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A comparative study on the prevalence of hypertension among obese and non obese post menopausal women

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Abstract
Background: Woman's body goes through some major changes during the menopause, and as a result they may experience a range of unexpected symptoms, such as high blood pressure. Both men and women experience hypertension during the aging process. However women are more prevalent in developing hypertension than men. Cardiovascular disease is the leading cause of death in women. The prevalence of obesity may be as high as 40% in postmenopausal women.
Aim: The aim of the study was to assess the prevalence of hypertension in obese and non obese post menopausal women.
Methodology: A questionnaire and interview-based method was used to collect the data. General information of the subjects and anthropometric measurements were assessed. Menopause and hypertension related information was collected. 24 hour three day dietary recall was used to assess participants' sodium consumption. Statistical package of social sciences (SPSS, version 23) was used to analyze the data. Findings were considered to be significant when $p \leq 0.05$ and were considered highly significant when $p \leq 0.01$.
Results: Majority of obese participants (26%) experienced hypertension as compared to non obese (22%) ($p \leq 0.05$). The energy consumption among both groups was significantly lesser ($p \leq 0.01$). Protein consumption for both groups was significantly greater ($p \leq 0.01$). Carbohydrate and sodium consumption among both obese and non obese was highly significantly lesser ($p \leq 0.01$). Fat consumption among both obese and non obese was highly significantly greater ($p \leq 0.01$).
Conclusion: As BMI increased, systolic blood pressure also increases which may be the reason for the high prevalence of hypertension among obese women. Hence it can be concluded that obese participants should not consume foods high in sodium and fat. Also excess stress could lead to hypertension. Obese women should also have a control on the BMI.

Keywords: Post menopause, obese, Non obese, hypertension, sodium

1. Introduction
The typical age of menopause is between 49 and 52 and the average age for last period is between 48 and 55 years [1]. Cessation of menses as a result of removal of the ovaries is called "surgical menopause". The sudden and complete drop in hormone levels usually produces extreme withdrawal symptoms such as hot flashes, etc. [2] Menopause occurs because of the sharp decrease of estradiol and progesterone production by the ovaries. After menopause, estrogen continues to be produced mostly by aromatase in fat tissues and is produced in small amounts in many other tissues such as ovaries, bone, blood vessels, and the brain where it acts locally [3]. women are more prevalent in developing hypertension than men. The mechanisms responsible for postmenopausal hypertension have not been completely elucidated. However, various mechanisms have been implicated to play a role. The presence of obesity is one of the possible mechanisms by which hypertension may be elevated. Weight that accumulates in the abdomen is associated with a higher incidence of cardiovascular disease than weight that is accumulated in the lower body [4]. There are indications that hot flashes may be due to a change in the hypothalamus's control of temperature regulation [5]. A clinical research study found that follicle-stimulating hormone (FSH) levels were strongly associated with bone resorption markers in postmenopausal women.

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These data raise the possibility that FSH causes PMOP independently of estrogen [6]. The inverse associations of breast cancer risk with premenopausal DHEA levels and the apparent protective effects of androgens in some of the experimental studies have been cited to support the use of postmenopausal androgen replacement therapy for the prevention of osteoporosis, improved well-being and/or sexual functioning and, possibly, breast cancer prevention [7]. Obesity, diabetes and hypertension increase the risk of endometrial cancer while smoking, low-fat diets and physical exercise appear to decrease the risk; all of these possibly exert their effects by various indirect influences on estrogen levels, thus influencing the level of stimulation of the target endometrial epithelium [8]. The main hormonal medications used in HRT for menopausal symptoms are estrogens and progestogens, among which progesterone is the major naturally-occurring female sex hormone and also a manufactured medication used in menopausal hormone therapy [9]. Menopause-related changes in body fat distribution may partially explain the greater risk of cardiovascular and metabolic disease during the postmenopausal years. Early postmenopausal status is associated with a preferential increase in intra-abdominal fat that is independent of age and total adiposity [10]. Menopause is a risk factor for cardiovascular disease (CVD) because estrogen withdrawal has a detrimental effect on cardiovascular function and metabolism. The menopause compounds many traditional CVD risk factors, including changes in body fat distribution from a gynoid to an android pattern, reduced glucose tolerance, abnormal plasma lipids, increased blood pressure, increased sympathetic tone, endothelial dysfunction and vascular inflammation [11].

