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Interventional study to improve ionized Calcium levels among Postmenopausal Women to prevent Osteoporosis

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ABSTRACT

This is due in part to vitamin D deficiency (vitamin D is a primary modulator of intestinal calcium and phosphate absorption), which is caused by a lack of sunlight combined with low vitamin D dietary intake and cutaneous synthesis. Secondary hyperparathyroidism is caused by low calcium intake and vitamin D deficiency, which is characterised as a serum 25-hydroxyvitamin D (25 (OH) D concentration below 12 ng/ml and is related to increased bone turnover and, indirectly, an increased risk of fracture. Furthermore, recent findings indicate that vitamin D deficiency is more widespread than previously thought, owing to a revision of the traditional 25 (OH) D threshold level below which parathyroid hormone secretion (PTH) begins to increase. The value of z is 2.44949, the value of p is 0.01428 and the result is significant at $p < 0.05$ are obtained for the calcium levels of pre and post-test results of all study groups when compared against BMI. The value of z is 1.36471, the value of p is 0.00321 and the result is significant at $p < 0.05$ are obtained for the T-values of pre and post-test results of all study groups when compared against BMI. After observing the findings, it is clear that after eating prescribed nutritional food for three months, the ionised Calcium levels, overall Calcium levels, and bone density have increased significantly as compared to before taking nutritional food. As a result, the nutrient food given is a good source of calcium and helps postmenopausal women strengthen their bones. Furthermore, it is recommended that all age groups consume the recommended food kit to minimise the risk of osteoporosis and bone fracture.

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INTRODUCTION

Low dietary calcium intake is related to decreased intestinal calcium absorption in elderly people, according to several reports (Pediatrics, 2012; Consensus Study Report, 2011). This is due in part to vitamin D deficiency (vitamin D is a primary modulator of intestinal calcium and phosphate absorption), which is caused by a lack of sunlight combined with low vitamin D dietary intake and cutaneous synthesis (Donangelo, 1997; Kovacs and Kronenberg, 2018).

Secondary hyperparathyroidism is caused by low calcium intake and vitamin D deficiency, which

is characterised as a serum 25-hydroxyvitamin D (25 (OH)) D concentration below 12 ng/ml and is related to increased bone turnover and, indirectly, an increased risk of fracture (Veldurthy *et al.*, 2016). Furthermore, recent findings indicate that vitamin D deficiency is more widespread than previously thought, owing to a revision of the traditional 25 (OH) D threshold level below which parathyroid hormone secretion (PTH) begins to increase (Cano *et al.*, 2018; Pfeifer *et al.*, 2009).

Decalyos I, which was conducted in French institutionalised elderly women, and Decalyos II, which was conducted in elderly American men and women, have both shown that a combined calcium and vitamin D supplement has a major protective effect against hip and/or other nonvertebral fractures (Gómez and Henríquez, 2011; Stage *et al.*, 2011). A rise in bone mineral density (BMD) and serum 25 (OH) D concentrations, as well as a decrease in serum PTH, are linked to a lower risk of fracture (Heaney, 2006; Ahmadieh and Arabi, 2011).

METHODOLOGY

Inclusion criteria

The target study population post-menopausal women of aged between 45 and 60 were selected from the proposed project area of ChittoorMandal of Chittoor district Andhra Pradesh. A local survey was conducted by project staff with the help of healthcare workers to find the target study population. Based on the survey report and study requirements, an application form was prepared to know the basic details like name, age, past health conditions and medication usage etc.

The complete details of the study and importance were explained to all eligible study population. Consent was taken from the study population before commencing the study. Pre-prepared application forms were distributed among the study population to fill the required details, encouraged to fill the form by own; those who are uneducated or unable to fill the form are helped by project staff.

RESULTS AND DISCUSSION

The detailed should be provided in the Table 1.

Assessment of Calcium levels

A calcium blood test measures the amount of calcium in your blood. Calcium is one of the most important minerals in your body. You need calcium for healthy bones and teeth. Calcium is also essential for the proper functioning of your nerves, muscles, and heart. About 99% of our body's calcium is stored in our bones. The remaining 1% circulates in the blood. If there is too much or too little calcium in the blood, it may be a sign of bone disease, thyroid disease, kidney disease, or other medical conditions.

There are two tests followed to measure blood calcium. The total calcium test measures both the free and bound forms. The ionized Calcium test measures only the free, metabolically active form, for both tests, a health care professional takes a blood sample from a vein in the arm using a small needle.

