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Impact of menopause on body mass index and bone mineral density in perimenopausal women

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Abstract
Background: Menopause is the period of declined ovarian activity and decreased oestrogen level with increased chances of obesity and co-morbidities like Hypertension, Hyper-cholestrelaemia, impaired cognitive function and cardio vascular dysfunction. Menopausal women are at high risk of osteoporosis which increases the mortality, morbidity and socio economic burden.
Aim & Objective: To study the effect of menopause on BMI and BMD in pre and post-menopausal women.
Design: Cross sectional study.
Participants: Apparently healthy 30 post-menopausal women in the age group of 55-60 years as study subjects and 30 pre-menopausal women aged 40-45 years as controls.
Methodology: The study was initiated with the approval of Institutional Ethical Committee. Standardised measurements of height and weight were taken and BMI was calculated using QUETELET'S INDEX. The bone mineral density of L1-L4 spine was estimated by DEXA Scan. The values are tabulated and analysed by Chi-square test. Statistical analysis was performed to find the association between BMI and BMD in pre and post-menopausal women.
Results: Post- menopausal women are likely to have higher BMI (Mean BMI 26.34) compared with the pre-menopausal women (24.39); $p<0.05$. Bone mineral density is low in pre-menopausal women when compared to post-menopausal women but statistically not significant. (p-0.8708).
Conclusion: Post-menopausal women have high BMI and higher BMD.BMI is an important anthropometric parameter which reflects the BMD.

Keywords: Menopause, body mass index, bone mineral density, osteoporosis

1. Introduction
Menopause is a global physiological milestone in every women's life and become non reproductive due to aging characterised by declining ovarian follicles and ovarian hormones and termination of menstrual cycle [1]. Age of menopause is genetically determined and is not related to race or nutritional status, it is around 40-55 years [2]. Post-menopausal women are at risk of conditions precipitated by oestrogen deficiency. More than 35 symptoms are associated with menopause [3]. Women have to spend 1/3 of their lives with these symptoms in postmenopausal period as average life expectancy is increasing. Menopause has its impact on women's health and sense of wellbeing. Oestrogen act as a shield and protect the women from cardio vascular dysfunction, impaired cognitive function, obesity, osteoporosis and related comorbidities [1]. Obesity in post menopausal women are multifactorial like reduced basal metabolic rate, less physical work and altered eating habits [4]. Osteoporosis, the slow progressive endocrine disease affects adults of both sex. Around 35% of post-menopausal females and 19% of males are osteoporotic. 25% of Caucasian women are above 60 years of age and 55% of them are osteoporotic due to both modifiable and non-modifiable causes. Caucasian and Asians are more affected[5]. Osteoporosis is one of the condition where "Prevention is better than cure". The special medical care related to post-menopausal women will form a specific field of medicine in future. As it is well accepted that the health of postmenopausal women represents the health of the society, this study concentrates on problems related to menopause by estimating bone mineral density, hormones and factors influencing bone metabolism.

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2. Materials and Methodology

This cross sectional study was conducted in the Research laboratory, Department of Physiology, Tirunelveli medical college between July 2014- October 2014 after obtaining ethical committee clearance. This Study involved 30 post-menopausal women in the age group of 55-60 years as subjects and 30 premenopausal women aged 40-45 years as controls. The study protocol was explained in detail to them and written consent was obtained. Women with diabetes, hypertension, alcoholism, smoking habits, Amenorrhoea due to surgical removal of uterus were excluded from the study. Weight in (kg) was measured using calibrated weighing scale and height in meters was obtained using stadiometer. The BMI was calculated using Quetlet's formula BMI=weight in Kg/height in m^2 as a measure of relative weight. Menstrual history including age at menarche, age of attaining menopause and number of years after menopause were recorded. The bone mineral density was measured at Antero posterior lumbar spine L1-L4 by using LUNAR DPX DEXA SCAN SYSTEM manufactured by GE Health care.

3. Results Analysis

The Data regarding body mass index and bone mineral density of the study group were recorded and analysis was done using Epidemiological Information Package 2010.

