Jundishapur Journal Chronic Disease Care
Quarterly Journal of Ahvaz Faculty of Nursing and Midwifery

Relationship of reproductive period and menopause age with body composition: A study in non-obese postmenopausal women

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Abstract

Introduction: Changes in body composition after menopause are including; decreased muscle mass, increased fat mass and central obesity with central fat accumulation ,which can increase the risk of cardiovascular diseases and metabolic syndrome. Body composition and its changes in postmenopausal women associate with osteoporosis and metabolic syndrome. Metabolic syndrome is the key factor for cardiovascular disease that is become a major health problem in many countries .We performed this study to recognize the relationship of reproductive period and menopause age with body composition among non-obese post menopausal women.

Materials & Methods: In this cross sectional research, we selected 140 healthy non-obese postmenopausal women who had a BMI less than30 Kg/m2, in 2010 in Iran. Data were obtained through interview that included demographic information (age, age at menarche, age at menopause, date of last menstrual period, parity), measured height and weight, skin folds (tricepse, superiliac, thigh), BMI and WHR. We used the Pearson correlation and multiple regression analysis by SPSS 15 software for statistical purposes.

Results: In this study a significant correlation was found between reproductive period and fat mass (r=0.22, p=0. 007) and weight (r=0.16, p=0. 04). A significant relationship was observed between menopausal age and fat mass (r=0.26, p=0. 002) weight (r=0.24, p=0. 004) and BMI(r=0.19, p=0.02), but menopausal age with WHR and fat-free mass was not significantly associated.

Conclusion: The increasing of reproductive period and menopausal age is associated with increased body weight and fat mass and increasing of menopausal age is associated with higher BMI.

Keywords: Reproductive period, Menopausal age, Body composition.

Introduction

Postmenopausal change in body composition is associated with increased risk of osteoporosis and metabolic syndrome. Decrease in endogenous estrogen levels could decrease bone mass and results in increase of osteoporosis profile. Menopause, cessation of menstrual function and end of female reproductive capacity, is associated with many undesirable changes in body weight and composition, in which body weight increases mainly due to increased adipose tissue, while body non-fat mass decreases with aging (2). Review of major health issues in postmenopausal women is important and besides the general health-related topics, nowadays the focus is on cardiovascular diseases and osteoporosis (3). Reproductive period includes the years between the onsets of menstruation (menarche) to the last menstrual period (menopause), which is important for reproduction. Body composition is the ratio of body weight composed of adipose tissue

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Received: 6April 2012 Accepted: 15Jul 2012

and its relationship with the rest of the body composed of non-fat tissue. Measuring of body composition can distinguish overweight from high fat. High fat tissue is associated with known risk factors for heart disease, diabetes, cancer, and other health problems (4). Anthropometric parameters including body mass index (BMI), waist-hip ratio (WHR), waist circumference (WC), skinfolds (SKFS), and skeletal diameters are used to evaluate the total and peripheral composition of the body (4). Significant changes occur in body mass composition by aging which is associated with fat mass (FM) increment and fat-free mass (FFM) reduction. Indeed, measuring skinfolds is a common method for evaluating body composition (4).

Information of the human body composition is obtained based on chemical analysis of body organs, including fat, total body water, minerals (bone and soft tissue) and protein. Several theoretical models exist for describing the body composition including the two component model that describes the body as fat and fat-free components, while multi-component models divide the body into three or more components(4).

Many changes occur in the body composition with aging that can affect the overall health of older people. FM increases along with age increment and consequently more fat is stored in the internal viscera which in turn augment the risk of central obesity associated diseases. Reduced FFM which is primarily due to loss of skeletal muscle mass and bone mineral result in muscle strength changes and disability and weaknesses of older populations (4). Change in water, minerals, and protein compounds in body fat-free mass with aging affects the density of fat-free mass in older people. In 25-65 years old population, a major reduction of 10-16% in body fat mass occurs due to decrease in bone mass (osteopenia) and skeletal muscle mass (sarcopenia) with aging. In addition, with aging, fat stores of the body are transferred from the peripheral sources to abdominal storage. Higher proportion of postmenopausal women show male obesity compared with premenopausal women (5). Other factors to consider can include metabolic changes in postmenopausal women which are normally associated with reduced energy expenditure during rest and activity. Accelerated loss of fat-free mass occurs following physical activity reduction and slow life (6). Netjasov et al studied 87 menopausal women. The aim of study was investigation the relationships between anthropometric characteristics, sex hormones, lipids and fasting glucose in menopausal women. significant positive correlations were found between BMI and glucose, WC and glucose and WHR with triglyceride. Gaining weight and decreased SHBG are related to dyslipidemia and increased fasting glucose confirming increased incidence of metabolic abnormalities in the menopause(7). But they didn’t study the relationships between menopausal age and body composition components (WHR, BMI, weight, WC), Thus, regarding the changes associated with menopause which is associated with muscle mass decrease and fat mass increase along with central fat accumulation and abdominal obesity can result in cardiovascular disease, osteoporosis and metabolic syndrome. The

aim of this study was to identify the relationship of reproductive period and menopause age with body composition among non-obese post menopausal women.

