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The Correlation of Anthropometric, the Estradiol Level and Obesity in Perimenopausal and Menopausal Saudi Women

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Abstract: In this study we assess the age-specific variation anthropometric measurements, the estradiol hormone, and Body Mass Index variation levels among perimenopausal and menopausal Saudi women. We conducted this study on 41 healthy women aged 40 to 75 and divided them into two groups. The group included 25 perimenopausal women (<50 Years), and 16 menopausal women (>50 Years) were examined. Demographic data were recorded, and blood serum samples were drawn in plain and in A serum separator tube was used to estimate estrogens in the serum. We found a significant difference between WHR in perimenopausal women (<50 Years) and menopausal women (>50 Years) subjects (mean ± SD WHR: 0.9040 ±0.0351 vs.0.8688 ±0.0602, p=0.0181). There was also a significant difference in circulating E2 level, where the osteoporotic patients had a lower circulating E2 than non-menopausal women (>50 Years) (mean ± SD E2: 81.6000 ± 54.7456 vs. 48.5000 ± 20.0300 pg/mL, p=0.0002). Our conclusion showed women with the highest levels of estradiol hormones had the highest WHRs, while women with low estradiol showed the lowest WHRs. However, we need more studies involving Saudi women with a larger sample population and different geographic locations are recommended to have more complete data on menopausal women.

Keywords: Anthropometric, BMI, Menopause, Perimenopause, Estradiol, WHR

1. Introduction

Menopause significantly affects the reproductive health and aging of women, as well as the distribution and storage of fat [1]. Menstruation completely stops with menopause since there is no longer any ovarian follicular activity [2]. Moreover, Around the last few years of a woman's reproductive life comes the ill-defined period known as perimenopause. The final menstrual period is defined as the time between the initial occurrence of monthly irregularity and the end of amenorrhea after one year [3]. Consequently, at this stage, the ability to reproduce ends and the aging process begins. Women experience diminished physical well-being and several menopausal symptoms like psychological, physical, sexual, and vasomotor problems during menopause as a result of the decline in estrogen hormone [4]. Importantly, body fat distribution and adipocyte differentiation are significantly influenced by sex hormones. However, the role of estrogens in the emergence of metabolic illnesses during menopause is debatable. Estrogens and testosterone have differing effects on adipocyte physiology. The metabolism of glucose and lipids is regulated by estrogens and estrogen receptors in several ways. The metabolic syndrome and increased cardiovascular risk in women were brought on by disturbances of this metabolic signal [5]. Additionally, according to the World Health Organization (WHO), there are 1 billion overweight adults globally, of whom 300 million are obese. Obesity is a relatively widespread public health issue [6]. It has been shown that women's fat mass increases as they age, although it is still unclear how much menopausal status affects these changes [1]. Previous studies revealed a six-year follow-up of middle-aged women who transitioned to post menopause showed a higher rise in fat mass, a greater increase in the waist-to-hip ratio, and a greater loss of fat-free mass [7]. In addition, body mass index (BMI), abdominal obesity, or fat distribution affect menopausal women's quality of life [8]. Furthermore, several studies have focused on the correlation between body mass index (BMI) and perimenopausal symptoms. A study found that women aged 40–44 years with

a high BMI tend to have a higher incidence of hot flashes [9].

The objectives of the present investigation are to assess the age-specific variation anthropometric measurements, the estradiol hormone, and Body Mass Index variation levels among perimenopausal and menopausal Saudi women.

2. Materials and Methods

2.1. Subjects

In this cross-sectional study, we compiled subjects of 41 healthy women aged from 35 to 75 and divided them into two groups. The group included 25 perimenopausal women (<50 Years), and 16 menopausal women (>50 Years) were enrolled. Inclusion criteria for the menopausal women were: (1) natural menopausal status, (2) intact uterus and ovaries, and (3) last menstrual period 1 year ago. Information on health status was obtained from medical history. Exclusion criteria were: (1) hormone replacement therapy; (2) neuromuscular or neurophysiologic diseases; (4) hysterectomy; and (5) currently menstruating. All subjects were written an informed consent form prior to study enrollment after consent forms were obtained from the Department of Endocrinology and Diabetes in King Fahad Medical City in Riyadh (IRB#10-026).

2.2. Anthropometric Measurements

BMI was calculated as the weight in kilograms divided by the square of the height in meters. Weight and height were measured by one of the investigators, with the participant wearing light clothing and no footwear. In addition to the waist and hip circumference to calculate the waist-hip ratio (WHR) which was measured with an anthropometric tape placed directly on the narrowest point between the lower rib margin and the iliac crest, in a plane perpendicular to the long axis of the body. The measurement around the hips at the level of the buttocks was used in clothing. All measurements were made while the subjects stood balanced on both feet approximately 20 cm apart, and with both arms hanging freely at their sides.