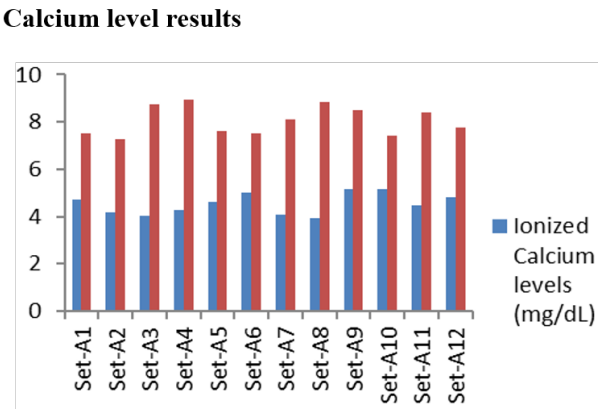

Figure 1: Graphical representation of average Calcium level results of Group A

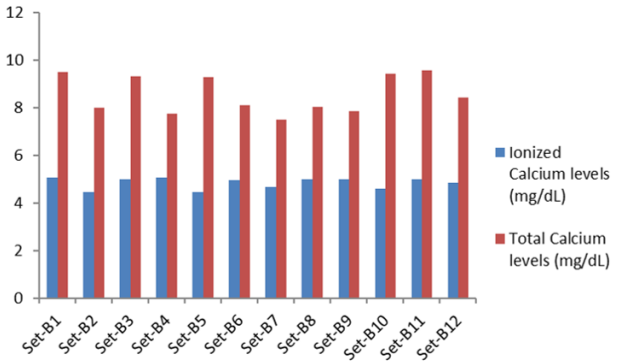

Figure 2: Graphical representation of average Calcium level results of Group B

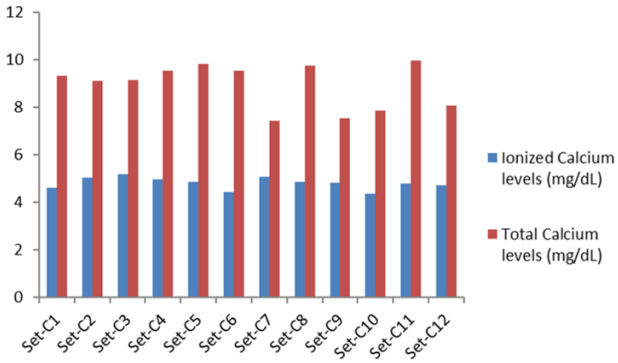

Figure 3: Graphical representation of average Calcium level results of Group C

Table 1: Details of study periods

S. No.	Study Group	Start Date	End Date
1	Group A	April 01, 2019	June 30, 2019
2	Group C	July 29, 2019	October 28, 2019
3	Group D	December 02, 2019	March 01, 2020

Table 2: Frequency distribution and percentage of pre-testing ionized Calcium levels and total Calcium levels

Group	Test parameter	Class	Count	Percentage
Group A	Ionized Calcium levels	3.95 - 4.24	4	33.3
		4.25 - 4.54	2	16.7
		4.55 - 4.84	3	25
		4.85 - 5.14	3	25
	Total Calcium levels	7 - 7.49	4	33.3
		7.5 - 7.99	2	16.7
		8 - 8.49	2	16.7
		8.5 - 8.99	4	33.3
Group B	Ionized Calcium levels	4.4 - 4.59	2	16.7
		4.6 - 4.79	2	16.7
		4.8 - 4.99	3	25
		5 - 5.19	5	41.7
	Total Calcium levels	7.5 - 8.09	5	41.7
		8.1 - 8.69	2	16.7
		8.7 - 9.29	1	8.3
		9.3 - 9.89	4	33.3
Group C	Ionized Calcium levels	4.3 - 4.54	2	16.7
		4.55 - 4.79	2	16.7
		4.8 - 5.04	5	41.7
		5.05 - 5.29	3	25
	Total Calcium levels	7.4 - 8.09	4	33.3
		8.1 - 8.79	0	0
		8.8 - 9.49	3	25
		9.5 - 10.19	5	41.7

Post testing results
Calcium level results

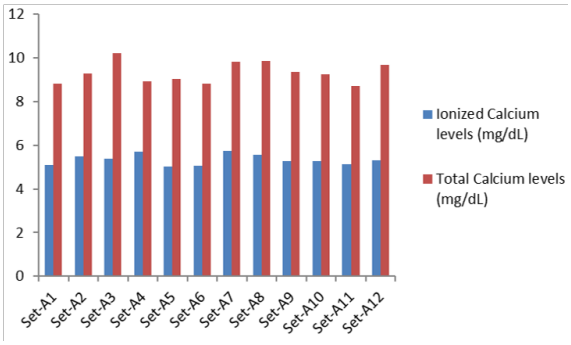

Figure 4: Graphical representation of average Calcium level results of Group A

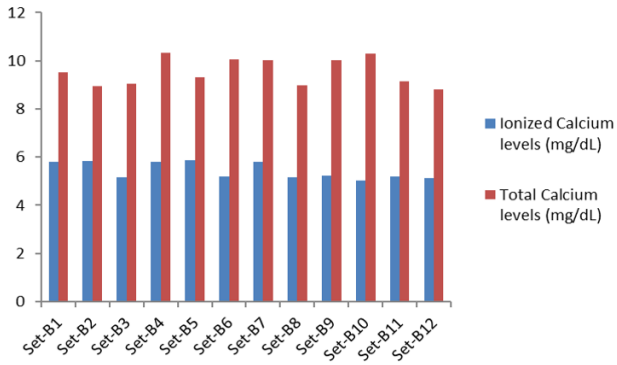

Figure 5: Graphical representation of average Calcium level results of Group B

Table 3: Frequency distribution and percentage of post-testing ionized Calcium levels and total Calcium levels