2. Materials and methods: The study was approved by the Institutional Ethical Committee of Seva Mandal Education Society of Matunga on 11th August 2018. A sample of 100 (50 obese and 50 non obese) post menopausal women of age 45-65 were selected from Mumbai city. The subjects interviewed for this study were completely aware of this study design and purpose of this study and consent of the participants was taken. A questionnaire and interview-based method was used to collect the data. General information of the subjects included basic information like Name, Age, Food habits and Occupation. The subjects Height, Weight, Body Mass Index (B.M.I), Waist circumference, Hip circumference and Waist to hip ratio (WHR) was taken. Participants' medical history and family history was considered. The blood pressure of subjects was assessed using a digital sphygmomanometer. Menopause and hypertension related information was collected. 24 hour three day dietary recall was used to assess participants' sodium consumption. Statistical package of social sciences (SPSS, version 23) was used to analyze the data. Univariate chi-square test was used to analyze the representation of cases across the values of single variable and bivariate chi-square test to analyze the representation of cases across the two proportions, one sample t/Z test was used for comparing with reference standards. Pearson's correlation coefficient was used to examine the relationships between two quantitative variables. Findings were considered to be significant when $p \leq 0.05$ and were considered highly significant when $p \leq 0.01$.

3. Results and Discussion
The age of the study participants ranged from 42 to 65 years with the mean age of 55.50 years and standard deviation of 6.09 years. Majority of the participants (64%) were non vegetarians and 36% were vegetarians. Eighty percent of the participants were housewives, 16% were working and 4% were retired.

Table 1: Anthropometric parameters among obese and non obese post menopausal women

Anthropometric parameters	BMI Status	Mean ± Standard Deviation (SD)	Mean Difference	Reference Value	Test Score (Z Value)	Significance Level (p Value)
BMI (kg/m^2)	Non obese	20.99 ± 1.71	-1.90	22.9	-7.83	0.00**
	Obese	30.18 ± 3.81	7.28	22.9	13.46	0.00**
Waist circumference (cm)	Non obese	85.18 ± 7.66	5.18	80	4.78	0.00**
	Obese	95.20 ± 9.21	15.20	80	11.66	0.00**
WHR	Non obese	0.87 ± 0.66	0.20	0.85	2.20	0.03*
	Obese	0.86 ± 0.07	0.01	0.85	1.51	0.13

*($p \leq 0.05$) findings considered to be significant and ** ($p \leq 0.01$) findings considered to be highly significant

According to table 1, when compared with the reference values, the BMI among non obese females was highly significantly lesser and among obese was highly significantly greater. ($p \leq 0.01$) The WHR among non obese females was significantly greater ($p \leq 0.05$) and among obese was non-significantly greater. ($p > 0.05$).

Table 2: Menopausal history of post menopausal women

Variable	Category	Non obese Frequency	Non obese %	Obese Frequency	Obese %	P Value
Onset	Natural	41	82	41	82	1.000
	Hysterectomy	9	18	9	18	
Reason for hysterectomy	Excess bleeding	5	55.6	4	44.4	1.000
	Fibroids	3	33.3	3	33.3	
	Uterus damage	1	11.1	2	22.2	
Symptoms experienced	None	19	38	18	36	0.618
	Joint pain, mood swings and irritability	8	16	3	6	
	Mood swings and irritability	7	14	4	8	
	Joint pain	3	6	5	10	
	Irritability	3	6	4	8	
	Hot flashes, joint pain and irritability	3	6			
	Hot flashes, mood swings and irritability	3	6	8	16	

	Hot flashes and irritability	2	4	2	4
	Hot flashes	1	2		
	Mood swings	1	2	2	4
	Irritability			2	4
	Sleep disturbances			1	2
	Sleep disturbances and irritability			1	2

According to table 2, in both obese and non obese participants 82% had a natural onset of menopause and 18% underwent hysterectomy, and the main reason for hysterectomy was excessive bleeding. Majority of non obese participants (38%) and 36% of obese participants didn't experience any symptoms related to menopause. (p >0.05).

