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## Menopausal obesity: A contributory negligence

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**Abstract**--This narrative review paper aims at highlighting the menopausal obesity-related health problems in women, their effects on physical and mental health, the mechanism of its development and its impact on the functionality of the female hormones. Furthermore, we also try to understand the lifestyle behaviour patterns that cause deleterious health consequences, thus disrupting the production of estrogen and increasing hyperandrogenaemia (high levels of androgens) in postmenopausal females. Also, we have addressed some healthier lifestyle alternatives and the use of hormonal substitution treatment, if applicable. Menopause is characterized by a change in the hormonal structure in women, wherein, there is a rapid decline in estrogen levels, which is a major contributor to the central abdominal fat accumulation, reduction in subcutaneous fat and increase in total adiposity. Women after menopause are thus thrice as likely as premenopausal women to develop obesity and metabolic syndrome. There is a stark difference in the way the eastern and western societies perceive menopause. For instance: a woman is more likely to gain more authority or prestige in her family in Asia, whereas, in the West a significant number of postmenopausal women- experience loneliness, self-confidence issues and inculcate depressive symptoms which eventually develop unhealthy lifestyle habits and thus contribute towards obesity.

**Keywords**---menopausal obesity, estrogen, hyperandrogenaemia, adiposity.

## **Abbreviations**

CHD - coronary heart disease  
CVD - cardio-vascular disease  
AT - Adiposity  
FFA - free fatty acid  
TNF - tumour necrosis factor  
IL - interleukin  
SHBG - sex-hormone binding globulin  
BMI - body mass index  
CNS - central nervous system  
HRT - hormonal replacement therapy

## **Introduction**

Menopause represents a stage in which a woman's body becomes nonreproductive due to the cessation of ovarian insufficiency. It has been observed that middle-aged women have reduced physical activities and a low level of healthy appetite, which enhances the possibility of obesity and cardiovascular risks. The transition in menopause consists of three stages- primary, secondary, and final. Irregularities in the menstrual cycles characterise the preliminary stage. The second stage begins with amenorrhea or skipped cycles for more than 60 days. Post menopause is succeeded by the - "perimenopause stage", wherein the women experience symptoms related to vasomotor [1]. Thus, it is imperative to introduce weight loss programs, pharmacotherapy, or surgical alternatives. However, the efficacy of these programmes is unclear during the transitional phases of menstruation. Moreover, there are limited studies that evaluate these methods on women during this phase. Although the woman's body undergoes significant changes during pregnancy, etcetera notes that postmenopausal transition affects the body most severely [2].

Several research papers have concluded that women, in general, tend to develop coronary heart disease (CHD) much later if compared to men. However, a notable increase in CHD was recorded, especially during the menopause transition amongst middle-aged women [3]. Longitudinal studies of the women transitioning through the menstrual cycles have helped understand the relationship between menstrual evolution and coronary heart diseases. These studies have spanned for 20 years, wherein changes in the endogenous sex hormones, redistribution of body fat, lipid profiles have been documented. These studies also highlighted an increased risk of CVD during the MT phases, which must be monitored [4]

## **Methodology**

A literature search for relevant literature that link menopause with obesity was done using various electronic databases, including PubMed, Google Scholar & Medline. Various search terms used were not limited to menopause, obesity, estrogen, BMI & Hyperandrogenaemia.

### BMI (Body Mass Index)

WHO has defined Quality of life (QoL) as, “individual’s perceptions of their position in life in the context of the cultural and value systems in which they live and in relation to their goals, expectations, standards and concerns”. They further defined obesity as “abnormal or excessive fat accumulation that presents a health risk. A body mass index (BMI) over 25 is considered overweight, and over 30 is obese”. The 1995 WHO Technical Report, responsible for initially creating the BMI categories, states, “the method used to establish BMI cut-off points have mainly been arbitrary. The relationship between BMI and mortality: the cut-off of 30, is based on the point of flexion in the curve” [5]. BMI (Body Mass Index), although accepted as a measurement for body obesity clinically, it is also gaining concerns regarding its validity as it does not distinguish between lean and fat mass in postmenopausal women. However, it is replaced with the x-ray absorptiometry technique, which is considered one of the most accurate methods to check adiposity (AT).

