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#### **RESEARCH ARTICLE**

#### ENERGY BALANCE AND BODY COMPOSITION OF POSTMENOPAUSAL WOMEN.

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## **Manuscript** Info

#### Abstract

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#### Key words:

Obesity, Postmenopausal women, Energy balance, Physical activity, Risk factor. Abbreviations: BF-Body fat, MMS- Muscle mass, VF-Visceral fat

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..... The menopause is accompanied by increased risk of obesity, altered body fat distribution and decreased skeletal muscle mass. The resulting decrease in BMR should be accompanied by a compensatory change in energy balance to avoid weight gain. The aim of the study is to investigate habitual energy intake and expenditure of postmenopausal women. The study sample included 450 healthy postmenopausal women, aged 45-60 years . Data collection comprised of anthropometric, dietary and Physical activity analysis. BMR and TEE was calculated using ICMR equation. Body composition was measured using body composition analyzer. Positive energy balance was observed among obese and non obese individuals. High BF%, VF level and low MMS% was observed among obese population (significant at 5% level). The results of the study suggest that weight maintenance can be achieved in the postmenopausal women by increasing Physical Activity level, total energy expenditure and decreasing energy intake.

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#### **Introduction:-**

The menopause is caused by a fall in the amount of the hormone estrogen produced by the ovaries. Menopause is a time of transition, the end of the fertile years and an individual experience for every woman. The decline or absence of estrogen can mean changes to energy levels, memory, bone health, hormones, urinary and heart health. Several alterations in fat deposits occur with the advent of the menopause, leading to a change in the distribution of body fat. Hypoestrogenism has a negative effect on fat metabolism, favoring the appearance of central-body obesity Douchi T et al. (2003). The combined effect of ageing and the menopause leads to a sharp increase in the risk of adverse clinical outcomes such as incidence and mortality rates for CHD in women, Heller RF & Jacobs HS(1978). Lovejoy et al. (2008) conducted a study for four years on 156 middle-aged, healthy, premenopausal women and divided them according to menopausal status (pre-, peri- and postmenopausal). He concluded that menopause is associated with small but unfavorable changes in body fat distribution, All women gained subcutaneous adipose tissue (AT) but only those who became postmenopausal had a significant increase in visceral AT, also showed that both free energy expenditure (and activity energy expenditure; AEE) and sleeping energy expenditure declined over time in mid-life women (the decrease in sleeping energy expenditure was 1.5 times greater in women who became postmenopausal over the 4-year follow-up period). If both RMR and AEE are reduced and there is no equivalent reduction in energy intake, then an increase in BMI along with increased health risks will be inevitable. Therefore the present study aimed to determine the association of waist circumference and body composition, energy intake and expenditure pattern among postmenopausal women.

## Method:-

Four hundred and fifty postmenopausal women between the age 45-60 years were participated in this cross sectional study from Bangalore urban areas. Informed consent was taken from the study population. In the evaluation the investigator used a pre coded questionnaire including a full clinical history, socio-economic and personal information, habitual or current drug use, careful recording of principle gynecological events, physical activity, a

complete history of weight variations during the subject life. Anthropometric measurements such as Height (in cm.) and weight (in kg.) were recorded and body mass index was calculated. Sample were classified according to their anthropometric measurements as obese and non obese respondents for comparison between the groups with respect to body composition, energy intake and expenditure.

The food and nutrient intake was assessed by the 24 hour recall method of diet survey. The respondents were asked about the type of foods they had for breakfast, lunch, tea and dinner and the raw ingredients used for each of the preparation. Nutrient intake was computed using the food composition tables-Nutritive value of Indian foods. Body composition was measured using body composition analyzer (Omron BF511), which measures the body fat percentage by the Bioelectrical Impedance (BI) method. Body fat percentage, muscle mass percentage and visceral fat level were obtained. PAL Value was calculated using Factorial approach by recording 24 hr physical activity of the respondents. BMR and TEE was calculated using ICMR Equation. (BMR= 8.3xBW(kgs)x788) where as BW is body weight. (TEE= BMR x PAL). Data analysis was performed using SPSS Statistics 20 (IBM) Data are presented as mean values with their standard deviation and groups were compared using unpaired 't' tests significance of comparisons was tested using chi-square test as appropriate.

## **Results and Discussion:-**

Table .1 Anthropometric Measurements of the Respondents.

Anthropometric Indices	Category	Respondents	
		Number	Percent
Body mass index (BMI)	Normal (18.5-24.9)	23	5.1
	Over weight (25.0-29.9)	48	10.7
	Obese-I (30.0-34.9)	219	48.7
	Obese-II (35.0-39.9)	160	35.6
Waist/Hip ratio	Non obese (<0.85)	141	31.3
	Obese (>0.85)	309	68.7
Total		450	100.0

Source: WHO (2004) and (2008)

### **Respondents characteristics:-**

Mean age of study population was found to be 53.60 years whereas mean age at menopause was 50.67 years, and mean duration since menopause was (MDSM = 2.93 years). Based on BMI and waist hip ratio respondents were classified as non obese and obese which is depicted in table -1, It is clear from the above table that majority of the respondents belong obese grade I (48%), and obese grade II (36%). Central obesity was observed in majority of study population (69%). This high prevalence may be due to a reduction in ovarian hormones at the menopause leads to diverse functional and endocrinological disturbances, among them an increase in body weight and a decrease in basal metabolism, which leads to greater weight gain Heine PA et al,.(2000). Another factor related to the control of body weight is the effect of activation of estrogen receptors. Estrogen receptor- $\alpha$ , activated by estradiol, has a crucial role in inhibiting the development of adipose tissue; therefore, there is an increase in adipose tissue during the menopause as a result of the deficiency of estrogen Heine PA et al,.(2000).

