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Nutritional Package for Preventing Osteoporosis among Post-Menopausal Women –In view of bone density

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Abstract

The National Osteoporosis Foundation (NOF) announced the actual and estimated number of adults aged 50 and older in the United States with osteoporosis and low bone mass (previously known as osteopenia) in 2002, (US). The estimates were based on population-based data from the National Health and Nutrition Examination Survey (NHANES)–III (1988–1994), which measured bone mineral density (BMD) at the femoral neck. According to the study, approximately 10 million Americans aged 50 and up had osteoporosis, with another 33 million having low bone mass. (a) Only the femoral neck BMD was used in these calculations since it was the only skeletal site for which nationally representative data was available.According to the study, approximately 10 million Americans aged 50 and up had osteoporosis, with another 33 million having low bone mass.The total selected members for study were non-randomlydivided into 3 groups (Group A, Group B and Group C). Quasi-experimental design method used for making an experimental design. Study was conducted on each group separately. Each study period covers 3 months' time and 15 to 20 days for data analyses and reporting. The detailed should is provided in the table below. After observation of results, it is clearly indicating that the ionized Calcium levels, total Calcium levels and bone density is improved significant levels after consuming recommended nutritional food for three months compared to before taking nutritional food. Thus, the provided nutrient food is a good source of Calcium and improves bone strength in the post-menopausal women. Further, this is recommended that, the consumption recommended nutritional package for all the age groups to reduce the chance to get osteoporosis and bone fracture.

Keywords: Bone Density, Post-Menopausal Women, Osteopenia, National Osteoporosis Foundation.

INTRODUCTION:

The National Osteoporosis Foundation (NOF) announced the actual and estimated number of adults aged 50 and older in the United States with osteoporosis and low bone mass (previously known as

osteopenia) in 2002, (US) [1]. The estimates were based on population-based data from the National Health and Nutrition Examination Survey (NHANES)–III (1988–1994), which measured bone mineral density (BMD) at the femoral neck [2]. According to the study, approximately 10 million Americans aged 50 and up had osteoporosis, with another 33 million having low bone mass [3, 4]. (a) Only the femoral neck BMD was used in these calculations since it was the only skeletal site for which nationally representative data was available [5].According to the study, approximately 10 million Americans aged 50 and up had osteoporosis, with another 33 million having low bone mass [6]. Since the femoral neck was the only skeletal site for which nationally representative BMD data were available from NHANES, these estimates were based on it [7].Multiple US and international organisations have established new clinical care recommendations since then, which can be used to determine the overall incidence of osteoporosis [8]. To describe osteoporosis or low bone density, the NOF suggests that clinicians look at BMD at both the femoral neck and the lumbar spine. The European Society for Clinical and Economic Aspects of Osteoporosis and Osteoarthritis, as well as the World Health Organization, have suggested that population levels of osteoporosis and low bone mass be based solely on the femoral neck [9]. The International Society for Clinical Densitometry (ISCD) notes that femora differ in scale [10].

The European Society for Clinical and Economic Aspects of Osteoporosis and Osteoarthritis, as well as the World Health Organization, have suggested that population levels of osteoporosis and low bone mass be based solely on the femoral neck [11]. The International Society for Clinical Densitometry (ISCD) notes that BMD can be used to diagnose osteoporosis and low bone mass in the femoral neck, lumbar spine, and complete hip [12].

Methodology:

The application form is prepared in bilingual (English and Telugu) for convenience of study population. The model forms (Empty/Filled) used to acquire the study population basic details are provided below.

A basic preliminary medical checkup including blood pressure, pulse rate, height and weight etc. was conducted for the study population.

After careful observation of all filled forms and preliminary medical checkup data, a total of 525 post-menopausal women of aged between 45 and 60 were selected from 541, 16 members were rejected based on their medical history and current medication usage.

EXPERIMENTAL DESIGN:

The total selected members for study were non-randomlydivided into 3 groups (Group A, Group B and Group C). Quasi-experimental design method used for making an experimental design. Study was conducted on each group separately. Each study period covers 3 months' time and 15 to 20 days for data analyses and reporting. The detailed should is provided in the table below.

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

Assessment of bone density by FRAX®:

Bone density assessment for all the selected study population was performed by WHO Fracture Risk Assessment Tool (FRAX®). The tool was developed to evaluate a patient's 10-year probability of hip fracture and major osteoporotic fracture (clinical spine, forearm, hip, or shoulder fracture). Previously, clinicians could only estimate a 5-year fracture risk.