Obesity is more common and causes severe health-related issues, especially in the postmenopausal women as their body undergoes a lot of transition during those years. Significant physical changes such as a change in the body weight, height loss, the inability of the bones to absorb minerals are some of the critical transitions that one can observe in older adults (who have undergone the cycle of menstrual evolution). Nonetheless, it wouldn’t be wrong to summarize that obesity is also related to genetic factors adopted due to social, behavioural, and cultural circumstances. As per the reports, the urban and illiterate population is more likely to be impacted by the health-related diseases caused due to the series of poor lifestyle choices and reduced physical activities [6]. As per the research, apart from the standard  $BMI \geq 30 \text{ kg/m}^2$  classification of obesity, it was observed that it is, perhaps, extremely challenging for the busy clinical facilities with limited resources to develop an alternate method through which obesity in postmenopausal women could be detected. Also, the frequent usage of BMI as a basis to form clinical decisions such as - identifying patients who can undergo surgery and potential diseases in the future, etcetera. BMI (iBMI=1000/BMI,  $\text{cm/kg}^2$ ) is recommended as one of the best alternate economic resources to detect obesity in the body [7].

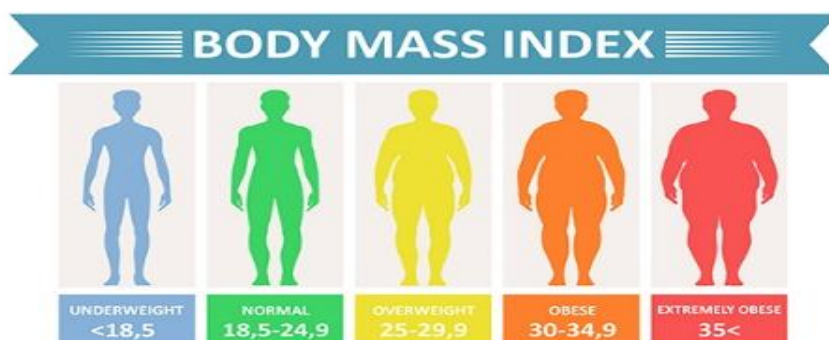


Figure 1. (Body Mass Image BMI: Image credit: cdc.gov)

### **Diseases associated with postmenopausal obesity**

Obesity is an inflammatory and prothrombotic condition, with white adipose tissues which produce fatty acids (FFA) and inflammatory adipokines, including tumour necrosis factor (TNF), interleukin (IL)-1 and IL-6. These are unhealthy atherogenesis are prone to develop the risk of cardiovascular disease and it also impacts the insulin resistance. This unhealthy atherogenesis is prone to develop the risk of cardiovascular disease, and it also impacts insulin resistance” [8]. Some menopausal symptoms are associated with joint and muscle pain and can also cause sweaty nights, poor memory, and insomnia. The marital status of the subjects and the educational qualification of their respective husbands were the only demographic factors affecting the severity of menopausal symptoms [7]. Severe health conditions such as osteoporosis, vasomotor related risks, sexual dysfunction, urinary infections, cancerous tumours and kidney diseases were predominant in the postmenopausal women due to obesity [9].

As per the stats, a total of 86.5% of the total postmenopausal women have a tendency of developing sexual disorders. Being obese reduces all the spectrums of life- physical, mental, and social. Physical activities enhanced a more healthy/favourable body composition, which subsequently lowered the adiposity and improved the quality of lean mass in the body. Inculcating physical activities as a part of our routine helps combat obesity and reduces the possibility of developing diseases such as cardiovascular disease, hypertension, cancers etc. Habits like routine walking or running on a regular basis helps in bringing down the visceral fat levels. It is suggested that a total of 10% of basal weight must be shed in approximately 6-12 months. Also, sleep cycles also appetite-regulating hormones in the body, such as -leptin and ghrelin. Therefore, the hypothesis derived from the research was that shorter sleep cycles can be held responsible for obesity as well [10]. Furthermore, stress impacts the physiological functioning of the hypothalamus and causes- secretion of the cortisol which increases weight. Thus, adding to the risk of obesity [11]. “Fat storage in women tends to occur subcutaneously, whereas fat storage in men tends to occur viscerally.” [12], [13].

