identification of the risk factors will certainly help to improve control measures of the disease. In previous studies, parity was shown to have highly significant positive effect on blood pressures and hypertension. Other studies in the field failed to show any significant relationship. The studies which showed a significant effect of parity on blood pressures and hypertension related this to the association of pregnancy with three strong risk factors for hypertension namely, hyperinsulinaemia, hyperlipidaemia and obesity. However, most of these studies were conducted on pregnant women, and it is unclear whether these factors persist after pregnancy or into later life.

Grandmultiparity is a common occurrence in Saudi Arabia. It accounted for 23.9% of pregnancies in the Central Region, 37.5% in the Northern Region, 24.4% in the Eastern Region and 27.9% in the Southwestern Region. Because high parity women are older than low parity women, it is also unclear whether hypertension in the high parity women is due to the effect of age. The present study was, therefore, undertaken to assess the effect of age, obesity and parity on BPs and hypertension in non-pregnant married women aged 15 to 60 years.

MATERIAL AND METHODS

This study was carried out during the winter of 2002 in and around Abha city. Abha is the capital of Aseer region which lies in the Southwestern part of the Kingdom of Saudi Arabia. Five health centres were selected for this study, one in Abha and four around it. The health centres were run by qualified physicians who used a central referral hospital with good access roads. A total of 441 non-pregnant married women ranging in age from 15-60 years were involved in this study. The local people working in the health centres were instructed to recruit all non-pregnant women registered in the five health centers. The inclusion criteria for this study were non-pregnant married Saudi women ranging in age from 15-60 years, born and permanently resident in the area of study and who did not have secondary hypertension resulting from pre-eclampsia, pre-existing renal, endocrine or other diseases. A total of 662 women were recruited (85% of the total number of non-pregnant women registered in the five health centres), 221 of whom were excluded for not fulfilling the criteria for inclusion. Those excluded included single women (170), divorcees (8), widows (13), diabetics (25) and women with other diseases (5). Those chosen for the study had modern amenities including potable water and electricity and an adequate diet (comprising mainly meat, chicken and rice).

For each woman selected, a detailed questionnaire dealing with a sociodemographic profile including reproductive data was completed by the attending physicians in the health centres. Systolic and 5th phase diastolic BPs were measured to the nearest 2 mmHg by a well-trained nurse using a standard mercury sphygmomanometer after the participant was seated and had had 5 minutes rest. Arm sizes were measured and the appropriate cuff size used. The blood pressure values used in the analysis were the means of the last two of the three repeated measurements by a single observer. In determining the prevalence of hypertension, it was necessary to include women with established hypertension who were receiving medication as well as those with a blood pressure of ≥ 140/90 mmHg. The latter were referred to the central hospital for further investigation and confirmation of hypertension. Only cases of essential hypertension were included in this study.

Body weight was measured and recorded using an Avery Beam weighing scale to the nearest 0.1 kg. Women were weighed partly dressed and a correction of 0.5 kg was made for clothing. Standing height was measured and recorded to the nearest 0.5 cm with stadiometer (without shoes). Body mass index was computed from the weight and the height (BMI = weight (in kg)/height (in meters squared). Obesity was defined as a BMI equal to or greater than 30. Parity was defined as the number of pregnancies of 20 weeks of gestation or more, irrespective of the outcome, and grandmultiparity referred to the births of five or more viable infants. To determine the effect of age on blood pressure, the women were divided into two age groups from 15 to 39 and 40 to 60 years.

The collected data were compiled, coded and fed into a computer. SPSS package version 10 was used for standard statistical analysis including multiple regressions. Student’s t-test and Chi-square test were used where appropriate to determine statistical significance, p<0.05 was considered statistically significant.
RESULTS
Table 1 shows some of the characteristics and the mean BPs by age. Among the non-pregnant married women, the mean weight, BMI, systolic and diastolic BPs increased significantly between the age groups 15-39 and 40-60 years (P<0.0001 for all) while the mean height remained constant between the same age groups.