Materials and Methods

This cross-sectional study was conducted in 2010 in health center number 6 and a private office in Ahvaz, Iran. It lasted 6 month .The study population consisted of 140 non-obese postmenopausal women whose their BMI was less than 30 kg/m^2, one year has passed from their last menstrual period, and their menopause was normal (not surgery-induced)... The women who had previous disease of liver or renal, thyroid dysfunction, immobility , myocardial infarction, acute or chronic inflammatory disease, vaginal bleeding or were under medication for hyperlipidemia or hypetension were excluded from the study.

After selecting the qualified individuals, their written consent were obtained, and then a demographic questionnaire including age, menarche age, and menopause age was completed(table1), and the height, weight, WHR, BMI, and skinfolds were measured and recorded.

The height and weight were measured by an nonelastic meter and the Laica scale number 0434, and then the BMI was calculated through weight per kg devided to square of height per meter.

Waist and hip circumferences were measured by nonelastic meter at the slimmest part of the waist and at the largest part of the hip, respectively.. WC is the measure of waist in meters in its slimmest part between the last rib and iliac crest. WHR was calculated for waist circumference divided by hip circumference.

Most methods used for estimating body fat mass and fat-free mass include bioelectrical impedance analysis, skinfold measurements, and anthropometric measurements such as height, weight, and circumferences (like waist or arm circumference) (8).

Skinfolds was measured by a caliper on standing at 3 points; triceps at midaxillary line between acromion process and elbow (the right hand in right-handed and the left hand in left-handed individuals), suprailiac at iliac crest and front thigh in the middle of the groin and knee. Measurements were performed twice and the averages were calculated.

To calculate the body density, the Jackson formula was used.

The sum of skinfolds measured in three points and their squares, as well as the person's age, were put in the formula and the body density was calculated in gram.

To determine fat mass the Brozek formula was used and the obtained result was multiplied in weight in kg and fat mass was calculated in kg. The difference between body weight and fat mass shows the fat-free mass.

Jakson et al (1978) formula:

$$DB(g/cc) = 1.0994921 - 0.0009929(\sum 3SKF) + 0.0000023(\sum 3SKF)^2 - 0.0001392(Age)$$

$$\sum 3SKF = Triceps + \sup erailiac + Thigh$$

Brozek(1963)formula:

$$BF\% = (\frac{4.57}{Db} - 4.142) \times 100$$

FM (kg) = BF × weight (kg)

Body Fat=BF

FFM (kg) = weight (kg) – FM (kg)

The obtained data were analyzed by SPSS-15 and using Pearson correlation

coefficient test and multiple Regression model with 95% confidence and an error of 0.05

Results

Table 1 shows the frequency of demographic indices.

In this study, the mean of reproductive period and menopause age were 36.15 ± 3.5 and 49.49 ± 3.3 years, respectively. Reproductive period showed a positive significant correlation with fat mass (r=0.22, p=0.007) and weight (r=0.16, p=0.04) so that increase of reproductive period was associated with increment of fat mass and weight. However there was no significant correlation between other variables of body composition and reproductive period (Table2).

There was a significant relationship between menopause age and BMI (r=0.19, p=0.02), between menopause age and weight (r=0.24, p=0.004) and also late menopause was correlated to fat mass, weight, and BMI. But no significant relationship was found between menopause age and other components of body composition (Table3).

