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Original Research Article

Body Composition by Bioelectrical Impedance Analysis in Post Menopausal Women: A Cross Sectional Study

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Abstract

Background: Various changes in body composition and body fat distribution significantly notable during menopause transition. Recently changes in body composition in post-menopausal women has gained importance in the research field.

Objectives: The aim was to determine the body composition in post-menopausal women.

Materials and Methods: Fifty postmenopausal women of age 45 to 60 years and fifty premenopausal women of age 35 to 45 years were selected for the study. Body composition parameters recorded by using bioelectrical impedance analysis.

Results: In postmenopausal women, body mass index was significantly higher than premenopausal women (p=0.013). Body fat percentage was significantly higher in postmenopausal women (p=0.043). In postmenopausal women, lean body mass percentage was significantly lower than premenopausal women (p=0.043).

Conclusion: The findings of our study suggest that change in body composition is due to menopausalstatus, age, health and life style factors.

Keywords: Premenopausal, Postmenopausal, Body Mass Index, Body Composition.

Introduction

The term menopause is defined as cessation of menstruation for 12 months which results in ovarian senescence and permanent amenorrhoea. It is a progressive endocrinological phase wherein women transit from regular cyclic menses to a final menstrual period followed by amenorrhoea, denoting inactive ovarian function. [1]

According to the Indian Menopause Society the average age of women is 47.5 years which is much less than western counter parts. [2] As the world's population is always on a rise with improved medical care, there will be increasing number of women entering menopause and a majority of them spend about one third of life in the post-menopausal stage.

During menopause, some women experience numerous and severe symptoms, while others experience minor or no symptoms [3]. The nature and prevalence of menopausal symptoms are common in most women. The symptoms experienced by the postmenopausal women depends on the level of estrogen hormone. The symptoms associated with estrogen deficiency include hot flushes, night sweats, insomnia and vaginal dryness. During menopause transition, the level of reproductive estrogen is reduced from 250-100pg/ml to less than10 pg/ml [4]. Therefore, the ability to saturate the receptors and stimulate the targeted tissue cells disappears, leading to estrogenic dysfunction. There are others symptoms and conditions that are not necessarily related to estrogen deficiency may be abnormal bleeding, osteoporosis, arteriosclerosis, depression, irritability, headache, amnesia, dry mouth, eyes, reduced skin elasticity, muscle and joint pain.

The body composition parameters determined by bioelectrical impedance analysis (BIA). It is non-invasive, easily applicable, safe, inexpensive and practical method to assess body composition [5]. Bioelectrical impedance analysis more popularly known as bioimpedance analysis. This method has been extensively used in studies of body composition mainly because of its rapid processing of information and portable instrument with easy handling [6]. Bioelectrical impedance analysis (BIA) is a commonly used method for estimating body composition parameter particularly body fat [7]. Bioelectrical impedance analysis actually determines the electrical impedance or opposition

to the flow of an electric current through body tissues which can then be used to calculate an estimate of total body water(TBW) [6]. In recent years technological improvement have made Bioelectric Impedance Analysis a more reliable and more acceptable way of measuring body composition.

The assessment of body composition has reached an outstanding position in studies in the area of nutrition, physical activity and health, especially regarding the influence of excess body fat and its distribution on the onset of non-communicable chronic diseases [8]. In women's life, menopausal transition is significantly associated with deleterious changes in body composition. Menopause is an important subject to study as due to increase in life expectancy and improved health care delivery, number of postmenopausal women is significantly increasing [9]. So, the concise study was designed to determine body composition in postmenopausal women.

Material and Methods

The present study was carried out in Department of Physiology of government medical college. Women aged 35 to 60 years attending to the outpatient department of government medical college and hospital and the staff working in the medical college and hospital has been recruited.

Sample Size: A study conducted by Batra J et al [10] inferred that the mean body mass index among premenopausal and postmenopausal women were 24.92 ± 2.65 and 26.55 ± 3.15 respectively. Using these, with 80% power and 95% confidence interval we calculated the sample size of 50 in each group namely study group – Postmenopausal women aged 45 to 60 years and comparison group – Premenopausal women aged 35 to 45 years. Both groups were subjected for anthropometric measurements like weight, height and body mass index and body composition analysis.

Body Composition Analysis: Body composition parameters like body fat percentage and lean body mass was assessed by body stat quad scan 4000body composition machine, body stat limited, British isles, fluid & illness/segmental monitoring unit. The basic principle of this method is lean tissue, which consists essentially of electrolyte containing water, conduct the electrical current, whereas the fat acts as an insulator. The impedance of the body is therefore determined largely by low-impedance lean tissues.

