FERCAP Conference 2024

Evaluation of serum calcium and vitamin D: A comparative study between pre-menopause and post-menopause women

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Background

- Menopause is a natural biological process that marks the end of a woman's reproductive years. It is defined as permanent cessation of menstruation and fertility.
- The transition through menopause represents a significant life stage for women, marked by hormonal changes that can impact bone health and mineral metabolism.

- Calcium, phosphorus, and vitamin D are pivotal components in maintaining bone health and overall well-being, particularly during this phase.
- The aim of this study is to comprehensively assess and compare the serum levels of calcium, phosphorus, and vitamin D in menopausal women to contribute to a better understanding of mineral metabolism during this critical period.

Introduction

- The term menopause ('change of life')is the counter part of the menarche and refer only to cessation of menstruation(Jeffcoate's, 1987).
- It is a time of women's life when there is adaption of physical, emotional, mental and hormonal changes are associated with the cessation of menstrual period(Yadav KP et al., 2020).

- It is estimated that there will be 1.2 billion women worldwide to be menopause by 2030(Afshari, Bahri, Sajjadi, Mansoorian, & Tohidinik, 2020).
- It is a consequence of the exhaustion of the ovarian follicles, which results in decreased production of estradiol and other hormones(Sachdeva, Seth, Khosla, & Sachdeva, 2005).

- In this period, the risk of osteoporosis, cardiovascular diseases, arterial hypertension, impairment of glucose metabolism, reproductive cancer and degenerative cognition diseases rises(Barrett-Connor, 1993; Gupta & Arora, 2011).
- The risk of nutritional disturbances, particularly trace elements and vitamin deficiencies is high during menopause(Dennehy & Tsourounis, 2010).

- All vitamins, minerals and trace elements play an important role in maintaining health and wellbeing among menopausal women(Dennehy & Tsourounis, 2010).
- The calcium absorption is decreased due to the lack of vitamin D, resulting from the age-related deterioration of organ functions(Arroyo & de la Morena, 2001).

- Since, a number of Nepalese populations are facing a deficiency of vitamin D as well as calcium(Khadka et al., 2018).
- The prevalence of vitamin D deficiency in the Nepalese population ranges from 32.0% to 73.6%, with a higher incidence observed in females(Baidya et al., 2024), while prevalence of hypocalcaemia in elderly women was reported as 24%(Thapa & Rayamajhi, 2020).

- Calcium and vitamin D are the most important nutrient for bone mineralization and deficiency of these nutrients may result to bone loss.
- Dietary and hormonal causes are also responsively for bone loss. So, early detection of an imbalance in serum calcium, vitamin D and phosphorus levels in menopausal women can be a useful tool to assist healthcare professionals for the therapeutic aspect and follow up.

- With this perspective, this comparative cross-sectional study of serum calcium, phosphorus and vitamin D level in premenopausal and postmenopausal women was undertaken.

- However, Nepal lacks this type of study in premenopausal and postmenopausal women. Therefore, this study aimed to compare the status of serum calcium, vitamin D and phosphorous between premenopausal and postmenopausal women, and their association with dietary calcium, and sunlight exposure are measured.

Statement of the Problem

- Menopause causes various physiological changes in women due to the decline in ovarian function and hormonal alterations, with significant concerns about the potential impact on bone health (Boschitsch, Durchschlag, & Dimai, 2017; Cheng, Chen, & Chen, 2022.
- Calcium, phosphorus, and vitamin D are essential for maintaining bone health and preventing osteoporosis, but the relationship between serum levels of these nutrients and bone health in menopausal women is not well understood Aggarwal & Nityanand, 2013.
- Due to lack of comprehensive studies comparing serum calcium, phosphorus, and vitamin D levels in menopausal women to pre-menopausal women, highlighting the need for further investigation into their associations with bone health indicators during menopause (Khadka et al., 2018.

Objective of study

- **General**
- To assess and compare the serum calcium, phosphorous, and vitamin D levels in pre and post-menopausal women

- **Specific**
- To assess and compare biochemical parameter (serum calcium, phosphorous and vitamin D levels) among pre-menopausal and post-menopausal women.
- To find the correlations between serum calcium, phosphorous, vitamin D levels
- To find the correlations between dietary patterns, sunlight exposure and serum calcium and vitamin D levels in menopausal women.