#### **List of diseases (Post-menopausal obesity)**

- Heart Disease
- Type 2 Diabetes
- Hyperlipidaemia
- High Blood Pressure
- Clogged Arteries
- Non-Alcoholic Fatty Liver Disease
- Certain Cancers
- Bone Loss
- Neurological Disorders
- Sexual Arousal Disorder
- Urogenital Problems
- Kidney Related Diseases

## Android VS Gynoid Fat: Roles of estrogens in the regulation of metabolism and energy balance in women

Obesity hinders the conversion of androgens into estrogens. Furthermore, abdominal fat increases during menopause by 44% and the gynoid fat increases by 32%,” which can cause CVD related health issues and cancers [14]. Estrogens regulate the accumulation of fat in the subcutaneous (under the skin) tissue, near the gluteal (the buttock region) and femoral (thigh) region [15]. Nuclear receptors - ER $\alpha$  and ER $\beta$  that regulate the behaviour of the genes in a female body [16]. Central obesity is usually linked with the voluminous decline in the number of estrogens in a female body. They connect with nuclear receptors -ER $\alpha$  and ER $\beta$ , that regulate the behaviour of the genes in the body. On the contrary, androgens encourage the development of abdominal fat. Therefore, due to the lack of estrogen in a female body, the fat is redistributed from the gynoid to the abdominal location known as “*hyperandrogenaemia*”. Androgens are also further produced at a much larger scale if there is a lack of SHBG, primarily a sex-hormone binding globulin [17].

“As per the reports by the experts, postmenopausal women are at a 4.88-fold higher risk of abdominal obesity in comparison to premenopausal women” [8]. In android obesity, the person accumulates the fat around their abdominal region that causes an apple-like body structure. However, in gynoid obesity, the excess fat is concentrated near the hip and thigh areas which causes a pear-shaped body structure. “*Increased body weight (BMI Index) and waist circumference caused by android fat redistribution are one of the major challenges that the postmenopausal women experience under this condition*”. Pre-clinical and clinical research has concluded that ovarian hormones play a significant role in stimulating this entire fat redistribution process. The first category has average metabolic profiles regardless of the increase in body fat. As per the research, the second category developed high levels of insulin sensitivity. The third category, on the contrary, had high traces of cardiometabolic health-related issues [18].

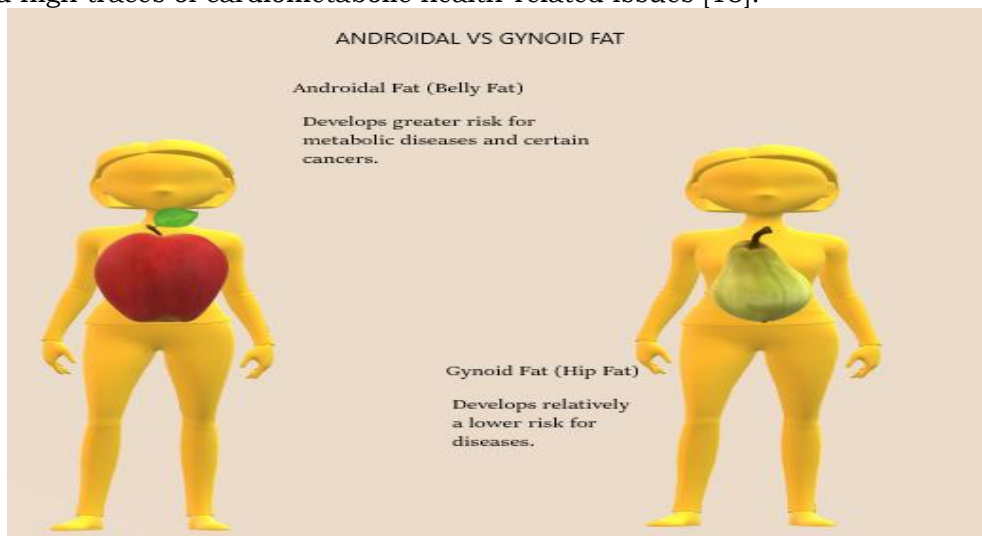


Figure 2. Android Vs Gynoid Obesity

### Effect of estrogens on our appetite

It is phenomenal to witness the pivotal role of Central Nervous System in determining the capacity of a human such as arcuate, ventromedial and paraventricular present in the hypothalamus produces an orexigenic and anorexigenic effect (stimulants that controls hunger in a person) [19]. Estrogen also reduces the level of Ghrelin or “*hunger hormone*” found in stomach and in the hypothalamus. As estrogens balance the energy in accordance with CNS - reducing the appetite. Thus, depletion or reduction of estrogens will eventually increase the appetite. Leptin and Ghrelin control the levels of hunger in a body- the former reduces the appetite, and the latter increases the level of the same. Hypothyroidism, medications and several other factors besides an unhealthy diet also play a predominant role in causing postmenopausal obesity. Furthermore, substitution therapies prevent the bloating of the body and reduce the metabolic disruptions caused due to the lack of estrogen. For instance- Hormonal Replacement Therapy (HRT) reduces obesity, decreases abdominal fat mass, lowers fasting glucose and insulin levels, and reduces cardiovascular diseases [20]. It has been noted that cardiovascular disease increases sharply after middle age in women, especially after menopause.