Table 2 shows the prevalence of obesity and hypertension by age and parity. Over half of the studied women (54%) were grandmultiparas; only 11.3% were nulliparas. The remaining percentage (34.7%) were women with 1-4 pregnancies. The incidence of grandmultiparas increased with an increase in age while that of nulliparas and women with fewer pregnancies decreased with increasing age. Using the BMI as an indicator for obesity, 52.4% of the women who participated in this study were found to be obese. The prevalence of obesity increased significantly between the youngest and the oldest age groups (P<0.0001). The proportion of obese women increased insignificantly with increasing age while that of nulliparas and women with fewer pregnancies decreased with increasing age. Using the BMI as an indicator for obesity, 52.4% of the women who participated in this study were found to be obese. The prevalence of obesity increased significantly between the youngest and the oldest age groups (P<0.0001). The proportion of obese women increased insignificantly between the nulliparous group and women with 1-4 pregnancies (P<0.0001). Out of the 441 women studied, 19 were found to have hypertension (4.3%) (16 with established hypertension and on medication and 3 were discovered during the survey). The proportion of hypertensive women increased significantly with increasing age from 0.7% in the youngest age group to 12.8% in the oldest age group (P<0.0001). The highest prevalence of hypertension was noted among nulliparous group (6%) which was not significantly different from what was noted among grandmultiparous group (5.4%) (P<0.5) and the lowest prevalence was noted in women with 1-4 pregnancies (2%). Hypertension was not detected in young grandmultiparas. In the other two parity groups, elderly women had a higher incidence of hypertension than their respective younger ones (Table 2).

Multiple linear regression analysis and direct logistic regression analysis were performed to assess the impact of age and BMI on BPs and hypertension respectively. The coefficients presented in Table 3a show positive and significant correlations between BPs and age and BMI and negative insignificant correlations between BPs and parity. Table 3b shows that age and BMI were positively and significantly associated with an increase in the risk of hypertension [Odds ratio, 95% confidence interval: 1.16 (1.1-1.2) and 1.11 (1.04-1.19) respectively] while parity was negatively and insignificantly associated with an increase in the risk of hypertension [Odds ratio, 95% confidence interval 0.87 (0.74-1.03)].

**Table 1:** The distribution of weight, height, BMI, systolic BP (SBP) and diastolic BP (DBP) by age (all values are expressed as mean ± standard deviation)

| Age (years) | Number | Weight (kg) | Height (cm) | BMI (Kg/m²) | SBP mmHg | DBP mmHg |
|------------|--------|-------------|-------------|-------------|---------|---------|
| 15-39      | 308    | 69.3 ± 14.4 | 152.9 ± 7.1 | 29.8 ± 6.5 | 111.9 ± 9.6 | 72.9 ± 7.0 |
| 40-60      | 133    | 75.8 ± 14.0 | 152.9 ± 5.6 | 32.4 ± 5.9 | 116.7 ± 13.2 | 75.6 ± 8.7 |
| Total      | 441    | 71.3 ± 14.6 | 152.9 ± 6.7 | 30.6 ± 6.5 | 113.3 ± 11.0 | 73.3 ± 7.7 |

**Table 2:** The prevalence of hypertension (Hyp) and obesity (Obs) in relation to age and parity (N denotes the total number of women in each cell)

| Parity | N  | Age 15-39 Hyp No. (%) | Obs No. (%) | N  | Age 40-60 Hyp No. (%) | Obs No. (%) | N  | Age 15-60 Hyp No. (%) | Obs No. (%) |
|--------|----|-----------------------|-------------|----|-----------------------|-------------|----|-----------------------|-------------|
| 0      | 42 | 1 (2.4)               | 14 (33.3)   | 8  | 2 (25.0)              | 5 (62.5)    | 50 | 3 (6.0)              | 19 (38.0)   |
| 1-4    | 141| 0 (0)                 | 72 (57.6)   | 12 | 2 (16.7)              | 3 (25.0)    | 153| 3 (2.0)              | 63 (41.2)   |
| > 5    | 125| 0 (0)                 | 113 (90.2)  | 13 | 13 (11.5)             | 77 (68.1)   | 238| 13 (5.4)             | 149 (62.6)  |
| Total  | 308| 2 (0.7)               | 146 (47.4)  | 133| 17 (12.5)             | 85 (63.9)   | 441| 19 (4.3)             | 231 (52.4)  |

**Table 3a:** Standardized regression coefficients (SRC) for systolic and diastolic BPs

| Variables | SRC | Systolic BP t-test | p-value | SRC | Diastolic BP t-test | p-value |
|-----------|-----|--------------------|---------|-----|---------------------|---------|
| Age       | 0.236| 4.14               | 0.0001  | 0.182| 3.07                | 0.002   |
| BMI       | 0.219| 4.62               | 0.0001  | 0.137| 2.80                | 0.005   |
| Parity    | -0.046| -0.82              | 0.413   | -0.086| -1.47              | 0.144   |
**DISCUSSION**