Group	Test parameter	Class	Count	Percentage
Group A	Ionized Calcium levels	5 - 5.19	4	33.3
		5.2 - 5.39	4	33.3
		5.4 - 5.59	2	16.7
		5.6 - 5.79	2	16.7
	Total Calcium levels	8.7 - 9.09	5	41.7
		9.1 - 9.49	3	25
		9.5 - 9.89	3	25
		9.9 - 10.29	1	8.3
Group B	Ionized Calcium levels	5 - 5.24	7	58.3
		5.25 - 5.49	0	0
		5.5 - 5.74	0	0
		5.75 - 5.99	5	41.7
	Total Calcium levels	8.8 - 9.19	5	41.7
		9.2 - 9.59	2	16.7
		9.6 - 9.99	0	0
		10 - 10.39	5	41.7
Group C	Ionized Calcium levels	5.05 - 5.24	2	16.7
		5.25 - 5.44	3	25
		5.45 - 5.64	4	33.3
		5.65 - 5.84	2	16.7
	Total Calcium levels	7.4 - 8.09	4	33.3
		8.1 - 8.79	0	0
		8.8 - 9.49	3	25
		9.5 - 10.19	5	41.7

Table 4: Summary of data for pre and post-testing ionized Calcium levels and total Calcium levels

	Treatments			
	1	2	3	Total
N	12	12	12	36
$\sum X$	54.42	58.22	57.74	170.38
Mean	4.535	4.8517	4.8117	4.733
$\sum X^2$	248.9056	283.0488	278.5182	810.4726
Std.Dev.	0.4381	0.2306	0.2509	0.3423

After the needle is inserted, a small amount of blood will be collected into a test tube or vial. The normal levels of total Calcium and ionized Calcium is provided below.

Total Calcium normal levels: The normal level of total blood calcium level in adults is 8.6 to 10.3 mg/dL. Ionized Calcium normal levels: Normal levels of ionized calcium in adults, is 4.64 to 5.28mg/dL. Figure 1, Figure 2, Figure 3, Figure 4, Figure 5 and Figure 6.

Data Analyses

The data analysis and interpretation has been done by descriptive and inferential statistics methods. Descriptive statistics include frequency and percentage calculation of initial and post-test assessment of calcium levels and bone density. Inferential statistics includes Z test, Chi-square test and one way ANOVA is used to compare the mean-variance among demographic variables with levels of Calcium and with bone density.

Frequency and Percentage

The frequencies distribution and percentage of pre and post-testing ionized Calcium levels and total Calcium levels for Group A, Group B and Group C

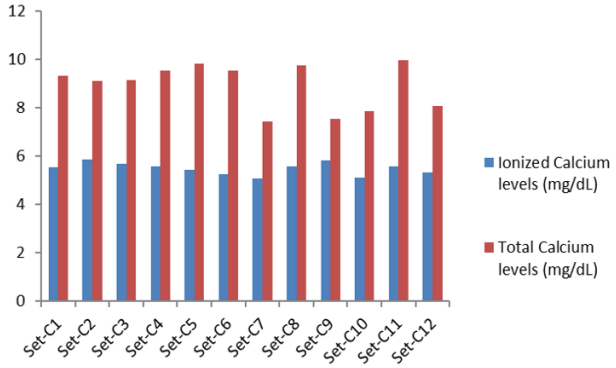

Figure 6: Graphical representation of average Calcium level results of Group C

study population are provided in the Table 2 and Table 3.

Z-Test

The value of z is 2.44949, the value of p is 0.01428 and the result is significant at $p < 0.05$ are obtained for the calcium levels of pre and post-test results of all study groups when compared against BMI.

The value of z is 1.36471, the value of p is 0.00321 and the result is significant at $p < 0.05$ are obtained for the T-values of pre and post-test results of all study groups when compared against BMI. Table 4

CONCLUSION

After observing the findings, it is clear that after eating prescribed nutritional food for three months, the ionised Calcium levels, overall Calcium levels, and bone density have increased significantly as compared to before taking nutritional food. As a result, the nutrient food given is a good source of calcium and helps postmenopausal women strengthen their bones. Furthermore, it is recommended that all age groups consume the recommended food kit to minimise the risk of osteoporosis and bone fracture.

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Conflict of Interest

The authors declare that they have no conflict of interest for this study.

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