The diastolic blood pressure among non obese participants ranged between 80-90 mmHg with a mean of 81 and standard deviation of 3.03 mmHg and among obese participants it ranged between 60-90 mmHg with a mean of 81.20 and standard deviation of 4.79 mmHg. The systolic blood pressure among non obese participants ranged between 120-140 mmHg with a mean of 121.80 and standard deviation of 5.22 mmHg and among obese participants it ranged between 120-180 mmHg with a mean of 127 and standard deviation of 13.43 mmHg. Thirty percent of non obese participants and 56% of obese participants experienced hypertensive symptoms (p ≤ 0.05), out of this dizziness was the most prevalent. (p >0.05) In most of the participants, these symptoms appeared after menopause and were present since 2 to 5 years. (p >0.05) These symptoms didn't alter the eating pattern of the participants and also most of the participants didn't make any changes in their eating patterns. Six percent of non obese participants and 24% of obese participants had localized edema. (p ≤ 0.05).

Overweight and obesity are a common finding in postmenopausal women, the complex mechanism of obesity-related hypertension can play a relevant role in explaining the high prevalence of hypertension after the menopause [12].

A study revealed that in a rather homogeneous representative population random sample of women around the menopause, the rise in blood pressure after the menopause appeared to be due to increased BMI rather than to ovarian failure per se [13].

Table 3: Stress experienced by obese and non obese post menopausal women

Variable	Category	Non obese		Obese		p Value
		Frequency	%	Frequency	%	
Stress	Yes	44	12	33	34	0.016*
	No	6	88	17	66	

*(p ≤ 0.05) findings considered to be significant and ** (p ≤ 0.01) findings considered to be highly significant

According to table 3, in non obese participants 88% didn't experience stress and 12% experienced stress. Similarly in obese participants 66% never experienced stress and 34% experienced stress in day to day life and these findings were found to be statistically significant (x^2 = 6.832, p ≤ 0.05).

Menopause plays a pivotal role in modulating both presence and degree of sleep disturbances in obese women [14].

The health consequences of obesity include increased risk of heart disease, hypertension, diabetes, sleep apnea, cancer, osteoarthritis, and mental health problems [15].

Table 4: Nutrient intake among obese and non obese post-menopausal women

Nutrient	BMI Status	Mean ± Standard Deviation (SD)	Mean Difference	Reference Value	Test Score (Z Value)	Significance Level (p Value)	% Adequacy
Energy (kcal)	Non obese	1787.45 ± 225.10	-112.54	1900	-3.53	0.001**	94.07
	Obese	1829.22 ± 239.33	-70.78	1900	-2.09	0.042*	96.27
Protein (gms)	Non obese	59.17 ± 9.78	4.17	55	3.01	0.004**	107.59
	Obese	58.56 ± 10.32	3.56	55	2.44	0.018*	106.47
CHO (gms)	Non obese	241.68 ± 39.30	-67.31	309	-12.10	0.000**	78.21
	Obese	254.30 ± 29.80	-54.69	309	-12.97	0.000**	82.30
Fats (gms)	Non obese	56.09 ± 8.64	7.09	49	5.80	0.000**	114.47
	Obese	57.79 ± 10.04	8.79	49	6.18	0.000**	117.93
Sodium (mg)	Non obese	563.41 ± 135.2	-1363.5	1900	-71.29	0.00**	28.23
	Obese	520.78 ± 127.13	-1379.2	1900	-76.71	0.00**	27.20

*(p ≤ 0.05) findings considered to be significant and ** (p ≤ 0.01) findings considered to be highly significant

According to table 4, when compared with RDA, The energy consumption among both groups was significantly lesser. (p ≤ 0.05) However for non-obese it was highly significantly lesser. (p ≤ 0.01) Protein consumption for both groups was significantly greater. (p ≤ 0.01) However for non obese was highly significantly greater. (p ≤ 0.01) Carbohydrate and sodium consumption was highly significantly lesser. (p ≤ 0.01) Fat consumption among both obese and non obese was highly significantly greater. (p≤ 0.01).