A T-score of between −1.0 and −2.5) as well as a ten-year risk of hip fracture or a ten-year risk of a major osteoporosis-related fracture can assess with the FRAX®.

A step-by-step procedure for assessing bone density by using FRAX®is explained through following screenshot images.

Assessment of bone density by DEXA Scan:

A Dual Energy X-ray Absorptiometry has procured with a cost of 19,24,000/- from the budget sanctioned by DST. The bone density was assessed to all the selected study population by DEXA scan by a radiologist.

DEXA scan uses a very small dose of ionizing radiation to produce pictures of the inside of the body (usually the lower (or lumbar) spine and hips) to measure bone loss. It is commonly used to diagnose osteoporosis, to assess an individual's risk for developing osteoporotic fractures. DEXA is simple, quick, and noninvasive. It is also the most used and the most standard method for diagnosing osteoporosis.

This exam requires little to no special preparation. Request was made to all study population toleave their jewelry at home and wear loose, comfortable clothing.

The DEXA machine sends a thin, invisible beam of low-dose x-rays with two distinct energy peaks through the bones being examined. One peak is absorbed mainly by soft tissue and the other by bone. The soft tissue amount can be subtracted from the total and what remains is a patient's bone mineral density.DEXA machines feature special software that compute and display the bone density measurements on a computer monitor. The radiologist interpreted radiology examinations, analyzed the images, and provided reports.

The test results were provided in the form of two scores:

T score- This number shows the amount of bone having compared with a young adult of the same gender with peak bone mass. A score of **-1** and above is considered normal. A score between **-1.1 and -2.4** is classified as osteopenia. A score of **-2.5** and below is defined as osteoporosis. The T score is used to estimate your risk of developing a fracture.

Z score- This number reflects the amount of bone you have compared with other people in your age group and of the same size and gender. If this score is unusually high or low, it may indicate a need for further medical tests.

A typical DEXA scan image is provided below.

The pre-testing results of Calcium levels and bone density by FRAX®and DEXA scan is provided below.

Pre-testing results:

Note: The difference between the results among the study population was found to be very minimal. Thus, the pre- and post-test results were tabulated from the average of set subjects, statistical analysis also performed with average values only. It was found that there is no difference in the analysis of individual and average values.

Average bone density results by FRAX®:

Table 2: Average bone density results by FRAX® of Group A

Set No.	BMI	T-Value	Z-Value	10-year probability fracture
Set-A1	24.1	-1.9	-1.9	≥25%
Set-A2	27.1	-2.1	-1.9	≥25%
Set-A3	25.1	-1.0	-1.4	≥27%
Set-A4	23.8	-2.3	-2.3	≥28%
Set-A5	27.2	-1.4	-2.3	≥25%
Set-A6	22.5	-2.2	-2.5	≥29%
Set-A7	25.0	-1.0	-2.5	≥27%
Set-A8	24.4	-2.5	-2.7	≥23%
Set-A9	24.9	-1.7	-1.2	≥22%
Set-A10	27.0	-1.6	-2.8	≥27%
Set-A11	26.3	-1.8	-2.6	≥23%
Set-A12	22.8	-2.1	-2.8	≥22%

Table 3: Average bone density results by FRAX®Group B

Set No.	BMI	T-Value	Z-Value	10-year probability fracture
Set-B1	24.3	-1.3	-2.3	≥27.0%
Set-B2	25.1	-1.0	-0.6	≥25.3%
Set-B3	25.3	-1.2	-1.5	≥26.9%
Set-B4	23.3	-2.4	-2.8	≥21.4%
Set-B5	23.2	-2.1	-0.7	≥21.6%

Set-B6	23.0	-1.4	-0.8	≥26.7%
Set-B7	26.7	-2.2	-2.8	≥26.3%
Set-B8	25.1	-1.1	-2.2	≥21.8%
Set-B9	27.0	-1.6	-1.1	≥21.9%
Set-B10	27.3	-2.3	-2.8	≥23.8%
Set-B11	25.2	-1.3	-2.2	≥26.0%
Set-B12	23.4	-2.3	-1.3	≥23.4%