After selection, women from both groups were then given appointment in group of five in the department of physiology, government medical college during morning hours for measurement of anthropometric parameters and body composition analysis. All women advised to observe 4 hours fasting before investigations. Before starting the work detailed information regarding project is given to women .Body composition was done in fasting state and with set protocol by bioelectric analysis method. Informed written consent was taken from each subject before the interview. No pressure was exerted on study participants to participate in a study. Confidentiality was ensured at all stages.

Postmenopausal women who have undergone hysterectomy, diabetic, hypertensive, on hormone replacement therapy and with h/o gynecological and hormonal disorder have been excluded in this study. Ethical approval for this study was obtained from institution.

Statistical Analysis: The data was collected, compiled and analysed using EPI info (version 7.2) The qualitative variables were expressed in terms of percentages. The quantitative variables were both categorized and expressed in terms of percentages or in terms of mean and standard deviations. Difference between two proportions was analysed using chi square orfisher exact test.

Observations and Results

The study was carried out in Department of Physiology government medical college on females of age group 35 to 60 years in postmenopausal and premenopausal women. Fifty cases each in postmenopausal and premenopausal group were selected randomly and study was carried out on body composition parameters in postmenopausal and premenopausal women.

Results:

Table 1: Distribution of the study subjects based on the age groups

Age group	Postmenopausal		Premenopausal		P value
	No[r]	%	No[r]	%	
30 to 40	0	0	30	60.00	<0.001
41 to 50	30	60.00	20	40.00	
51 to 60	20	40.00	0	0	
Total	50	100	50	100	
Mean	50.50		39.42		<0.001
SD	3.84		2.86		

The mean age of the subjects in postmenopausal group is 50.50 ± 3.84 years and among the premenopausal women it was 39.42 ± 2.86 years and this difference was statistically significant.

Table 2: Distribution of the study subjects based on various anthropometric parameters

Anthropometric parameters	Postmenopausal		Premenopausal		P value
	Mean	SD	Mean	SD	
Height	151.90	7.63	150.50	14.83	0.5542
Weight	61.78	13.17	55.96	12.81	0.0274
Body mass index	26.63	4.58	24.10	5.37	0.0131

There was no statistical difference in height of postmenopausal and premenopausal women. Weight of postmenopausal women were significantly higher as compare to premenopausal women. Body mass index of postmenopausal women were significantly higher as compare to premenopausal women.

Table 3: Distribution of the study subjects based on body mass index (Categories)

Body mass index (Categories)	Postmenopausal		Premenopausal		P value
	No[r]	%	No[r]	%	
Underweight (less than 18.50)	0	0	7	14.00	0.0334
Normal (18.50 -24.99)	23	46.00	20	40.00	
Overweight (greater than 25.00)	16	32.00	17	34.00	
Obese (greater than 30)	11	22.00	6	12.00	
Total	50	100	50	100	

Table 4: Distribution of the study subjects based on various body fat parameters

Body fat parameters	Postmenopausal		Premenopausal		P value
	Mean	SD	Mean	SD	
Body fat percentage	41.46	5.79	38.95	6.45	0.0437
Body fat in kgs	25.70	7.53	21.80	6.61	0.0069
Lean body mass percentage	58.54	5.79	61.05	6.45	0.0437
Lean body mass (kg)	36.04	7.34	34.14	8.08	0.2230

Body fat percentage & body fat in kgs were significantly higher in post-menopausal women. Lean body mass percentage was significantly lower in postmenopausal women.

Discussion

The present cross sectional study was undertaken in 100 women which includes 50 postmenopausal women as a study group & 50 premenopausal women as comparative. The parameters studied were anthropometric parameters like height, weight, body mass index and body composition parameters such as body fat percentage (BF%) and lean body mass percentage (LBM%).

There was statistically significantly higher BMI in post-menopausal women as compare to premenopausal women (p value 0.03). Same finding found in Grazyna Jasienska, (2005) [11]. Quadri S, Dhundsi S. (2012) [4] stated that the values of BMI was more in postmenopausal women and depends on duration of menopause. Another study Zuzana Danková et al. (2014) [12] mentioned that higher mean values of BMI in postmenopausal group than in premenopausal women reached again no statistical significance after controlling for age.

The mean age of the subjects in postmenopausal group is 50±3.84 years and among the premenopausal women it was 39.42±2.86 years and this difference was statistically significant. There was no statistical difference in height of postmenopausal and premenopausal women. Weight of postmenopausal women were significantly higher as compare to premenopausal women.

Body mass index (BMI): BMI is the ratio of weight in kilograms(kgs) to height in meters square.(kg/m^2).

