

The Status of Trace Elements after Menopause: A Comparative Study

NAVEENTA GUPTA, KHUSHDEEP SINGH ARORA

ABSTRACT

Aim: The aim of this study was to determine the status of trace elements in postmenopausal females as compared to that in premenopausal females.

Methods: 100 female subjects were studied, of which 50 were premenopausal (aged 30-40 years) and 50 were postmenopausal (aged 45-55 years, with a permanent cessation of menstruation for more than 1 year). The estimation of the serum levels of zinc (Zn), iron (Fe), copper (Cu), magnesium (Mg) and calcium (Ca) were done in both the groups.

Results: On comparative evaluation, the serum Fe ($p < 0.05$) and the serum Ca ($p < 0.001$) levels were found to be significantly increased,

while the serum Cu ($p < 0.05$) and the serum Mg ($p < 0.05$) levels were found to be significantly decreased in the postmenopausal females as compared to the levels in the premenopausal females. However, there was no significant difference in the levels of serum Zn in both the groups ($p > 0.05$).

Conclusion: Postmenopausal females are exposed to greater risk of serum biochemical changes as compared to the premenopausal females, thus leading to an increased risk of osteoporosis and cardiovascular diseases after menopause.

Key Words: Menopause, Trace elements

INTRODUCTION

Menopause is the consequence of the exhaustion of the ovarian follicles, which results in a decreased production of estradiol and other hormones [1]. The decrease in the levels of the sex steroid hormones during menopause in women causes a number of disturbances in the metabolisms of different organs. In this period of life, the risk of osteoporosis, cardiovascular diseases, arterial hypertension, impairment of glucose metabolism, breast cancer and degenerative cognition diseases rises. The impact of oestrogen deficiency after menopause on the trace minerals has not yet been widely studied but the expected menopause related alterations in the trace mineral status may have an impact on the above pathologies.

The risk of nutritional disturbances, particularly trace elements and vitamin deficiencies is high during menopause. Several trace elements are essential in bone metabolism [2]. Magnesium enhances bone turnover through the stimulation of the osteoclastic function and its deficiency may play a role in postmenopausal osteoporosis. Mg acts as a surrogate for calcium in the transport and mineralization process [3]. Its deficiency may lead to disturbances in the cardiac rhythm, necrotic changes, atheromatous plaques, a high value of total cholesterol and a low value of high density lipoprotein cholesterol [4]. Zinc regulates the secretion of calcitonin from the thyroid gland and it has an influence on the bone turnover. Copper induces a low bone turnover by suppression of the osteoblastic and the osteoclastic functions [3]. A deficiency of Cu, as well as its abundance may increase the cholesterol content of blood serum. In a condition of Cu deficiency, formation of the crosslinks of the elastin of blood vessels is disturbed [4]. Calcium is important to prevent bone loss and to help restore the bone that might have been lost due to osteoporosis [5]. Another important

factor for menopausal changes is iron that is essential for oxygen transport, electron transfer reactions and for the regulation of cell growth and differentiation. Excess Fe can damage the tissues by catalysing the conversion of hydrogen peroxide to free radical ions that attack the cellular membrane, proteins and DNA. Elevated plasma Ferritin levels can lead to an increased risk of ischaemic heart disease [6].

The aim of the present study was to find out the status of trace metals in postmenopausal women.

MATERIALS AND METHODS

The present study was conducted on 100 females selected from the general population, out of which 50 were premenopausal and aged 30-40 years and 50 were post menopausal (with natural menopause, permanent cessation of the menstrual cycle for more than 1 year) and were aged 45-55 years. None of the females under study had taken any oral contraceptives, hormone replacement therapy (HRT), oestrogen therapy or any supportive treatment for the menopausal symptoms prior to the study. A detailed reproductive and menstrual history of all the females was taken and their general physical and systemic examination was done to exclude any disease which was known to affect the present study.

Venous blood samples were collected under aseptic conditions after overnight fasting in trace element free containers (Vacutainer –7 ml). After centrifugation, serum was rapidly separated from these samples and it was stored at -70°C . The serum zinc levels were estimated by Makino method [7] and the serum magnesium levels by Bohoun method [8]. The serum calcium levels were determined by using the Ortho-Cresolphthalein complex, as described by Gitelman [9]. The copper in the serum was estimated by using

Bathocuproin disulphonate method [10] and serum iron by Zak method [11].

