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Original Research Article

Evaluation and Comparison of Common Biochemical Markers in Pre-Menopausal and Post-Menopausal Women from Khammam District

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Abstract

Menopause is an endocrinological transition that greatly affects health and disease susceptibility in middle-aged and elderly women. To gain new insights into the metabolic process of menopause, plasma metabolic profiles in 60 pre- and post-menopausal women were systematically analysed by biochemical methods in conjunction with univariate and multivariate statistical analysis. Biochemical markers signatures revealed considerable differences between pre- and post-menopausal women, and clear separations were observed. In total, five metabolites were identified as potential biochemical markers for menopause, including serum calcium, phosphorus, vitamin D, serum alkaline phosphatase and osteocalcin. These differences highlight those significant alterations occur in serum metabolism, biochemical reactions, hormone imbalance in post-menopausal women. In conclusion, our plasma biochemical study provides novel understanding of the metabolic profiles related to menopause, and will be useful for investigating menopause-related diseases and assessing metabolomic confounding factors.

Keywords: Calcium, Phosphorus, Serum alkaline phosphatase and Osteocalcin.

INTRODUCTION

The life of a human female is characterized from teenage years by monthly menstruation which ceases (the menopause) typically between the age of 40 and 60 years. The potential for reproduction declines and ceases as the ovaries become depleted of follicles [1]. A transition period in mid-life, for 2 to 10 years, when menstruation is less regular is called the perimenopause. The menopause is associated with a significant decline in plasma concentrations of sex hormones, an increase in the concentrations of the gonadotrophins and changes in other hormones such as the inhibins [2].

These changes are superimposed with effects of aging, social and metabolic factors, daily activity and well-being. Although the menopause is entirely natural, in some cases ovarian failure can occur earlier than usual; this is pathological and warrants careful biochemical investigations to distinguish it from conditions causing infertility. Elderly females are affected by a range of clinical disorders including endocrine, cardiovascular, skeletal, urogenital tract and immunological systems, body mass, vasomotor tone, mood and sleep pattern. Reference intervals for many diagnostic biochemical tests for the menopause need to be used when interpreting results in clinical investigations for patient management [1-3].

Some of the biochemical changes at the menopause are attributed to oestrogen and or progesterone depletion. Oestrogens are important in maintenance of lipid and glucose homeostasis. They regulate food intake and energy expenditure by action on the CNS. Oestrogens also act to promote synthesis of proteins that maintain peripheral energy homeostasis. Progesterone leads to gene transcription of proteins that regulate functions of the uterus, ovary, mammary gland and brain [4].

The menopause has significant effects on the functions of endocrine, cardiovascular, skeletal, immune and genitourinary systems. Gonadal hormones

affect many of the processes largely by their effects on steroid-binding proteins and receptors, but the changes in lifestyle with aging are also contributory. During the life of a human female, there are many changes in ovarian function starting before birth. The reproductive system ages faster than other organs [4, 5].

The Present study was designed to evaluate significance of biochemical markers in evaluation of post-menopausal complications such as relationship between serum osteocalcin and bone mineral density in post-menopausal females.

MATERIALS AND METHODS

Subjects: A total number of 60 women participants were recruited for this study. They were divided randomly in two groups as pre-menopausal group and post-menopausal group. Selection of participants were carried out from the outpatient department and wards of Department of Obstetrics and Gynaecology of Mamata general and super speciality hospital, Khammam, Telangana.

A detailed history and physical examination were carried out for every subject who entered in the study as per a pre-designed proforma. Examination comprised of a through physical examination assessment of vital parameters, anthropometry and systemic examination.

A total of 3 ml of blood sample (random) was collected. Serum is separated immediately by centrifuging for 10 minutes and analysed for total calcium, ionised calcium, phosphorus, albumin, alkaline phosphatase. All the biochemical and haematological Investigations were carried out by using the standard laboratory protocols.

STATISTICAL ANALYSIS

Data analysis was done by using SPSS Package version. Simple proportions, mean, standard deviation and Chi-square test was used. Chi-square test was used to find out the association between two groups. P value of less than 0.05 is considered as statistically significant.

RESULTS

The average age of the 60 women was 48.7 ± 12.6 years. The premenopausal women (n = 30) presented 40.35±5.83 years and the postmenopausal women (n = 30), 50.98±4.08 years. The mean value of Waist-Hip Ratio (WHR) was higher than 89 cm (value indicating metabolic risk) in all groups, reaching 76% of premenopausal women and 81% of postmenopausal women and.

Table-1: Demographic and anthropometric characteristics of Pre-Menopausal and Post-Menopausal Women

Variables	Pre-Menopausal Women	Post-Menopausal Women	*p* value
Age (years)	40.35±5.83	50.98±4.08	NS
BMI (kg/m^2)	25.29±3.79	28.19±4.46	NS
WHR	0.87 ± 0.09	0.92 ± 0.06	0.001
Body Adiposity Index (BAI)	35.48 ± 3.45	37.70 ± 5.05	0.001
Age at menarche (years)	12.4 ± 1.4	12.6 ± 1.7	0.01
Number of pregnancies	1.6 ± 1.4	5 ± 3.5	0.05
Breast feeding duration (months)	10.5 ± 12	35.9 ± 47	NS
Age at menopause (years)	-	47.3 ± 5.7	-

The groups were statistically significant in terms of BMI, WHR, BAI, age at menarche and number of pregnancies. Both before and after adjustment for covariate.

