

## ORIGINAL RESEARCH

# Study Of Serum Calcium And Vitamin-D Levels Among Pre-Menopausal And Post-Menopausal Women In Telangana

Dr. Ch. Venkata Pavan<sup>1</sup>, Dr. Radhika Rani Akkineni<sup>2</sup>, Dr. K. Ranjith Babu<sup>3</sup>, Dr. N. Sudheer Babu<sup>4</sup>

<sup>1</sup>Professor, Department of Surgery, Arundathi Institute of Medical Sciences, Hyderabad, Telangana, India

<sup>2</sup>Associate Professor, Department of Obstetrics & Gynecology, Arundathi Institute of Medical Sciences, Hyderabad, Telangana, India

<sup>3</sup>Associate Professor, Department of Physiology, Government Medical College, Rajanna Sircilla, Telangana, India

<sup>4</sup>Assistant Professor, Department of Physiology, Government Medical College, Mancherial, Telangana, India

## Corresponding Author

Dr. Radhika Rani Akkineni

Associate Professor, Department of Obstetrics & Gynecology, Arundathi Institute of Medical Sciences, Hyderabad, Telangana, India

Email: [medicalresearch2020@gmail.com](mailto:medicalresearch2020@gmail.com)

Revised date: 31 December, 2023

Acceptance date: 24 January, 2024

## ABSTRACT

**Introduction:** Menopause is a stage of women life indicating the cessation of the reproductive ability. Mostly the symptoms of menopause are started during 45 to 55 years. During Menopause ovarian follicular function is lost and blood estrogen and progesterone levels falls. Studies have found that the levels of serum calcium and vitamin-D are related to menopause in women. Calcium levels were found to be lower in post-menopause women when compared to pre-menopause women. The present study is focused on levels of calcium and vitamin-D in the postmenopausal women so that a healthy menopause can be observed in postmenopausal women. **Materials & Methods:** The present analysis study was carried out in 100 patients, out of these 50 women in reproductive period were included as control group. Other 50 women who have attained menopause were included as study group as inclusion and exclusion criteria. Care is taken for age matching among the two groups. The study has obtained approval from the Institute Ethics Committee of Arundathi Institute of Medical Sciences, Hyderabad, Telangana. Written informed consent has been obtained from all the participants of the study. The levels of serum calcium and vitamin D were analysed. Statistical analysis was done using IBM SPSS Statistics 20 package. p-value of <0.05 is considered as statistically significant and p-value of <0.005 is considered as statistically highly significant. The results were averaged as (mean  $\pm$  standard deviation) for each parameter subgroups separately for Diabetics & Non-diabetics. Statistical analysis was done using IBM SPSS Statistics 20 package. **Results:** It is observed that the mean levels of vitamin-D are low in the post-menopause group when compared to pre-menopause group. Similarly the serum calcium was also found to be lower in post-menopause. This lower calcium and vitamin D levels increase the risk of osteoporosis. The mean levels of vitamin D in post-menopausal and pre menopausal groups are 17.5 and 30.72 respectively. Also, the levels of calcium in post-menopausal and pre menopausal groups are 7.25 and 9.116 respectively. **Discussion:** In the present study, the correlation between the levels of serum calcium, vitamin D are highly significant. In women after menopause, the significant decrease in serum calcium level specifies chances of high risk of negative calcium balance. Women after menopause shall be carefully monitored for levels of serum calcium, for lowering risk of bone resorption. Normal serum calcium levels do not confirm negative risk of osteoporosis, however low serum calcium suggests supplementation of calcium with follow up. It is advisable to monitor the levels of serum calcium level, vitamin D status and Bone Mineral Density for a happy postmenopausal life for women.

**Keywords:** Menopause, calcium, Vitamin D

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution- Non Commercial-Share Alike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

## INTRODUCTION

Menopause is a stage of women life indicating the cessation of the reproductive ability. Mostly the symptoms of menopause are started during 45 to 55

years (1). About 1 million follicles are present at birth. Its number reduces to about 2.5 to 4 lakhs at puberty. During Menopause ovarian follicular function is lost and blood estrogen and progesterone levels falls (2,3).