Table 3 stated that the subjects none of them were underweight, 46% of them were normal range, 32% were overweight and 22% were obese in post-menopausal group. Among premenopausal women, 14% were underweight, 40% were normal, 34% were overweight and 12% were obese. There was statistically significantly higher BMI in post-menopausal women as compare to premenopausal women (p value 0.03). This finding are consistent with the study Grazyna Jasienska (2005) [11]. Quadri S, Dhundsi S. (2012)[4] stated that the values of BMI was more in postmenopausal women and depends on duration of menopause. Zuzana Danková et al.(2014)[12] stated that higher mean values of BMI in postmenopausal group than in premenopausal women reached again no statistical significance after controlling for age.

Sowers et al. [13] report findings from The Study of Women's Health Across the Nation (SWAN)

that both chronological aging and ovarian aging contributed to a cumulative increase in Fat Mass (FM) of 3.4 kg and body mass index (BMI) of 1.2 kg/m^2 in a group of obese (BMI: 32.1±8.1 kg/m$_2$) premenopausal or early perimenopausal African-American and Caucasian women aged 42–52 years (n = 543) followed for 6 years. Sternfeld B et al (2004) [14] study reported that diet, physical activity, smoking habits, and BMI were still significantly higher among perimenopausal and postmenopausal women compared to premenopausal women an effect that persisted after adjusting for age.

Body fat percentage: The body fat percentage gives the relative percentage of fat in human body. Body fat percentage were significantly higher in post-menopausal women. Mean value of body fat percentage in post-menopausal women was 41.46±5.79 while that of comparative (premenopausal women) was 38.95±6.45 in our study. The greater value of BF% in post menopausal women was found in the study of Quadri S, Dhundsi S. (2012)[4] but it is age related. SC Ho et al (2010) [15] stated that increase in BF % among post-menopausal women and those undergoing menopause transition, menopausal status remained a significant predictor of these changes in body composition.

Another cross-sectional study by Toth *et al.*[16]looked at 53 premenopausal women and 28 postmenopausal women aged 47 ± 3 years and 51 ± 4 years, respectively. They reported that total body FM was 28% higher and % body fat was 17% higher in the postmenopausal women compared to the premenopausal women. The increase in FM remained significant, even after adjusting for age.

Lack of estrogen in postmenopausal females was associated with an increase in body fat. Estrogen plays many roles with respect to body fat regulation. Estrogen has been shown to directly affect adipose tissue and act centrally to alter food intake and energy expenditure.

Lean body mass percentage: Lean body mass is a part of body composition that is defined as the difference between total body weight and body fat weight. In present study lean body mass percentage inpost menopausal women was significantly lower than premenopausal women.p values is 0.04.

SC Ho et al (2010) [15] observed that decrease in lean body mass in postmenopausal women. Our finding supports finding of a cross-sectional study by Rolland et al [10] showed a decline of 0.6% and 1.17% in muscle mass and muscle strength, respectively, in healthy postmenopausal women (54.1 ± 4.3 years). Moreover, a 6-year longitudinal study (SWAN) reported that there was an absolute cumulative decrease in skeletal muscle mass of approximately 0.23 kg (1.06%), which represents a yearly average decrease of 0.18% in a group of obese (BMI: 32.1 ± 8.1 kg/m^2) premenopausal or early perimenopausal African-American and Caucasian women. [16]

The mechanism underlying the menopause related loss of lean body mass are unclear, it is believed that estrogen plays a role. There is evidence that estrogen receptors (ER) are present in skeletal muscles, under the form of ERα and ERβ. With the presence of these receptors, it suggests that muscles are estrogen responsive tissues. However, a comprehensive understanding of the physiological mechanisms underlying these changes remains to be elucidated. It was hypothesized that as estrogen binds to its ERα there is an increase in antioxidant protein, such as superoxide dismutase and glutathione peroxidase, which in turn reduces oxidative stress, further improving muscle contractility and strength. Other evidence has shown that estrogen can act as an antioxidant or as a membrane stabilizer influencing muscle membrane stability and reducing muscle damage by limiting.

Conclusion

The study was undertaken to determine body mass index, body composition parameters like body fat percentage, lean body mass percentage in postmenopausal women.

In postmenopausal women, body fat percentage (BF%) was significantly more and lean body mass percentage (LBM%) was significantly lower as compared to premenopausal women. Lack of estrogen in females was associated with an increase in body fat. Estrogen plays many roles with respect to body fat regulation. Estrogen has been shown to directly affect adipose tissue and act centrally to alter food intake and energy expenditure. This direct inhibitory effect is thought to occur through the inhibition of adipose deposition by decreasing lipogenesis due to a decrease of lipoprotein lipase (LPL) activity. Estrogen can also affect adipogenesis by increasing proliferation and inhibiting differentiation of adipocytes. The central effects of estrogen on Fat Mass has been associated with a reduction in food consumption, leptin secretion and an increase in energy expenditure. Altogether, the presence of estrogen could help maintain or reduce fat deposition in females.

Recall bias for personal information and blood estrodiol test are our limitation of the study.

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