Table-2: Comparative analysis of common biochemical markers in Pre-Menopausal and Post-Menopausal Women groups

Variables	Pre-Menopausal Women	Post-Menopausal Women	*p* value
BMI (kg/m2)	35.48 ± 3.45	37.70 ± 5.05	0.001
Serum Calcium (mg/dl)	9.38±0.43	8.52±0.54	0.001
Ionized Calcium (mmol/l)	1.03±0.24	1.04±0.53	NS
Inorganic Phosphorus (mg/dl)	34.08 ± 4.16	36.4 ± 5.3	0.05
25 OH Vitamin D	27.86±3.73	20.58±1.98	NS

The groups were statistically significant in terms of BMI, Serum calcium and Inorganic phosphorus. Both before and after adjustment for covariate. Inorganic Phosphorus levels were significantly higher, whereas serum calcium, and vitamin D were decreasing among post-menopausal women.

Table-3: Comparative analysis of serum parameters in Pre-Menopausal and Post-Menopausal Women groups

Variables	Pre-Menopausal Women	Post-Menopausal Women	*p* value
Serum Creatinine (mg/dl)	0.95 ± 0.16	1.14 ± 0.19	0.05
Serum Osteocalcin (ng/ml)	17.08 ± 7.8	18.16 ± 8.46	0.001
Serum Alkaline Phosphatase (U/L)	81.2 ± 18.22	114.62 ± 33.45	NS
Serum Albumin (g/dl)	3.67 ± 0.32	3.74±0.25	0.05

The groups were statistically significant in terms of serum creatinine, serum osteocalcin and serum albumin. Both before and after adjustment for covariate. Serum osteocalcin level and serum alkaline phosphatase level was found to be significantly higher ins post-menopausal women.

Table-4: Pearson correlation of BMI with selected variables.

Variables	Age	BMI	Serum Calcium	25 OH Vitamin D	Serum Osteocalcin	Serum Alkaline Phosphatase
BMI Pearson Correlation	-0.03	1	-0.02	0.02	0.12	0.37
Sig. (2- tailed)	0.76	-	0.80	0.03	0.20	0.00

Statistical analysis using Pearson correlation shows a significant negative correlation between BMI and age, calcium level. There is a significant positive correlation between BMI and BMI, Vitamin D, Osteocalcin, which were statistically significant.

DISCUSSION

Women spend more than one third of their lives in the postmenopausal state owing to increased longevity, necessitating a clearer understanding of the impact of menopause on body systems, a critical aspect in targeting effective preventive measures [6]. The pathophysiology of four key health problems associated with menopause, namely, changes in body composition, cardiovascular disease, vasomotor symptoms and osteoporosis [7].

In this study, we found BMI, Inorganic Phosphorus and ALP were significantly higher in post-menopausal women than pre-menopausal women, while Calcium and Vitamin D were significantly lower in post-menopausal women. Converse to our study, previous studies found that serum calcium level of post-menopausal participants was significantly higher than pre-menopausal women [8-10]. Differences might be attributable to sampling and measurement variation and whether post-menopausal women were receiving the supplementary therapy of vitamin D and calcium.

Bone specific alkaline phosphatase (ALP) is known to be sensitive marker for bone turnover and also in postmenopausal osteoporosis. Total serum ALP pool is composed of different dimeric isoforms which originate from various tissues like liver, bone, intestine, spleen, kidney and placenta of which approximately 50% of total serum ALP is derived from liver in the adults with normal liver function and 50% arises from bone [7, 8, 9]. In our study, Serum osteocalcin level and serum alkaline phosphatase level was found to be significantly higher ins post-menopausal women.

Vitamin D is another critical factor modulating bone growth and turnover. Vitamin D deficiency and related diseases are prevalent in post-menopausal women [10]. Normally vitamin D is responsible for maintaining a proper calcium level mainly by promoting the intestinal calcium absorption. Several studies reported that reduced vitamin D level in post-menopausal women [11-13]. Reduced vitamin D in post-menopausal women is known to be influenced by age related decrease in the cutaneous synthesis of vitamin D, decline renal production of the hormone calcitriol, poor intestinal sensitivity to vitamin D absorption, inadequate sun exposure and hyperparathyroidism increases the bone resorption and accelerates the bone loss [14]. Similar type of trend we could find in this study, serum calcium, and vitamin D levels were decreased among post-menopausal women.

Our study revealed that body mass index, inorganic phosphorus and alkaline phosphatase positively correlated with year since menopause while calcium and vitamin D were negatively correlated suggesting for a medical supervision of hormonal changes and periodic dosing of calcium and vitamin D among post-menopausal women to reduce the problem of bone health.

CONCLUSIONS

Menopause has significant effects on a number of organ systems including the cardiovascular, skeletal, and endocrinological and central nervous systems. These effects could induce a series of physiological and potential pathological changes. Establishing menopause-related biochemical and metabolic signatures will facilitate our understanding of these influences, and have important biological implications. In this study, selected biochemical markers profiling was performed to investigate metabolic signatures associated with menopause. These findings increase the current understanding of menopause-induced biochemical and metabolic changes, and will be useful for investigating diseases associated with menopause.

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