Table 1: Distribution of Body Mass Index

BMI	Pre-menopausal group		Post-menopausal group	
	Numbers	%	Numbers	%
Under weight (< 19)	3	10	-	-
Normal (19 -24.9)	23	76.7	11	36.7
Overweight ($\geq$25)	4	13.3	19	63.3
Total	30	100	30	100
BMI Range Mean SD	21.6 - 27.7 22.3 2.6		20.3-29.3 24.8 2.4	
P VALUE	0.0017* (Significant)			

The difference between pre and post-menopausal group regarding BMI is statistically significant. The post-menopausal group have higher BMI than pre-menopausal group**.**
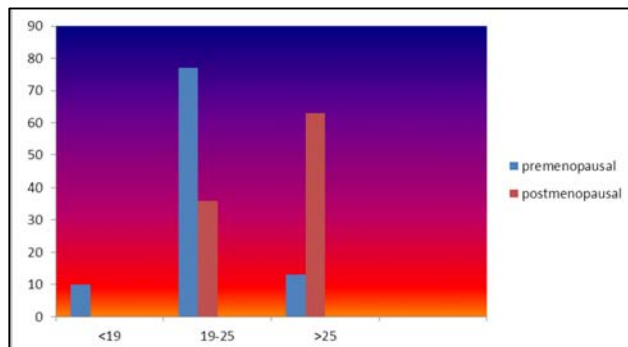

Fig 1: Distribution of Bmi In Pre And Postmenopausal Women

Table 2: Association between Body Mass Index and Bone Mineral Density

Body Mass Index	Bone Mineral Density (g/cm²)			
	Pre-menopausal group		Post-menopausal group	
	Mean	SD	Mean	SD
Under weight	1.14	0.16	-	-
Normal	1.09	0.07	1.01	0.08
Over weight	1.17	0.13	1.2	0.2
Obese	1.21	0	1.16	0.07
P VALUE	0.2439 (Not Significant)		0.025* (Significant)	

The association between BMI and BMD is not significant in the premenopausal group, but significant in the post-menopausal group.
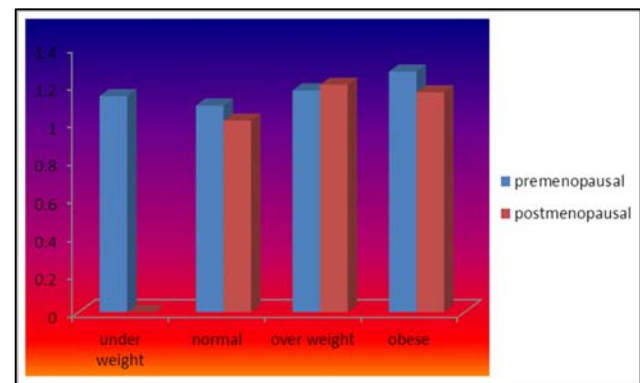

Fig 2: Association between Body Mass Index and Bone Mineral Density

4. Discussion

Menopause occurs as a continuous transition from a regular cycles of ovulation, not as a sudden event. The prevalence of obesity in women rises in each decade but 20% weight gain ie 4-5 kg occurs within 3 years of menopause. Similar findings were observed in a study on postmenopausal women in Zaria, Nigeria [6]. The altered hormonal status precipitates central obesity which in turn leads to non-communicable diseases like diabetes, dyslipidaemia, hypertension, cardiovascular dysfunction and altered mental status. Though post-menopausal women are defective in oestrogen, there is peripheral conversion of adrenal androstenedione into estrone occur in adipocytes and muscular tissue. In obese women there is higher level of free sex hormone [7, 8]. This prevents the sudden endogenous decrease and partially explain the protective effect of obesity on bone tissue because the osteoblasts and adipocytes arise from the same progenitor cell, there is increased osteoblastic activity and increased bone mineral density. Ribot C, Tremollieres F and Pouilles concluded in their study that overweight may protect women

against bone loss after menopause. Paul T V *et al.* observed a statistically significant association between BMI and BMD. It is obvious that BMI is an important parameter which affects BMD and we observed a positive correlation between BMI and BMD. As aging is associated with low bone mineral density, BMI should be maintained in elderly population to prevent osteoporosis

5. Conclusion
Osteoporosis is one of the condition where "An ounce of prevention is worth of a pound of cure". Bone mineral density is very much influenced by body mass index and menopause. This effect may be mediated by adipocytokines and extragonadal oestrogen reservoir represented by adipocytes. It is well established that thicker bones resist osteoporotic changes when compared to thinner bones.

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