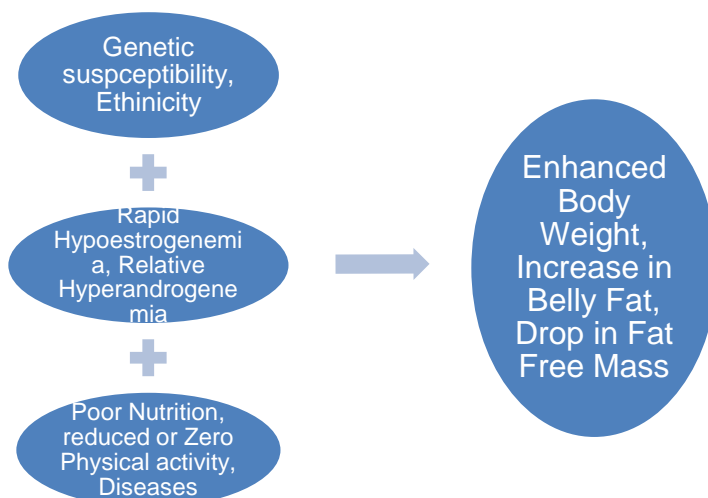
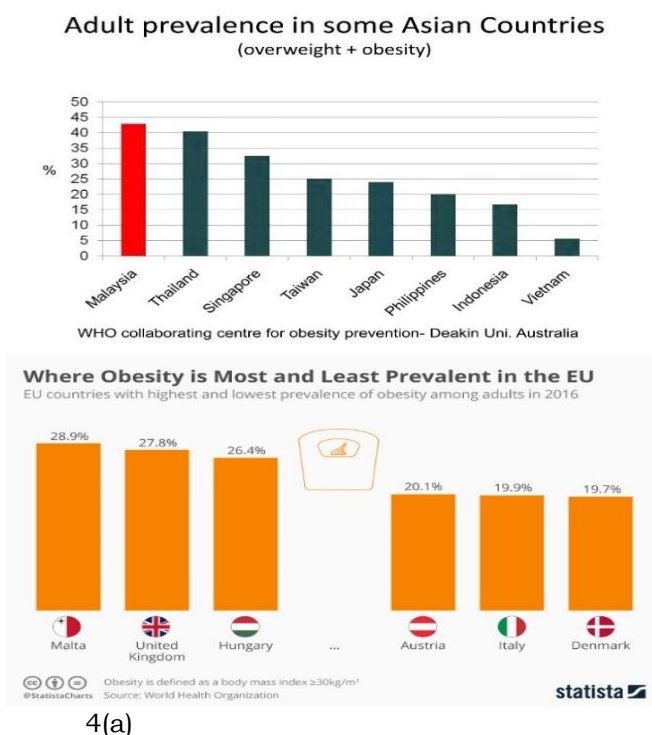


Figure 3. Factors causing menapausal obesity

As per the research conducted by some of the panel experts, it has been noted that postmenopausal transition has also affected the level of protein, and there has been a significant increase in the fat% in postmenopausal women. Sex hormones regulate the eating and energy behaviour in a human body; for instance- estrogen represses food intake, whereas progesterone and testosterone, on the contrary, may stimulate the same process [21]. Thus, it has been noticed that during the menstrual cycle, there has been a reduction in the protein and dietary fibres along with the calories. Female sex hormone- estradiol controls the food intake, and energy balance in humans is proved by the increase in postmenopausal obesity [22]. The Framingham Nutrition Study center concluded that women with a high-calorie diet intake- rich in fat and alcohol with reduced

fibre and micronutrients diet for a minimum of 12 years, developed extravagant levels of abdominal obesity and metabolic syndromes [23].

### Data collection & measurements



4(a)

4(b)

Figure 4. (Image Credit: WHO & Statista Obesity Data for Asia & Europe)

In a recent survey conducted by Informa Healthcare, 233 Iranian women (postmenopausal) were shortlisted for research. The age of the subjects varied between 45-64 years that encompassed women from a plethora of socio-economic backgrounds with diverse civic status- 2.1% of the subjects were unmarried, 74.7% were married, and 23.2% were either divorced or widowed. As per their observation, according to the BMI values, “31.5% of the women were obese, 42.2% were overweight, 25.8% were normal weight, and none were underweight”. They further added, “The types of fat distribution were android in 88% of women (Abdominal Obesity: waist-to-hip ratio 40.08), and gynoid in 11% of women (waist-to-hip ratio between 0.68 and 0.8).” in their survey report. Furthermore, the report also highlighted that “women with the android pattern of fat distribution had significantly higher scores in the vasomotor compared to the others, and those who were considered illiterate scored significantly higher on symptoms for all domains”.

