



## **EFFECT OF BLOOD PRESSURE ON BONE MINERAL DENSITY IN PRE AND POST MENOPAUSAL DIABETIC WOMEN**

**Kavita Bakshi<sup>1</sup>, Sabiha Vali<sup>2</sup> & Sunil Gupta<sup>3</sup>**

<sup>1</sup>Research Scholar, P.G. Department of Home Science R.T.M. Nagpur University

<sup>2</sup> Ex Professor & Head, P.G. Department of Home Science R.T.M. Nagpur University

<sup>3</sup> Managing Director, Diabetologist, Sunil's Diabetes Care n Research Centre Pvt Ltd, Nagpur.

### **ABSTRACT**

Hypertension, diabetes mellitus, and osteoporosis are important co morbidities commonly seen in postmenopausal women. The evaluated the relationship of blood pressure to bone mineral density (BMD) in type 2 diabetic women. 100 premenopausal and 111 postmenopausal women were selected by purposive sampling from a renowned diabetic centre at Nagpur. Blood pressure and Bone Mineral Density (BMD) were assessed by standard methods with technical support. Mean age of premenopausal subjects ( $46 \pm 5.64$  range 30-54yrs) and postmenopausal subjects ( $60 \pm 6.30$  range 53-80yrs) differed significantly ( $p=0.0001$ ). The mean age of menopause was  $4.55 \pm 4.37$ . The mean age of onset of diabetes was  $40 \pm 7.06$  in premenopausal subjects and  $50 \pm 8.22$  in post menopausal subjects. The mean systolic and diastolic blood pressure of postmenopausal subjects was ( $131 \pm 18.7$  &  $74 \pm 9.99$  respectively) and premenopausal ( $129.7 \pm 16.56$  &  $77.6 \pm 9.69$  respectively). Mean BMD- T scores showed significant difference ( $p=0.014$ ) between the two group of subjects. BMD T-scores of both premenopausal (-1.43) and postmenopausal subjects (-1.80) reflected an insignificant relationship to blood pressure. The blood pressure levels showed insignificant relationship to BMD status irrespective of menopausal status.

**Key words:** BMD T-score, Systolic, Diastolic, Blood Pressure

### **INTRODUCTION**

Osteoporosis is a global health problem that will take on increasing significance as people live longer and the world's elderly population continues to increase in number. Type 2 diabetes and osteoporosis

are common diseases with increasing prevalence in the aging population. Due to their associated morbidity and mortality; the conditions cause a high health burden. Men and women with type 2



diabetes have lower BMD  
**M.K.Dutta et.al., (2012)**

Osteopenia defines BMD that is not normal, but that is not as low as the density in osteoporosis. It is defined by bone densitometry with a T-score of -1 to -2.5 based on the definition of the World Health Organization (WHO). Osteopenic decreased BMD leads to bone fragility and an increased risk of bone fractures. The major causes for osteopenia include calcium deficiency, vitamin D deficiency, genetic factors, and physical inactivity.

Hypertension is associated with alterations in calcium metabolism, leading to increased calcium loss, compensatory activation of the parathyroid gland, and increased movement of calcium from the bones **Cappuccio FP et.al., (1999)** The long-lasting impairment of hypertension in calcium homeostasis may constitute one of the mechanisms involved in the pathophysiology of age-related

excessive reduction of BMD. Moreover, it has been reported that calcium loss associated with high blood pressure may be due to lack of ability of the kidneys to handle this mineral. Recent study has also suggested that raised angiotensin II levels in hypertensive settings have a harmful effect by increasing bone resorption and decreasing mineralization **Pérez-Castrillón JL et.al., (2003)**

**Maninder Kaur et.al., (2015)** has demonstrated that high blood pressure is negatively associated with bone mineral density among elderly population.

**Selma Yazici et.al., (2011)** has however reported that the presence of HT was found to be an independent predictor of low bone density.

Since the association between both blood pressure and glucose levels with BMD at the same time has not been studied previously in pre and post menopausal women, we aimed to investigate this relationship in this setting.



## MATERIALS AND METHODS

Present study was conducted at a renowned Diabetes Center in Nagpur, located in Central India. The study included 211 diabetic women, 100 pre menopaual (Age-30 to 52years), 111 postmenopaual (Age-53 to 80 years ) with type-2 diabetes and absence of complications of diabetes. Basic information was collected using questionnaire schedule with personal interview. Blood pressure was assessed by standard methods using technical support.

Bone mineral density of all subjects was measured by Meyers BM Densitometer. The diagnosis of osteoporosis was done with the assistance of specialists. T- Score was calculated and results were compared to WHO criteria.