4. Conclusion

The systolic blood pressure among obese post menopausal women was greater as compared to non obese women. Also higher number of obese participants experienced hypertensive symptoms as compared to non obese participants. As perceived by the participants, obese women experienced stress in greater amounts than non obese women which may be an indicator for high blood pressure. The consumption of energy and carbohydrates was less and the consumption of proteins and fats was high in both the groups. Although the sodium consumption among both the groups was found less, the presence of high blood pressure could be linked to excess stress, high consumption of fat and higher BMI.

Hence it can be concluded that obesity leads to hypertension in post menopausal women. Appropriate lifestyle modification with healthy food choices, exercise and decrease

of stress may help in reducing obesity and in turn hypertension in post menopausal women.

5. Acknowledgement

6. References

1. Takahashi TA, Johnson KM. Menopause. The Medical Clinics of North America. 2012; 99(3):521-534.
2. Harlow SD, Gass M, Hall JE, Lobo R, Maki P, Rebar RW *et al*. Executive Summary of the Stages of Reproductive Aging Workshop + 10: addressing the unfinished agenda of staging reproductive aging. Fertility and Sterility. 2012; 97(4):843-851.
3. Simpson ER, Davis SR. Minireview: aromatase and the regulation of estrogen biosynthesis--some new perspectives. Endocrinology. 2001; 142(11):4589-4594.
4. Roberta Lima, Marion Wofford, and Jane F. Reckelhoff. Hypertension in Postmenopausal Women. Current Hypertension. 2012; 14(3):254-260.
5. Soules MR, Sherman S, Parrott E, Rebar R, Santoro N, Utian W *et al*. Executive summary: Stages of Reproductive Aging Workshop (STRAW). Climacteric. 2001; 4(4):267-272.
6. Jie Wang, Wenwen Zhang, Chunxiao Yu, Xu Zhang, Haiqing Zhang, Qingbo Guan *et al*. Follicle-Stimulating Hormone Increases the Risk of Postmenopausal Osteoporosis by Stimulating Osteoclast Differentiation. PLoS One. 2015; 10(8).
7. Kaaks R, Rinaldi S, Key TJ, Berrino F, Peeters PHM, Biessy C. Post-menopausal serum androgens, oestrogens and breast cancer risk: The European prospective into cancer and nutrition. Endocrine Related cancer. 2005; 12(4):1071-1082.
8. David Purdie M, Adèle Green C. Epidemiology of endometrial cancer, Best Practice & Research. Clinical Obstetrics & Gynaecology. 2001; 15(3):341-354.
9. Stuenkel CA, Davis SR, Gompel A, Lumsden MA, Murad MH, Pinkerton JV. Treatment of Symptoms of the Menopause: An Endocrine Society Clinical Practice Guideline. J. Clin. Endocrinol. Metab. 2015; 100(11):3975-4011.
10. Michael Toth J, Andre Tchernof, Cynthia Sites K, Eric Poehlman T. Menopause related changes in body fat distribution. Annals of the New York academy of Sciences. 904(1):502-506.
11. Dr. Rosano GMC, Vitale C, Marazzi G, Volterrani M. Menopause and cardiovascular disease: the evidence. Climacteric Journal. 2009; 10(1):19-24.
12. Rappelli A. Hypertension and Obesity after Menopause, Journal of Hypertension. Supplement: Official Journal of The International Society of Hypertension. 2002; 20(2):26-28.
13. Cifkova Renata, Pitha Jan, Lejskova Magdalena Lanska, Vera Zecova, Silvia. Blood pressure around the menopause: a population study. Journal of Hypertension. 2008; 26(10):1976-1982.
14. Resta, Caratozzolo G, Pannacciulli N, Stephano A, Giliberti T, Carpagnano GE *et al*. Gender, Age and menopause Effects on the Prevalence and The Characteristics of Obstructive Sleep Apnea in Obesity. European Jornal of Clinical Investigation. 2003; 33(12):1084-1089.
15. Karen Dennis E. Postmenopausal Women and the Health Consequences of Obesity. Journal of Obstetric, Gynecologic & Neonatal Nursing. 2007; 36(5):511-519.