Table1: Frequency of demographic indices

Demographic Indices	Frequency	Frequency Percentage
Education		
primary	108	77.14
Guidance	16	11.42
High school	10	7.14
Collegiate	6	4.2
Job		
Housekeeper	125	89.28
Employed	15	10.71
Economical state		
low	112	80
Middle-class	24	17.14
high	4	2.85
Parity		
0-1	7	5
2-4	59	42.1
5-7	37	26.4
8-10	24	17.1
10>	12	9.3
BMI		
20< BMI	4	2.8
20-25= BMI	24	17
BMI=25-30	112	79.4

Table2: Pearson correlation between body composition and reproductive period

Body Composition Variables	p-Value	Pearson Correlation
WHR	0.55	0.05
BMI	0.08	0.14
FM	0.007	0.22
FFM	0.71	0.03
BW	0.04	0.16

Table3: Pearson correlation between body composition and menopausal age

Body Composition Variables	p-Value	Pearson Correlation
WHR	0.41	0.07
BMI	0.02	0.19
FM	0.002	0.26
FFM	0.14	0.12
BW	0.004	0.24

Discussion

The results of this study showed that there was a positive significant association between reproductive period and fat mass and body weight in postmenopausal women. Long reproductive period in women is associated with higher weight and fat mass. Late menopause and greater menopause age which in turn cause long reproductive period had a positive relationship with body weight, fat mass and BMI in postmenopausal women. Feng studied the correlation of menarche age, reproduction years and postmenopausal years with body composition and metabolic risk factors. They found a significant association between menarche age, reproduction years, menopausal status and postmenopausal years, body composition and metabolic risk for cardiovascular disease. In general, early menarche onset and long years of reproductive period are associated with adverse vascular changes and metabolic risk factors. The number of reproductive years is associated with increase in body fat and reduction of HDL-cholesterol. In our study like the Feng et al study significant relationship was found between reproductive period and menopause age with body fat mass, so that increased menopause age and prolonged reproductive period are associated with body increase in fat mass (9).

Koskova et al. studied 213 women of 20-65 years old including healthy, at menopause (48-54 years old) and menopause (55-65 years old). Fat mass and its percentage increment in early menopause and decrease in fat-free component were

seen(1). We performed our study only on postmenopausal women and found an association between late menopause and fat mass increase, but no association was found with fat-free mass .

Different studies such as Kirchengest et al. found that overweight is associated with menopause age and reported late menopause onset in obese women (10). In our study we found a positive correlation between menopause age and body weight, FM, and BMI which means body weight, FM, and BMI increase along with menopause age increment. It also can be said that menopause occurs later in persons with high weight, BMI, and FM.

Ito et al. studied the association between body composition with age on 2411 healthy Japanese male and female. They found that the obesity-related variables such as BMI, WC, hip circumference, WHR, total and local fat mass, FM percent, the ratio of trunk to leg FM in men was like a curve with its peak in 40s and 50s while in women it was ascending linear which increases in older women (augments in women with aging) (11) In the present study menopause age had a positive association with FM and BMI which is inconsistent with the above study about women. Lee et al studied 178 Japanese overweight women with BMI higher than 24 and average age of 48 years (20-69). Premenopausal women had significantly higher total and peripheral bone mineral density(BMD) compared to postmenopausal women. No significant difference was seen in BMI, FM, and FM percentage between postmenopausal and premenopausal women. Total and peripheral BMD to FM had a strong negative relationship with menopause in overweight women. We did not study the mineral density directly and have divided the body into FM and FFM components and we found a positive significant association between FM and menopause age while we could not find a significant relationship between FFM and menopause age (12).

Ley studied the relationship between menopause age and body composition and regional distribution of fat and found that men had 50% more fat-free mass and 13% less fat mass compared to women and that postmenopausal women had 20% more fat mass compared to premenopausal women. The ratio of upper trunk fat (android) was more in men but it was significantly lower in postmenopausal women while this was opposite about lower trunk fat (gynoid). The researchers concluded that; BMI cannot be used to show that men have less total fat than women, while postmenopausal women have more total fat than premenopausal women (13). This study showed increased fat mass in postmenopausal women and in our study fat mass increment was observed in women with late menopause. However, a comparison was not performed between the fat mass in premenopausal and postmenopausal women.

Limitations of study were low level of education, social and cultural issues cause reluctance and fear in people. Problems of access to laboratory facilities. The study lasted 6 months.

Conclusion

Increasing of reproductive period and menopause age is associated with increased body weight and fat mass. Increasing of

menopause age was also associated with high BMI. Regarding the results of this study, women with late menopause and long reproductive period are prone to weight gain, high BMI, and increased fat mass which are known risk factors for cardiovascular disease, diabetes, cancer, and other health problems. Therefore recommendations and trainings should be considered for diet control, weight control, regular and appropriate physical activity as preventive strategies.

Acknowledgments

Hereby, I give my deep gratitude to the respectful professors in Tarbiat Modarres University who helped me to provide this article.

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