Regarding prevalence of menopause, about 1.3 million women develop menopause each year in United states (4). In about 5% of women, menopause was reported before the usual period. Further, 1% of women have even stoppage of menses before the age of 40 years (5). About 80% of women experience menopause, but the symptoms vary person to person. It may be due different factors such as lifestyle, food habits, smoking, ethnicity, extent of exercise, socioeconomic status, body mass index and medical & gynecologic history (6). Menopause, a physiologic process related to decrease in primary ovarian follicles. Resulting in no effect of FSH, no LH surge and no ovulation. As the inhibiting effect of LH and FSH is lost, their levels continue to be higher after menopause. Small amounts of estrogen may still be produced via conversion from testosterone released by the adrenal glands, such that symptoms other than the discontinuation of periods may be negligible in some individuals (7). There are substantial changes in vulva and vagina related to low estrogen levels. Mucosal surface inflammation with erythema and friability, increased vaginal pH are observed. Similarly, introitus narrowing, thinning of labial with decreased depth, width of vagina are noted (8). Studies have found that the levels of serum calcium and vitamin-D are related to menopause in women. Calcium levels were found to be lower in post-menopause women when compared to pre-menopause women (9,10). Low calcium levels and inadequate vitamin D reserves have been related to bone loss and osteoporosis in postmenopausal women (11). Calcium, an important mineral constituent of bones is also responsible for calcium homeostasis. Vitamin-D has a vital role in maintaining the calcium levels which is absorbed through gastro-intestinal tract, kidneys and related to remodeling of bones (12,13). Decreased Calcium and vitamin D levels results in resorption of bone (14,15). With related to calcium and vitamin D in normal bone structure, postmenopausal females to be observed along with supplementation of calcium and vitamin D (16). Sustained levels of Calcium and vitamin D are required for optimal bone strength and to prevent osteoporosis and also the risk of fractures. The present study is focused on levels of calcium and vitamin-D in the postmenopausal women so that a healthy menopause can be observed in postmenopausal women. In our routine patient services, we have observed complications of lowered calcium and vitamin D levels in the postmenopausal women. Based on this observation, to explore further the study of serum levels of calcium and vitamin D are done.

## MATERIAL & METHODS

The present analysis study was carried out in the department of Obstetrics & Gynecology, Arundathi Institute of Medical Sciences, Hyderabad. Patients came for OPD, health check-up and other complaints were included in the study. A total of about 124 women have given their initial consent for participating in the study. Out of these, about 113 were eligible as per the inclusion criteria. Among these, 100 patients were randomly included in the present analysis after considering the inclusion and exclusion criteria. Patients with history of major illness such as diabetes, hypertension, other endocrinal disorders, renal diseases, hormone replacement therapy and on drug known to alter calcium or/and vitamin D were excluded; already under previous other medical treatment, under calcium, vitamin-D supplementation or taking any other hormones which may alter bone composition are excluded from the study. Out of total 100 patients, 50 women in reproductive period were included as control group. Other 50 women who have attained menopause were included as study group. Care is taken for age matching among the two groups. The study has obtained approval from the Institute Ethics Committee of Arundathi Institute of Medical Sciences, Hyderabad, Telangana. Written informed consent has been obtained from all the participants of the study. Laboratory analysis was performed on the morning in fasting state. Among typical routine laboratory values, serum calcium, vitamin D were assessed. Blood samples were collected into serum separator tubes (BD Vacutainer, Australia). Blood samples were left to clot for 30 min before being centrifuged at 1500g for 10 min at 4°C. Serum was obtained and calcium and vitamin D concentrations were measured by chemiluminescent immunoassay (Access 2; Beckman Coulter, CA). The data was arranged in suitable tables for analysis under different headings. The results were averaged as (mean  $\pm$  standard deviation) for each parameter subgroups separately for Pre & Post-menopause groups. Statistical analysis was done using IBM SPSS Statistics 20 package. p-value of <0.05 is considered as statistically significant and p-value of <0.005 is considered as statistically highly significant. Conclusions were drawn based on outcome of this statistical analysis.

## RESULTS

On statistical analysis of the levels of Serum calcium and Vitamin D among Pre menopause and post menopause groups, the following results were observed.