Materials and methods

- A present quantitative cross sectional study was conducted at Kathmandu Medical College, Sinamangal from February 2024 - April 2024 after obtaining ethical approval from institutional review committee (IRC).
- Orthopedic in and out patient department were chosen as the study site for this study. The study was conducted among 354 women where the sample were divided equally into two groups, of which 177 as a pre-menopausal and the rest as a post-menopausal women.

- Study group are enrolled on the basis of selection criteria and patients were informed regarding the nature of the study.
- Subjects, who wished to participate in this study, a written consent was obtained and administration of a structured questionnaire and 24 hour diet recall were provided to gather information on demographics, medical and dietary habits.

- Participants were enrolled in group by using non-probability sampling methods with consecutive sampling technique. Study subject were instruction to perform the biochemical test regarding serum calcium, phosphorous and vitamin D following the procedure.

- Under aseptic conditions, venous blood sample was obtained by venipuncture from cubital vein and were collected in a vial. Serum were separated after centrifugation.
- The specific biochemical test was performed on the sample using automated analyzer and the obtained value were recorded.

Sample selection

- **Inclusion criteria**
- **Pre-menopausal Group: -** Premenopausal Women with the reproductive age group 30 – 45 years, with a normal menstrual cycle.
- **Postmenopausal Group: -** Post-menopausal women 46 – 60 years, with one year of amenorrhea and were not receiving any hormonal replacement therapy.

- **Exclusion criteria**
- The women with some sort of menstrual disorders e.g. Irregular menses, menorrhagia, with any bone fracture in previous one year, on hormonal replacement therapy, oral contraceptives, under any estrogen therapy or any supportive treatment for menopausal symptoms for at least 6 months prior to study, antioxidants, diabetes, hypertension, malabsorption and any bone diseases

Sample size

- The prevalence of vitamin D deficiency observed was 66.4% in a study conducted by Sinha A. K. et al(Sinha, Shah, & Rai, 2022).
- The sample size was calculated by using the formula,
- $n= z^2pq / e^2$
- Where,
- z= 1.96 at 95% of Confidence Interval (CI)
- P= prevalence of Vitamin D deficiency = 66.4%
- q= (1-p)
- and e= permissible error at 5% with degree of assurance as 95% confidence level

- So, sample size is
- = (1.96)2 x 0.664 x 0.336 / 0.0025
- = 342.83
- So putting non-response rate of 3%
- 342.83 X 3 = 10.28
- 342.83+10.28 = 353.11
- So required sample size for this study was 354.

Data Collection Tools & Techniques

- Structured questionnaire:
  - Using pre-tested English and Nepali questionnaires (face to face interview)
- 24 hour diet recall

- Data were entered in excel sheet and analyzed using SPSS (Statistical package for social science) version 21.
- Analytical Statistical Analysis- was done to Compare serum calcium, phosphorous and vitamin D level which are evaluated by using independent T test.

- Assessment of Correlation test done by Pearson's correlation coefficient- analyze the relation between calcium, phosphorous and vitamin D in pre and post-menopausal women with Statistical significance assumed at $p<0.05$.

Results

- The BMI of postmenopausal women was significantly higher ($24.28 \pm 0.49 kg/m^2$) than that of premenopausal women (23.25 ± 1.722 kg/m^2). Premenopausal women had higher serum calcium ($9.18 \pm 0.47 mg/dl$) and vitamin D levels ($23.03 \pm 6.01 ng/ml$) compared to postmenopausal women, who had levels of $8.91 \pm 0.43 mg/dl$ and $21.75 \pm 5.86 ng/ml$, respectively.

- Serum phosphorus was higher in postmenopausal women (4.19 ± 0.66mg/dl) than in premenopausal women (4.01 ± 0.54mg/dl). Vitamin D positively correlated with calcium and dietary calcium in postmenopausal women, while it showed an insignificant correlation with sunlight exposure and a negative correlation with phosphorus.

Conclusion

- This study found the higher BMI and lower serum calcium and vitamin D levels in postmenopausal women than premenopausal women. Regular monitoring of bone markers, dietary intake of calcium and increased sunlight exposure are recommended to improve bone health in pre- and postmenopausal women.

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