Results were tabulated and expressed as means, standard deviation and ranges for both the groups and compared statistically using " t" test of significance and one way Anova Pearson's correlation

test was applied between BMD and Blood pressure.

## RESULTS AND DISCUSSION

Mean age of premenopaual and postmenopaual subjects was  $46 \pm 5.64$  (range 30-54yrs)  $60 \pm 6.30$  (range 53-80yrs) respectively, which differed significantly ( $p=0.0001$ ). The mean age of menopause was  $4.55 \pm 4.37$  and onset of diabetes  $40 \pm 7.06$  in premenopaual subjects and  $50 \pm 8.22$  in post menopaual subjects. Medical problems faced by the subjects are represented in **figure 1.1 (a) and (b)**.

A higher percentage of post menopaual subjects have diabetes with hypertension (34%) as compared to pre menopaual subjects (28%). The percentage of subjects suffering from diabetes, hypertension and cardiovascular disease is slightly higher in postmenopaual group (12%) as compared to the premenopaual group (9%).

### Blood Pressure



The mean systolic and diastolic blood pressure of the subjects is presented in **table: 1**

A slightly higher mean systolic blood pressure was observed in postmenopausal subjects ( $131 \pm 18.68$ ) as compared to the premenopausal subjects ( $129.7 \pm 16.56$ ). The diastolic blood pressure is found to be within the normal value of 80 mm of Hg ( $77.6 \pm 9.69$  in premenopausal and  $74 \pm 9.9$  in post menopausal subjects). Maximum level of systolic blood pressure of 198 mm of Hg was seen in premenopausal subjects. A maximum higher diastolic pressure of 100 mm of Hg was observed in post menopausal subjects.

The percentage distribution of subjects classified according to Joint National Committee on hypertension is presented in **table: 2**

The systolic blood pressure of the subjects varied between a minimum of 107 mm of Hg to a maximum of 198 mm of Hg in the premenopausal subjects. The

diastolic pressure ranged between 68 to 100 mm of Hg. Data from the table shows that a maximum of 53% subjects showed normal blood pressure followed by 27 % in stage I category. Below normal levels of blood pressure was observed in 15% of subjects while negligible percentage in stage III (1%).

The postmenopausal subjects showed a higher percentage (36%) in stage I corresponding to a blood pressure between 140-159 mm of Hg systolic and 90-99 mm of Hg diastolic. About 34% of subjects fall into the mean normal blood pressure category. The percentage of subjects in the below normal blood pressure category were higher (21.7%) as compared to premenopausal subjects. The mean systolic and diastolic blood pressure range in this group is lower than that observed in the premenopausal subjects (106 – 180 mm of Hg systolic and 68 to 77 mm of Hg diastolic)

The distribution of subjects according to blood pressure



categories and BMD T-score is presented in **table 3**.

All the study subjects irrespective of menopausal status and blood pressure levels had BMD T-scores below the normal score of -1 indicating a loss in bone density. However a decline in bone density with an increase in blood pressure is noted in both the groups of subjects. The mean BMD T-scores of pre menopausal subjects remained at -1.4 suggestive of osteopenia at Normal, stage I and stage I levels of blood pressure. A BMD T score of -1.9 was noted at stage III level of blood pressure indicating a further decrease in bone density.

Comparatively the bone loss is more in postmenopausal subjects as evident from the mean BMD T-scores. At the normal stage I and stage II levels of blood pressure the BMD T score was similar (-1.8) showing a decrease in bone loss greater than that observed in pre menopausal subjects. At stage II level of blood pressure the BMD T

score was -2.1 suggestive of increased bone loss.

Irrespective of the blood pressure variations differences in the mean BMD T-scores of both pre and postmenopausal subjects reflected Osteopenia.

Postmenopausal women who have diabetes or in whom diabetes develop are at higher risk for hip fracture than non-diabetic postmenopausal women. The risk is increased with greater duration of diabetes. Fractures and bone abnormalities seen in postmenopausal women with type 2 diabetes mellitus, showed that the BMD T-score of the subjects revealed a condition of Osteopenia at the lumbar spine **Fillipella MG et.al.,(2016)**.