In this study, the prevalence of hypertension among non-pregnant married women aged 15-60 years was found to be 4.3%, which is higher than what was reported by Khalid et al. (1.4%)\(^\text{19}\) and Mafouz et al. (2.4%)\(^\text{20}\) in the Aseer region of the Southwestern Saudi Arabia, but far lower than what was reported by Alnozha and Osman (9.2% and 15.6% for systolic and diastolic hypertension respectively) in the same region.\(^\text{21}\) These differences in the prevalence of hypertension may be due to the selection of target study groups in relation to age, gender and the criteria used in the definition of hypertension.\(^\text{19-21}\)

The present study also showed the lack of any significant influence of parity on either BPs or hypertension, but there were significant positive influences of women’s age and BMI on BPs and hypertension. It was evident from the multiple regression analysis that in this study sample, age and BMI were more significant contributors to BPs and hypertension than parity. These findings agree with observations from previous studies but are at variance with other reports in the field. Thus, while Lawlor et al.\(^\text{13}\) found no significant linear relationship between the number of children and systolic and diastolic BPs in women aged 60-79 years, Ness et al.\(^\text{7}\) found a significant relationship between parity and coronary heart disease risk factors including hypertension. In another study, hypertension in married women aged less than 60 years tended to rise with parity though the trend was not statistically significant.\(^\text{22}\)

The association between parity and hypertension was thought to be due to the biological responses to pregnancy and the lifestyle risk factors associated with child rearing. Pregnancy is known to be associated with hyperinsulinaemia,\(^\text{23}\) hyperlipidaemia,\(^\text{24}\) and obesity.\(^\text{25}\) Although the relationship between these factors and hypertension especially the relationship between hyperinsulinaemia and hypertension\(^\text{26-28}\) has been documented in a number of studies, it is unclear whether these factors persist after pregnancy or into later life. Lifestyle risk factors such as anxiety and stresses associated with child-rearing were shown to lead to obesity and an increase in the risk of coronary heart disease but no linear relationship between the number of children and BPs was found\(^\text{13}\). On the other hand, nulliparity was shown to be associated with increased incidence of metabolic syndrome (including hypertension) which tends to persist into later life\(^\text{13}\). In addition, Elting et al.\(^\text{29}\) found that around the time of menopause, nulliparous women with polycystic ovarian syndrome were 2.5 more likely to have hypertension than their age-matched control, and this was thought to be due to their associated obesity\(^\text{29}\). In this study sample, the relationship between hypertension and parity is “U” shaped (Figure 1) with the highest prevalence noted among nulliparous and grandmultiparous women, and in these two parity groups, old women had higher incidences of hypertension and obesity than their respective younger ones. It appears, therefore, that elderly nulliparous and grandmultiparous women had higher prevalence of hypertension than their respective younger ones on account of the confounding effects of age and obesity on hypertension. This may be taken to indicate that nulliparous and grandmultiparous women share a common mechanism in the development of hypertension. As for other parity

![Figure 1: The prevalence of hypertension by parity](image-url)
groups, the effect of age is the same as that seen in nulliparous and grandmultiparous women, but the prevalence of obesity was higher among the youngest age groups compared to the oldest age groups. The latter could be due to the unavoidable small numbers of participants in the oldest age groups. However, age and obesity alone cannot fully explain the higher prevalence of hypertension among nulliparous and grandmultiparous women. Our data did not allow for the evaluation of other relevant risk factors because insulin resistance and lipid profile were not measured.

Although the findings of this study were obtained from a selected group of women, they certainly present a clear indication that age and BMI were significant contributors to BPs and hypertension rather than parity. The negative association between parity and hypertension, although insignificant, implies that nulliparity rather than multiparity imposed an important effect on hypertension. If verified, the findings of this study raise questions about the mechanism by which an association between nulliparity and hypertension may be mediated.

ACKNOWLEDGMENT
The author would like to thank Mrs. C. Pasion of the Department of Obstetrics and Gynecology (Ob/Gyn) and all the medical and administrative staff working in Almanhal, Alsoda, Tabab, Alasan and Almalaha health centers, for their valuable assistance during the field work. Thanks are also due to Dr. A.Bahar of the Department of Ob/Gyn for revising the manuscript.

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