A study of menopausal Indian women in Australia showed that there were variations in the severity of sexual and physical symptoms depending on marital status [24]. To conclude, obese women performed below average than their normal-weight counterparts. Moreover, when the same survey was conducted on

Spanish menopausal women, the findings were that obesity affected the sexual and physical segments [25]. The subjects with android fat (abdominal obesity) experienced a lower quality of life and struggled with everyday daily physical activities than women with non-abdominal obesity [26]. Education and unemployment also played a crucial role in encouraging the severity of menopausal symptoms. For instance, the women who were uneducated had more severe menopausal health related issues than the women who received secondary education. To summarize the illiterate women experienced much worse menopausal symptoms than their counterparts [27].

### **Prevention measures for menopausal obesity**

- **Estrogen Treatment:** Estrogens are essential to regulate female obesity. Reduction in estrogens after menopause increases total AT mass which subsequently also reduces the lean body mass. Menopause also partially reverses women's protective AT distribution. However, it is curable with the proper estrogen treatment.
- **Increasing estrogen levels decreases eating during the follicular phases in menopause** (stage when the follicles in the ovary mature from primary follicle to a fully mature Graafian follicle) and peri-ovulatory phases of the menstrual cycle [28].
- **Progesterin Levels:** When we eat during the second half of our menstrual cycle, causes binge eating due to negative emotional states caused in this stage. Pre-clinical research indicates that estrogens satiate cholecystokinin, which reduces the eating capacity in a person [29].
- **Reduce Sweet Foods:**  $\alpha$ -melanocyte-stimulates the hormone-melanocortin receptor (melanocortin 4 receptor, MC4R) in the brain, which leads to overeating and obesity. "Fluctuations in ovarian hormones affect eating by influencing striatal dopaminergic processing of flavour hedonics and lateral prefrontal cortex processing of cognitive inhibitory controls of eating" [30].
- **Monitor Your Diet** It is imperative to monitor the calorie intake on a regular basis during the menopausal stage. Various studies that have experimented with diets in people concluded that a diet up to 600 kcal or a low-fat and calorie diet (800-1600 kcal/day) is ideal for weight reduction and reducing cardiovascular risk factors [31].
- **Hormone replacement therapy (HRT):** For postmenopausal women (non-diabetic), estrogen replacement orally or trans dermally (ingredients are injected in the skin for systemic distribution) reduces- visceral fat, improves insulin resistance, decreases blood pressure [28].
- **Pharmacotherapy: Bariatric Surgery,** also known as weight loss surgery, is one of the most recommended resolutions to get rid of morbid obesity (BMI higher than 35. BMI), which also improves the cardiometabolic risks in an individual [32].



Figure 5. Preventive measures for menopausal obesity

## Conclusion

The contemporary generation, dominated by unprecedented events, “obesity” seems to be at a center stage. A world that is dictated by technology is now facing one of the biggest health crisis. Lack of physical day to day activities, degraded quality of life and environment are some of the key components that are fuelling the pandemic- “obesity”. Along with the socio-cultural factors, one must minutely analyse the genetic conditions to monitor the characteristics that might add to obesity. Central adiposity is more prevalent in women who are in the second phase of their lives (postmenopausal obesity). Depletion of estrogen amidst the menopause transition and its pivotal role regarding fat redistribution has resulted in increasing central adiposity. Thus, a rapid alteration in our way of life by adopting a healthier lifestyle - including active physical routine and monitoring calorie intakes by the people on a regular basis.

Furthermore, it has been observed that there were differences in how menopausal obesity affects women on a global scale; for instance: in some geographic location (such as Spain), obesity had no effect on the health quality in postmenopausal women, however, it did influence their physical life. There needs to be a larger emphasis on promoting physical activities in the routine life of women so that obesity can be combated (postmenopausal), and adequate initiatives should be taken to ensure further research on the development of resources that can ease the detection of a higher BMI in women at cost-effective pricing. Health issues in postmenopausal women are quite common amongst elderly women. One of the most interesting analysis was that of the association of breastfeeding with obesity in women. Breastfeeding reduced the risk of diabetes and controlled obesity by 13% amongst women [33].

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