Table 4: Average bone density results by FRAX® of Group C

Set No.	BMI	T-Value	Z-Value	10-year probability fracture
Set-C1	22.9	-1.6	-1.5	≥25.6%
Set-C2	26.8	-1.5	-2.2	≥29.0%
Set-C3	27.0	-1.3	-1.4	≥21.5%
Set-C4	24.7	-1.0	-0.7	≥24.8%
Set-C5	25.6	-1.9	-2.5	≥24.5%
Set-C6	27.2	-1.9	-0.5	≥25.8%
Set-C7	24.8	-1.7	-1.9	≥28.5%
Set-C8	25.4	-1.6	-2.2	≥23.0%
Set-C9	23.5	-2.3	-2.3	≥23.6%
Set-C10	25.2	-2.1	-0.9	≥29.0%
Set-C11	24.4	-2.0	-2.8	≥24.1%
Set-C12	22.8	-1.9	-0.8	≥20.8%

Average bone density results by DEXA scan:

Table 5: Average bone density results by DEXA scan of Group A

Set No.	BMI	T-Value	Z-Value
Set-A1	24.1	-1.9	-1.9
Set-A2	27.1	-2.1	-1.9
Set-A3	25.1	-1.0	-1.4
Set-A4	23.8	-2.3	-2.3
Set-A5	27.2	-1.4	-2.3
Set-A6	22.5	-2.2	-2.5
Set-A7	25.0	-1.0	-2.5
Set-A8	24.4	-2.5	-2.7
Set-A9	24.9	-1.7	-1.2
Set-A10	27.0	-1.6	-2.8

Set-A11	26.3	-1.8	-2.6
Set-A12	22.8	-2.1	-2.8

Table 6: Average bone density results by DEXA scanGroup B

Set No.	BMI	T-Value	Z-Value
Set-B1	24.3	-1.3	-2.3
Set-B2	25.1	-1.0	-0.6
Set-B3	25.3	-1.2	-1.5
Set-B4	23.3	-2.4	-2.8
Set-B5	23.2	-2.1	-0.7
Set-B6	23.0	-1.4	-0.8
Set-B7	26.7	-2.2	-2.8
Set-B8	25.1	-1.1	-2.2
Set-B9	27.0	-1.6	-1.1
Set-B10	27.3	-2.3	-2.8
Set-B11	25.2	-1.3	-2.2
Set-B12	23.4	-2.3	-1.3

Table 7: Average bone density results by DEXA scan of Group C

Set No.	BMI	T-Value	Z-Value
Set-C1	22.9	-1.6	-1.5
Set-C2	26.8	-1.5	-2.2
Set-C3	27.0	-1.3	-1.4
Set-C4	24.7	-1.0	-0.7
Set-C5	25.6	-1.9	-2.5
Set-C6	27.2	-1.9	-0.5
Set-C7	24.8	-1.7	-1.9
Set-C8	25.4	-1.6	-2.2
Set-C9	23.5	-2.3	-2.3
Set-C10	25.2	-2.1	-0.9
Set-C11	24.4	-2.0	-2.8
Set-C12	22.8	-1.9	-0.8

Post-results of BONE DENSITY:

Average bone density results by FRAX®:

Table 8: Average bone density results by FRAX® of Group A

Set No.	BMI	T-Value	Z-Value	10-year probability

				fracture
Set-A1	24.1	-1.0	-0.8	≥17.16%
Set-A2	27.1	-0.2	-1.2	≥16.96%
Set-A3	25.1	-0.3	-1.8	≥14.07%
Set-A4	23.8	-0.7	-1.8	≥15.67%
Set-A5	27.2	-0.8	-1.1	≥13.24%
Set-A6	22.5	-0.3	-0.9	≥17.71%
Set-A7	25.0	-0.5	-1.8	≥12.51%
Set-A8	24.4	-0.3	-0.8	≥14.67%
Set-A9	24.9	-0.4	-1.8	≥11.41%
Set-A10	27.0	-1.0	-2.0	≥11.49%
Set-A11	26.3	-0.8	-1.0	≥17.88%
Set-A12	22.8	-0.9	-1.1	≥15.15%

Table 9: Average bone density results by FRAX®Group B

Set No.	BMI	T-Value	Z-Value	10-year probability fracture
Set-B1	24.3	-0.8	-0.7	≥15.49%
Set-B2	25.1	-0.6	-1.1	≥17.66%
Set-B3	25.3	-0.3	-1.8	≥16.43%
Set-B4	23.3	-0.0	-0.7	≥17.34%
Set-B5	23.2	-0.6	-1.4	≥11.19%
Set-B6	23.0	-0.2	-1.5	≥17.27%
Set-B7	26.7	-1.0	-0.7	≥12.74%
Set-B8	25.1	-0.7	-1.6	≥15.77%
Set-B9	27.0	-0.6	-1.5	≥15.23%
Set-B10	27.3	-0.0	-1.2	≥17.55%
Set-B11	25.2	-0.7	-1.5	≥11.68%
Set-B12	23.4	-0.2	-1.3	≥15.47%