Statistical analysis was carried out by the Student's paired 't'-test. The data was expressed as mean \pm SD and p values < 0.05 were taken as significant.

RESULTS

[Table/Fig-1] shows the Mean \pm SD of various parameters which were studied in the premenopausal and the postmenopausal women. There was a significant increase in the serum Fe and Ca levels, with a significant decrease in the levels of Cu and Mg in the post menopausal women as compared to those in the premenopausal women whereas no significant difference was found in the serum levels of Zn in both the groups.

Trace elements	Premenopausal (Mean \pm SD)	Postmenopausal (Mean \pm SD)	p value
Fe (μ mol/l)	16.57 \pm 2.91	19.13 \pm 1.12	<0.05
Cu (μ g/dl)	92.6 \pm 9.4	82.3 \pm 8.4	<0.05
Zn (μ mol/l)	9.6 \pm 0.5	10.1 \pm 0.3	>0.05
Ca (gm/dl)	8.1 \pm 1.09	11.5 \pm 0.79	<0.001
Mg (mmol/l)	0.95 \pm 0.07	0.81 \pm 0.03	<0.05

[Table/Fig-1] Serum Fe, Cu, Zn, Ca and Mg levels in Premenopausal and Postmenopausal females.

DISCUSSION

Menopause is associated with numerous physiological and biochemical changes. The results from the present study show a significant increase in the Fe levels in the postmenopausal women as compared to those in the premenopausal women, which may be due to the increasing iron stores when the regular bleeding ceases. The accumulation of iron overload is related to a postmenopausal risk of coronary heart disease. This mechanism may involve the oxidant activity of the iron-dependent enzymes [12].

In our study, we observed a highly significant increase in the serum Ca levels after menopause, which may be explained by oestrogen deficiency, which induces synthesis of cytokines by the osteoblasts, monocytes and the T-cells. Thereby, the stimulation of bone resorption by the increasing cytotlastic activity. This results in modification of the reabsorption, excretion and the resorption of Ca, thus leading to increased circulating levels of Ca [13].

A decrease in the serum Cu levels was observed in the postmenopausal women as compared to that in the premenopausal women, which agrees with the previous reports that the concentration of Cu decreases with age in women. The administration of oestrogen during hormone replacement therapy has shown an improvement in the Cu levels in postmenopausal women [2]. Serum Mg levels were also found to be reduced in postmenopausal women, which may be due to the uncoupling of bone formation as a result of loss of the bone mass. It may also be related to renal wasting and

is exacerbated by dietary element deprivation and gastrointestinal losses with diarrhoea or vomiting [14].

The serum Zn concentration was not significantly different in the postmenopausal women from that of the premenopausal women. Menopause causes increased bone resorption, resulting in the mobilisation of bone Zn along with an increased urinary Zn excretion with normal serum Zn levels [15].

CONCLUSION

This study shows that there are changes in the serum biochemical profiles in postmenopausal women. Therefore, micronutrients in the form of trace elements, can be given to postmenopausal women as a substitute or an adjunct to HRT, (Hormone Replacement Therapy) in order to improve the symptoms and to minimise the side effects of HRT.

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AUTHOR(S):

1. Dr. Naveenta Gupta
2. Dr. Khushdeep Singh Arora

PARTICULARS OF CONTRIBUTORS:

1. Dr. Naveenta Gupta, M.B.B.S., M.D.
Assistant Professor, Department of Physiology,
Guru Gobind Singh Medical College,
Faridkot, Punjab - 151203, India.
2. Corresponding Author.

NAME, ADDRESS, TELEPHONE, E-MAIL ID OF THE CORRESPONDING AUTHOR:

Dr. Khushdeep Singh Arora, M.B.B.S., M.D.
Associate Professor, Department of Physiology,
Adesh Institute of Medical Sciences and Research,
Bathinda, Punjab - 151101
E-mail: khushdeep@gmail.com
Mobile no: 9780042132

DECLARATION ON COMPETING INTERESTS:

No competing Interests.

Date of Submission: **May 03, 2011**

Date of Peer Review: **Jun 06, 2011**

Date of Acceptance: **Jun 07, 2011**

Date of Publishing: **Aug 08, 2011**