**Table 1: Paired samples statistics among Post and Pre-menopause women.**

		Mean	N	Std. Deviation	Std. Error Mean
Vitamin D	Post-menopause	17.500	50	4.6346	0.6554
	Pre-menopause	30.720	50	10.0001	1.4142
Calcium	Post-menopause	7.250	50	1.3829	0.1956
	Pre-menopause	9.116	50	0.9360	0.1324

In the present study, the mean levels of vitamin D in post-menopausal and pre menopausal groups are 17.5 and 30.72 respectively. Also, the levels of calcium in post-menopausal and pre menopausal groups are 7.25 and 9.116 respectively. So, it is observed that the levels of Calcium and vitamin D were lowered in post-menopausal women when compared to pre-menopause women as shown in Table-1.

**Table 2: Paired samples Correlations among Post and Pre-menopause women.**

		N	Correlation	Sig.
Vitamin D	Post-menopause & Pre-menopause	50	-0.122	0.400
Calcium	Post-menopause & Pre-menopause	50	0.066	0.648

In Table-2, on analysis of correlation, it is observed that there was a negative correlation showing that the levels of vitamin D decreases significantly in post-menopause when compared to pre-menopause women. Further, upon analysis as in Table-3 below, the vitamin D and Calcium levels were significantly altered in post-menopause women when compared to pre-menopause women. It can be concluded that the levels of vitamin D and calcium reduces due to changes of menopause.

**Table 3: Paired samples Test among Post and Pre-menopause women.**

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Vitamin D	Post-menopause & Pre-menopause	-13.2200	11.5216	1.6294	-16.4944	-9.9456	-8.113	49	0.000
Calcium	Post-menopause & Pre-menopause	-1.8660	1.6177	0.2288	-2.3257	-1.4063	-8.156	49	0.000

It can be observed that the levels of vitamin D and calcium reduces due to changes of menopause.

## DISCUSSION

In the present study, the serum calcium levels were significantly reduced in the post-menopausal group 7.25 mg/mL (SD 1.38) when compared to the premenopausal group i.e. 9.116 mg/m L (SD 0.93). Lowering ovarian function with menopause is associated with low bone mass and calcium metabolism. Estrogens will result in re-modelling of bone by increased osteoblast activity and reduced osteoclast activity with synthesis of cytokine resulting bone resorption. After attaining menopausal, the mechanism resulting in negative calcium balance is not completely known, but low oestrogen levels may result in low calcium because of decreased intestinal calcium absorption and decreased renal reabsorption along with possible increased gut calcium excretion (17). Low estrogen is also associated with calciuria, by more filtered load of Calcium. Estrogen receptors on renal tubules may be associated with renal calcium conservation (18). The low calcium absorption is related to low circulating 1,25 dihydroxy

vitamin D levels and also with gut resistance (19). Low intestinal 1,25\_dihydroxy vitamin D receptors with ovariectomy are associated with low intestinal calcium absorption(20). Oestradiol is also related to be with the gut receptor and increase calcium absorption. Few studies have shown altered intestinal weight per unit length after ovariectomy, which may be associated with passive, paracellular calcium transport. Nordin et al.7 in their study on postmenopausal women found low calcium absorption which may be due to either active calcium transport or calcium absorption system. Further, they also reported high urinary calcium which may be related to low tubular resorption (21). In countries like India, the awareness related to calcium supplementation women particularly after menopause is very less. Low levels of calcium and vitamin D are associated with low calcium absorption, high parathyroid hormone and bone loss. There are studies showing low calcium levels, high PTH, high IL-6 (Interleukin-6) in postmenopausal women (22–24).

## CONCLUSION

In women after menopause, the significant decrease in serum calcium level specifies chances of high risk of negative calcium balance. Women after menopause shall be carefully monitored for levels of serum calcium, for lowering risk of bone resorption. Normal serum calcium levels do not confirm negative risk of osteoporosis, however low serum calcium suggests supplementation of calcium with follow up. It is advisable to monitor the levels of serum calcium level, vitamin D status and Bone Mineral Density for a happy postmenopausal life for women.