Table 10: Average bone density results by FRAX® of Group C

Set No.	BMI	T-Value	Z-Value	10-year probability fracture
Set-C1	22.9	-0.2	-0.9	≥11.35%
Set-C2	26.8	-0.1	-1.5	≥14.51%
Set-C3	27.0	-0.3	-1.1	≥14.70%
Set-C4	24.7	-0.5	-0.7	≥12.33%
Set-C5	25.6	-0.7	-1.0	≥17.52%

Set-C6	27.2	-0.2	-0.7	≥11.61%
Set-C7	24.8	-0.6	-1.2	≥12.80%
Set-C8	25.4	-0.6	-1.7	≥16.92%
Set-C9	23.5	-0.5	-1.1	≥11.94%
Set-C10	25.2	-0.8	-1.3	≥15.32%
Set-C11	24.4	-0.3	-1.7	≥16.86%
Set-C12	22.8	-0.9	-1.4	≥14.23%

Average bone density results by DEXA scan:

Table 11: Average bone density results by DEXA scan of Group A

Set No.	BMI	T-Value	Z-Value
Set-A1	24.1	-1.0	-0.8
Set-A2	27.1	-0.2	-1.2
Set-A3	25.1	-0.3	-1.8
Set-A4	23.8	-0.7	-1.8
Set-A5	27.2	-0.8	-1.1
Set-A6	22.5	-0.3	-0.9
Set-A7	25.0	-0.5	-1.8
Set-A8	24.4	-0.3	-0.8
Set-A9	24.9	-0.4	-1.8
Set-A10	27.0	-1.0	-2.0
Set-A11	26.3	-0.8	-1.0
Set-A12	22.8	-0.9	-1.1

Table 12: Average bone density results by DEXA scanGroup B

Set No.	BMI	T-Value	Z-Value
Set-B1	24.3	-0.8	-0.7
Set-B2	25.1	-0.6	-1.1
Set-B3	25.3	-0.3	-1.8
Set-B4	23.3	-0.0	-0.7
Set-B5	23.2	-0.6	-1.4
Set-B6	23.0	-0.2	-1.5
Set-B7	26.7	-1.0	-0.7
Set-B8	25.1	-0.7	-1.6
Set-B9	27.0	-0.6	-1.5
Set-B10	27.3	-0.0	-1.2
Set-B11	25.2	-0.7	-1.5

Set-B12	23.4	-0.2	-1.3

Table 13: Average bone density results by DEXA scan of Group C

Set No.	BMI	T-Value	Z-Value
Set-C1	22.9	-0.2	-0.9
Set-C2	26.8	-0.1	-1.5
Set-C3	27.0	-0.3	-1.1
Set-C4	24.7	-0.5	-0.7
Set-C5	25.6	-0.7	-1.0
Set-C6	27.2	-0.2	-0.7
Set-C7	24.8	-0.6	-1.2
Set-C8	25.4	-0.6	-1.7
Set-C9	23.5	-0.5	-1.1
Set-C10	25.2	-0.8	-1.3
Set-C11	24.4	-0.3	-1.7
Set-C12	22.8	-0.9	-1.4

Table 14: Summary of data for pre and post testing bone density levels

	Treatments			
	1	**2**	**3**	**Total**
N	12	12	12	36
$\sum X$	-21.6	-20.2	-20.8	-62.6
Mean	-1.8	-1.6833	-1.7333	-1.739
$\sum X^2$	41.46	37.14	37.48	116.08
Std.Dev.	0.4843	0.534	0.3601	0.4544

Conclusion:

After observation of results, it is clearly indicating that the ionized Calcium levels, total Calcium levels and bone density is improved significant levels after consuming recommended nutritional food for three months compared to before taking nutritional food. Thus, the provided nutrient food is a good source of Calcium and improves bone strength in the post menopausal women. Further, this is recommended that, the consumption recommended nutritional package for all the age groups to reduce the chance to get osteoporosis and bone fracture.

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