An attempt was made to correlate the BMD status of the subjects with the blood pressure. The results are presented in **table 4**

Observations reveal an insignificant ( $p=0.0114$ ) and low – ve relation ( $r=-0.127$ ) between the BMD status and diastolic blood



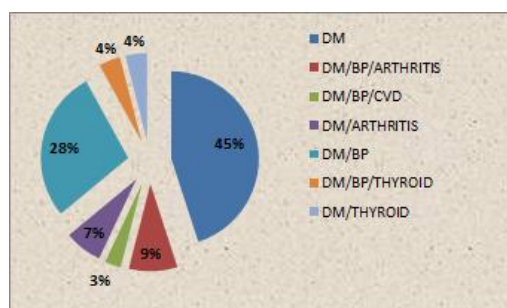
pressure and a low +ve (0.0543) and insignificant relation ( $p=0.1046$ ) between systolic blood pressure and BMD status in premenopausal subjects. The post menopausal subjects show an insignificant ( $p=0.1491$ ) and low +ve relationship ( $r=0.0996$ ) with systolic and insignificant ( $p=0.21680$ ) and low +ve relationship ( $r=0.0754$ ) with diastolic blood pressure. Hence irrespective of menopausal status and blood pressure levels no significant relationship was observed.

Treating elevated blood pressure and diabetes as well as

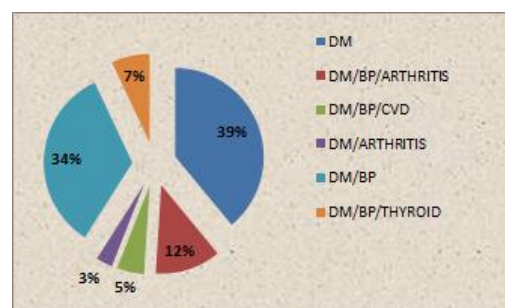
maintaining with medications for selected at-risk persons are the standards of care. In general, pre menopausal age is as crucial as the changes have already begun and if adequate care is not taken problems arising in post menopause may be aggravated.

### CONCLUSION

The post menopausal status of type 2 diabetic women contributes significantly to bone loss. However irrespective of menopausal status the blood pressure levels of subjects show insignificant relationship to BMD status.



**Fig- 1.1 (a) Present Medical Problems of Premenopausal women**



**Fig- 1.1 (b) Present Medical Problems Of Postmenopausal women**

**Table: 1 Mean Blood Pressure Levels of Subjects**

Blood Pressure (mm of Hg)	Premenopausal		Postmenopausal	
	Systolic	Diastolic	Systolic	Diastolic
Mean	129.7	77.6	131	74
SD	16.56	9.69	18.68	9.9
Range	100-198	50-96	100-180	50-100

**Table: 2 Distribution of Subjects based on Blood Pressure levels**

S.No	Blood Pressure (mm of Hg)	Premenopausal (n=100)				Postmenopausal (n=111)			
		No	Mean systolic	Mean Diastolic	%	No	Mean systolic	Mean Diastolic	%
1	<120/80 (below normal)	15	107	68	15	24	106	68	21.7
2	120/80 (Normal)	53	125	76	53	38	126	74	34.2
3	140-159/90-99 (stage-1)	27	143	82	27	40	143	78	36
4	160-179/100-109 (stage-2)	04	166	93	04	06	165	83	5.4
5	180/110 (stage-3)	01	198	100	01	03	180	77	2.7

Source: Joint National Committee on Hypertension (2003)

**Table: 3 BMD T- Scores of Subjects according to Blood Pressure Categories**

Particulars	Blood Pressure (mm of Hg)	No	%	BMD T Score
Premenopausal (n=100)	<120/80 (below normal)	15	15	-1.2
	120/80 (Normal)	53	53	-1.4
	140-159/90-99 (stage-1)	27	27	-1.4
	160-179/100-109 (stage-II)	04	04	-1.4
	180/110 (stage-III)	01	01	-1.9
Postmenopausal (n=111)	<120/80 (below normal)	24	21.7	-1.6
	120/80 (Normal)	38	34.2	-1.8
	140-159/90-99 (stage-1)	40	36	-1.8
	160-179/100-109 (stage-II)	06	5.4	-1.8
	180/110 (stage-III)	03	2.7	-2.1

**Table: 4 Correlation of Blood Pressure with BMD T scores.**

Particulars	BMD	Parameter	Mean $\pm$ SD	r value	P value	P value summary
<b>Premenopausal</b>	-1.43	Systolic	129.7 $\pm$ 16.6	-0.0543	0.0114	ns
		Diastolic	77.6 $\pm$ 9.69	-0.127	0.1046	ns
<b>Postmenopausal</b>	-1.80	Systolic	131 $\pm$ 18.7	-0.0996	0.1491	ns
		Diastolic	74 $\pm$ 9.99	-0.0754	0.2168	ns

\*significant at 0.05 level, \*\* significant at 0.01 level,\*\*\*significant at 0.001 level

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