#### Table 2 Energy Intake and Expenditure Of Respondents.

Characteristics	Waist Hip ratio of the respondents				't'Test
	Non obese ( <0.85)	SD	<b>Obese</b> (>0.85)	SD	value
	Mean (N=141)		Mean (N=309)		
Age of the respondents	53.45	0.86	53.67	0.89	2.42*
Age at menopause	50.69	0.78	50.66	0.80	0.35 <sup>NS</sup>
Height (mts)	1.58	.038	1.57	0.04	$1.62^{NS}$
Weight (kgs)	66.99	8.37	73.50	8.11	7.82*
BMI	27.00	3.38	29.50	3.55	7.03*
Waist (cms)	87.45	5.35	97.55	9.26	12.05*
Hip (cms)	116.36	7.21	111.82	7.23	6.18*
Waist hip ratio	0.7521	0.030	0.8714	0.04	26.69*
PAL Value	1.327	0.30	1.316	0.02	4.36*
BMR	1344.04	69.50	1398.13	67.33	7.82*
TEE	1783.36	83.09	1839.17	77.91	6.90*
Energy Intake	2191.48	38.87	2217.11	44.30	6.20*
Difference in energy intake	408.11	62.27	377.93	53.39	5.27*

\* Significant at 5% Level NS- Non significant Source: WHO (2004) and (2008)

Table 2 reveals characteristics of respondents based on waist hip ratio, indicating age at menopause has no significance on obesity where as weight, BMI has statistical significance. waist circumference of obese individuals was significantly higher compare to non obese, so as significant difference was found in waist hip ratio. Both the groups were found to be sedentary, among obese population PAL value was found to be low. Energy intake of both the groups was found to be more than energy expenditure which is significant at five percent level indicating positive energy balance which leads to further weight gain with lower PAL value. Abildgaard J et al. (2013) in his study shown that postmenopausal women have a lower fat oxidation and energy expenditure during exercise than premenopausal women, further contributing to a lower capacity for substrate utilization by skeletal muscle after the menopause Nguyen TV et al. (1998).

Characteristics	Category	Waist Hip ratio of the respondents			$\chi^2$ Value
		Non Obese <0.85	Obese >0.85	Total	
BMI of the	18.5-23	12	11	23	47.01*
respondents	23.1-24.9	30	18	48	
	25-29.9	75	144	219	
	30-39.9	24	136	160	
Visceral fat levels	<10 Normal	118	50	168	188.59*
	>10 High	23	259	282	
Body fat	20-30% Normal	30	193	223	65.68*
percentage	>33 Obesity	111	116	227	
Muscle mass%	<24.1 low	39	219	258	79.91*
	24.1-30.1 Normal	102	90	192	
	Total			450	

Table 3 Association	of body	composition	and	waist hi	o ratio.
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\* Significant at 5% Level

Strong statistical association was found between waist hip ratio and visceral fat levels (p value <0.05), high level of visceral fat was found among majority obese population compare to non obese indicating fat deposition. Higher Body fat percentage and lower muscle mass percentage was associated with obesity which is significant at five percent level depicted in table 3. There is a decrease in lean mass in women after the menopause which is related to years since menopause rather than age Wang Q et al. (1994), and a decrease in lean mass is associated with a decrease in BMR Goris AH et al. (2000). A healthy lifestyle to reduce risk of CVD is therefore particularly important in postmenopausal women. Exercise is beneficial to health and a recent study has shown that habitual running and walking are associated with similar risk reductions of hypercholesterolemia and hypertension Williams PT & Thompson PD (2013) . Progesterone secretion during the menstrual cycle was associated with an increase in core temperature and energy expenditure. According to Heymsfield et al. (1994) and to Poehlman et al. (1993), three factors may contribute to the gradual fall in resting energy expenditure with age and menopause: loss of luteal phase, effect of ageing on fat-free mass and perhaps a specific effect of menopause on the resting metabolic rate. Other hormones may be involved in the menopausal changes in body composition: cortisol and adrenocorticotrophic hormone (ACTH), growth hormone (GH), androgens (Marin et al., 1992; Bjorntorp, 1993)

## Summary and conclusion:-

The importance of maintaining body weight in mid-life cannot be underestimated for women where age, menopausal status and BMI are risk factors for CVD. The present study concludes that higher energy intake and lower Physical activity level is prevalent among postmenopausal women which predicts obesity if not corrected. Study also concludes strong association of higher body fat percentage, lower muscle mass percentage and high level of visceral fat with obesity which are risk factors for CVD. The study results may be useful for targeting efforts to promote strategies to reduce the risk of obesity and weight gain in postmenopausal women.

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