2.3. Measurement of the Estradiol Level

A serum separator tube was used to calculate circulating residual estradiol (E2) levels assayed using BioSource Enzyme Amplified Sensitivity Immunoassay E2-EASIA (Thermo Fisher Scientific, Waltham, MA, USA), which is a competitive binding immunoassay for quantitative determination of estradiol in the serum and plasma. The capacity of KAP0621 is 96 tests (BioSource Europe S. A. Cat. No. 103305/A).

2.4. Statistical Analysis

Using SPSS version 20, the mean, standard deviation, and standard error of the mean were calculated for each parameter in the different groups. Continuous variables between groups were compared by independent t-tests or analyses of covariance as appropriate. Categorical variables were compared by the chi-square test [10].

3. Results

Anthropometric and hormonal parameters were obtained for each group as shown in Table 1. The results were compared using the t-test, and the characteristics of perimenopausal women (<50 Years) and menopausal women (>50 Years) subjects were compared. Our results showed a significant difference between WHR in perimenopausal women (<50 Years) and menopausal women (>50 Years) subjects (mean ± SD WHR: 0.9040 ±0.0351 vs.0.8688 ±0.0602, p=0.0181). There was also a significant difference in circulating E2 level, where the osteoporotic patients had a lower circulating E2 than non-menopausal women (>50 Years) (mean ± SD E2: 81.6000 ± 54.7456 vs. 48.5000 ± 20.0300 pg/mL, p=0.0002).

Table 1. *Anthropometric and hormonal parameters of perimenopausal women (<50 Years) and menopausal women (>50 Years).*

Variable	Perimenopausal women (<50 yr) (n=25) (Mean± SD)	Menopausal women (>50 yr) (n=16) (Mean± SD)	*p value*
BMI (kg/m2)	33.0000 ± 6.4807	29.5625 ± 4.4567	0.1356
Waist	97.8000 ±9.0012	91.7500 ±12.5406	0.1426
Hip	103.0 ±10.0296	98.6563 ±11.5018	0.5339
WHR	0.9040 ±0.0351	0.8688 ±0.0602	0.0181
E2 Level (pg/mL)	81.6000 ± 54.7456	48.5000 ± 20.0300	0.0002

SD = Standard Deviation, Signification value=$p \leq 0.05$, yr=year, BMI=Body Mass Index, E2=17β-estradiol, pictograms per milliliter

4. Discussion

Women who have undergone menopausal symptoms, as well as the associated adiposity and morbidity, are critical in terms of menopausal health. Additionally, health conditions associated with various socioeconomic, cultural, physiological, and psychological factors that also affect age at menopause, really should be considered [11]. The BMI, waist, hip, and hence the calculation of WHR is the most used anthropometric measure to ascertain the level of adiposity and nutritional status in epidemiological and clinical studies [12]. Furthermore, the adiposity indices such as BMI and WHR are measured for central and/or visceral/regional adiposity assessment, which are a major determinant of several non-communicable diseases include of cardiovascular risk of hypertension, diabetes mellitus, metabolic syndrome, and breast cancer [13]. Singh et al study has shown that 78% (WHR≥0.80) of the post-menopausal women were found to have high risks of excess adiposity.

Whereas our study has been comparing the peri menopausal and menopausal women showed a significant difference between them (mean ± SD WHR: 0.9040 ±0.0351 vs.0.8688 ±0.0602, p=0.0181). Subsequently, there is an urgent need to create awareness related to excess adiposity, obesity as highly risk factor for several co-morbidities related to adiposity among menopausal women.

According to the estradiol levels investigated, the rate of estradiol decline occurred late in the menopausal transition stage, especially in the 1-2 years before the last menstrual period [14]. Additionally, research using daily urine samples indicated that average estrogen secretion may initially be higher with short cycle intervals but start to fall towards the late menopausal transition [15]. Overall, no cutpoint has been found to predict the timing of the menopausal transition or final menstrual period. However, significant intra- and inter-individual variability in serum estradiol was seen during the menopausal transition [16]. Our measurements of estradiol in both subjects' groups were consistent with those reported results (mean ± SD E2: 81.6000 ± 54.7456 vs. 48.5000 ± 20.0300 pg/mL, p=0.0002).

5. Conclusion

Fat distribution and estradiol hormone level are important factors in determining the health status of perimenopausal and menopausal women since it's considered associated with the severity of menopausal symptoms. our study has revealed that women with the highest levels of estradiol hormones had the highest WHRs, while women with low estradiol showed the lowest WHRs. However, we need more studies involving Saudi women with a larger sample population and different geographic locations are recommended to have more complete data on menopausal women.

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