## REFERENCES

- Menopause [Internet]. [cited 2024 Jan 26]. Available from: <https://www.who.int/news-room/factsheets/detail/menopause>
- Wang X, Wang L, Di J, Zhang X, Zhao G. Prevalence and risk factors for menopausal symptoms in middle-aged Chinese women: A community-based cross-sectional study. *Menopause* [Internet]. 2021 Nov 30 [cited 2024 Jan 26];28(11):1271–8. Available from: [https://journals.lww.com/menopausejournal/fulltext/2021/11000/prevalence\\_and\\_risk\\_factors\\_for\\_menopausal.12.aspx](https://journals.lww.com/menopausejournal/fulltext/2021/11000/prevalence_and_risk_factors_for_menopausal.12.aspx)
- Wang X, Wang L, Xiang W. Mechanisms of ovarian aging in women: a review. *J Ovarian Res* [Internet]. 2023 Dec 1 [cited 2024 Jan 26];16(1). Available from: <https://pubmed.ncbi.nlm.nih.gov/37024976/>
- Crandall CJ, Mehta JM, Manson JE. Management of Menopausal Symptoms: A Review. *JAMA* [Internet]. 2023 Feb 7 [cited 2024 Jan 26];329(5):405–20. Available from: <https://pubmed.ncbi.nlm.nih.gov/36749328/>
- Burkard T, Moser M, Rauch M, Jick SS, Meier CR. Utilization pattern of hormone therapy in UK general practice between 1996 and 2015: a descriptive study. *Menopause* [Internet]. 2019 Jul 1 [cited 2024 Jan 26];26(7):741–9. Available from: <https://pubmed.ncbi.nlm.nih.gov/30889086/>
- Talaulikar V. Menopause transition: Physiology and symptoms. *Best Pract Res Clin Obstet Gynaecol* [Internet]. 2022 May 1 [cited 2024 Jan 26];81:3–7. Available from: <https://pubmed.ncbi.nlm.nih.gov/35382992/>
- Polo-Kantola P, Rantala MJ. Menopause, a curse or an opportunity? An evolutionary biological view. *Acta Obstet Gynecol Scand* [Internet]. 2019 Jun 1 [cited 2024 Jan 26];98(6):687–8. Available from: <https://pubmed.ncbi.nlm.nih.gov/31087567/>
- Shifren JL. Genitourinary Syndrome of Menopause. *Clin Obstet Gynecol* [Internet]. 2018 Sep 1 [cited 2024 Jan 26];61(3):508–16. Available from: <https://pubmed.ncbi.nlm.nih.gov/29787390/>
- Patwa CK, Jindani NI, Afroz S. Study of serum calcium levels in premenopausal women and postmenopausal women. *MedPulse Int J Physiol* [Internet]. 2017 [cited 2024 Jan 26];4(2):14–6. Available from: <https://www.medpulse.in/Physiology/OriginalResearchArticle>
- Mei Z, Hu H, Zou Y, Li D. The role of vitamin D in menopausal women's health. *Front Physiol* [Internet]. 2023 [cited 2024 Jan 26];14. Available from: [/pmc/articles/PMC10291614/](https://pubmed.ncbi.nlm.nih.gov/410291614/)
- Dr. K. Madhurima Naidu DKS. EFFECT OF SERUM PTH, CALCIUM AND VITAMIN-D SUPPLEMENTATION ON FRACTURE HEALING. *Eur J Mol Clin Med* [Internet]. 2023;10(06):112–9. Available from: [https://elibrary.ru/doi\\_resolution.asp?doi=10.31862%2F9785426311961](https://elibrary.ru/doi_resolution.asp?doi=10.31862%2F9785426311961)
- Amling M, Priemel M, Holzmann T, Chapin K, Rueger JM, Baron R, et al. Rescue of the skeletal phenotype of vitamin D receptor-ablated mice in the setting of normal mineral ion homeostasis: formal histomorphometric and biomechanical analyses. *Endocrinology* [Internet]. 1999 [cited 2024 Jan 26];140(11):4982–7. Available from: <https://pubmed.ncbi.nlm.nih.gov/10537122/>
- Li YC, Pirro AE, Amling M, Dellling G, Baron R, Bronson R, et al. Targeted ablation of the vitamin D receptor: an animal model of vitamin D-dependent rickets type II with alopecia. *Proc Natl Acad Sci U S A* [Internet]. 1997 Sep 2 [cited 2024 Jan 26];94(18):9831–5. Available from: <https://pubmed.ncbi.nlm.nih.gov/9275211/>
- Lips P, Van Schoor NM. The effect of vitamin D on bone and osteoporosis. *Best Pract Res Clin Endocrinol Metab* [Internet]. 2011 Aug [cited 2024 Jan 26];25(4):585–91. Available from: <https://pubmed.ncbi.nlm.nih.gov/21872800/>
- Peacock M. Calcium metabolism in health and disease. *Clin J Am Soc Nephrol* [Internet]. 2010 [cited 2024 Jan 26];5 Suppl 1(SUPPL. 1). Available from: <https://pubmed.ncbi.nlm.nih.gov/20089499/>
- Cosman F, de Beur SJ, LeBoff MS, Lewiecki EM, Tanner B, Randall S, et al. Clinician's Guide to Prevention and Treatment of Osteoporosis. *Osteoporos Int* [Internet]. 2014 Sep 26 [cited 2024 Jan 26];25(10):2359. Available from: [/pmc/articles/PMC4176573/](https://pubmed.ncbi.nlm.nih.gov/25176573/)
- Tellez M, Arlot ME, Mawer EB, Diaz A, Hesp R, Hulme P, et al. Gastrointestinal calcium absorption and dietary calcium load: relationships with bone remodelling in vertebral osteoporosis. *Osteoporos Int* [Internet]. 1995 Jan [cited 2024 Jan 28];5(1):14–22. Available from: <https://pubmed.ncbi.nlm.nih.gov/7703619/>
- Davidoff M, Caffier H, Schiebler TH. Steroid hormone binding receptors in the rat kidney. *Histochemistry* [Internet]. 1980 Jan [cited 2024 Jan 28];69(1):39–48. Available from: <https://pubmed.ncbi.nlm.nih.gov/7440259/>
- O'Loughlin PD, Morris HA. Oestrogen deficiency impairs intestinal calcium absorption in the rat. *J Physiol* [Internet]. 1998 Aug 8 [cited 2024 Jan 28];511(Pt 1):313. Available from: [/pmc/articles/PMC2231105/](https://pubmed.ncbi.nlm.nih.gov/2231105/)
- Chen C, Noland KA, Kalu DN. Modulation of intestinal vitamin D receptor by ovariectomy, estrogen and growth hormone. *Mech Ageing Dev* [Internet]. 1997 Dec 15 [cited 2024 Jan 28];99(2):109–22. Available from: <https://pubmed.ncbi.nlm.nih.gov/9483486/>
- Nordin BEC, Need AG, Morris HA, Horowitz M, Robertson WG. Evidence for a renal calcium leak in postmenopausal women. *J Clin Endocrinol Metab* [Internet]. 1991 [cited 2024 Jan 28];72(2):401–7.

- Available from:  
<https://pubmed.ncbi.nlm.nih.gov/1991810/>
22. Bhattarai T, Bhattacharya K, Chaudhuri P, Sengupta P. Correlation of Common Biochemical Markers for Bone Turnover, Serum Calcium, and Alkaline Phosphatase in Post-Menopausal Women. *Malays J Med Sci* [Internet]. 2014 [cited 2024 Jan 28];21(1):58. Available from: [/pmc/articles/PMC3952340/](https://pubmed.ncbi.nlm.nih.gov/1991810/)
  23. Desai M, Khatkhatay MI, Taskar V, Ansari Z. Changes in Cytokines, Biomarkers of Bone Turnover and Hormones are Associated with Bone Loss in Postmenopausal Indian Women. *Int J Endocrinol Metab* 2012 101 [Internet]. 2012 [cited 2024 Jan 28];10(1):399–403. Available from: <https://brieflands.com/articles/ijem-71893>
  24. Radha Jada M, Perugu B, Chalasani S, Publications B. Evaluation of biochemical and bone density parameters in premenopausal and postmenopausal women Original Article. *Int J Biol Med Res Int J Biol Med Res* [Internet]. 2013 [cited 2024 Jan 28];4(3):3441–3. Available from: [www.biomedscidirect.com](http://www.biomedscidirect.com)