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The Therapeutic Impact of Flaxseed Oil and Walnuts on Osteoporosis Among Postmenopausal Women in Eastern Province of Saudi Arabia.

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ABSTRACT

Osteopenia and osteoporosis are related diseases. Both are varying degrees of bone loss, as measured by bone mineral density. Bone mineral density is a marker for bone strength and fracture risk. The study aims to elucidate the effect of flaxseed oil and walnut on bone minerals density among women. A sample of twenty-five pre- and postmenopausal women (mean age was 54 years) were randomly selected from Imam Abdulrahman Bin Faisal Univeristyand King Fahad University Hospital (KFUH). They were divided into three groups: The first group (control) (n=5) received bonviva-anti osteoporotic drug- (150 mg/month), while the second and third groups were given flaxseed oil and walnut at a dosage of 30 ml/day and 50 g/day for 30 days respectively. A questionnaire was constructed to collect data related to age of participants, socioeconomic status and presence of nuts allergy. Biochemical markers such as bone mass density by DEXA as well as parathyroid hormone (PTH), calcium and phosphorus in serum were measured before, during and after the interventions. Eighteen of the subjects were included in the final measurements. No significant improvement was found in bone minerals density for all three groups. (P-value = 0.6).There was no significant improvement in BMD in the intervention groups. Although, flaxseed oil had a positive effect on BMD for some participants. Whereas walnuts had negative impact on BMD.

Keywords: Flaxseed oil, walnuts, bonviva, biochemical, women, Saudi Arabia.

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INTRODUCTION

Bone is a rigid tissue consisting of cells embedded in an abundant, hard intercellular material. The two principal components of this material are collagen and calcium phosphate (1).

Osteopenia and osteoporosis are related diseases. Both are varying degrees of bone loss, as measured by bone mineral density, a marker for how strong a bone is and the risk that it might break (2).Osteoporosis is progressive disease diagnosed by low bone density to level where the risk of fracture is high especially in hip, wrists and spin (3). Some of the major risk factors contributing to this issue are menopause, sedentary life style, family history, liver diseases, diabetes and the use of oral gluco-corticosteroid therapy (4). Low intake of calcium (Ca), phosphorus, vitamin D rich food and lack of knowledge about Ca rich food are other factors contributing to osteoporosis according to study had been done among 160 female employees, from King Saud University, Riyadh, Kingdom Saudi Arabia (5).Some factors may reduce or increase the amount of calcium absorbed or increase calcium lost in the urine are high intake of caffeine (6). Globally, about 200 million women suffer from osteoporosis.

Consistent with the American National Health and Nutrition Examination Survey, 50% of women aged more than 50 years suffer from osteoporosis (7). About 20% of patients with a hip fracture die within one year (4). Furthermore, osteoporosis considered a widely spread issue among Saudi population in a range of 2.5-46.7% (7).A study reviewed 785 chest radiographs from Saudi women age 50 years and above at King Fahd Hospital of the University. They observed that 20.3 % of patients had at least 1 vertebral fracture and that only 13.2% of women with vertebral fractures were on therapy for osteoporosis (8). However, studies among Saudi women are limited on this field. Flaxseed oil and walnuts were selected as interventions to help on treating osteoporosis since both are nutritious and available in Saudi areas. Flaxseed oil comes from the seeds of the flax plant (Linumusitatissimum, L.) and contains both polyunsaturated omega-3 and omega-6 fatty acids (PUFAs), which are essential for health. Some researchers suppose that flaxseed oil might have some of the same benefits as fish oil. Omega-3 fatty acids obtained from fish oil is used to reduce inflammation and help to prevent certain chronic diseases, such as heart disease, arthritis and osteoporosis. Many researchers reported that omega-3 to omega-6 ration plays a role in preventing disease, a ratio of ¼ is consider adequate for adult female. (9) Walnut extract has a high anti-atherogenic potential and a remarkable osteoblastic activity, an effect mediated, at least in part, by its major component ellagic acid. Such findings implicate the beneficial effect of a walnut-enriched diet on cardio-protection and bone loss. (10).There is many drugs used in treating osteoporosis. bisphosphonate is the most common one of them. (11).Therefore, this study aims to elucidate the effect of flaxseed oil and walnuts on bone minerals density among adult women.

MATERIAL AND METHODOLOGY

Materials:

Flaxseed oil and walnut:

Unrefined, cold pressed and organic flaxseed oil and whole walnuts were purchased from local store in Al Qatif, Eastern Province, Saudi Arabia.

Anti-osteoporotic drugs:

Bonviva were prescribed as tablet by orthopedic doctors from King Fahad university Hospital, AlKhobar, Eastern Province, Saudi Arabia.

Subjects:

Twenty-five (25) Saudi women (age's 30-80years) were included in this interventional case control study. They were randomly selected from King Fahad University Hospital (KFUH) and Imam Abdulrahman Bin Faisal University, Saudi Arabia. They were divided into 3 groups.

Inclusion criteria:

Inclusion criteria were (T score 0 – < -1), osteopenia (T score > -1 – < -2.5) or osteoporotic (T score > -2.5), pre and postmenopausal Saudi women and age between 30-80 years.

Exclusion criteria:

Exclusion criteria were pregnant women and those who use corticosteroid. This study was approved by institutional review board in Imam Abdulrahman Bin Faisal University (IRB-UGS-2015-03-216).

Method:

Intervention materials dosage:

Materials	Unit
Flaxseed oil	30 ml / day
Walnuts	50g / day
Bonviva	150mg/month

Experimental design:

Twenty-five (25) Saudi women their age was between 30-80 years old were included in this interventional case control study. They were randomly selected from king Fahad university hospital and Dammam university, AL Khobar, Saudi Arabia. They were divided into 3 groups as follow:

Group I from KFUH (control): (n=5) received bonviva drug at dosage of 150 mg/months (12).And the intervention groups were selected from Imam Abdulrahman Bin Faisal University.
Group II: (n=10) Received flaxseed oil at dosage of 30 ml/ day (13).
Group III: (n=10) postmenopausal women were received walnut at dosage of 50 g/day (14).

Comparison was done between the three groups to determine which interventions are the most effective.

Questionnaires:

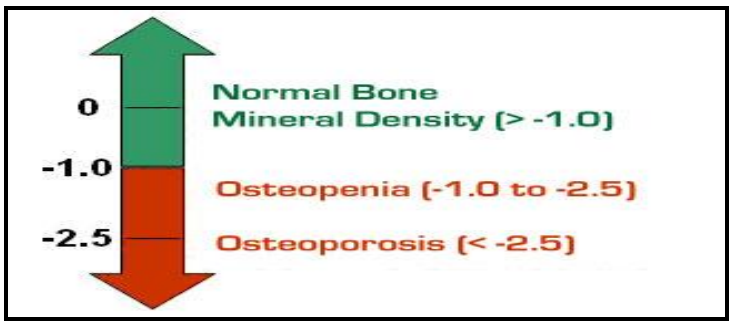
Asocio-demographic and eating habits questionnaires were employed to capture information on participant'sage, food consumption pattern, exposure to the sunlight, life style and medical history.

Determination of biochemical parameters that measured the effectiveness of this interventions:

Parathyroid hormone, calcium and Phosphorus were measured in serum of all participants.

Determination of DEXA for measuring bone mass density.

Picture 1: ranges of DEXA



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The most accurate way to determine bone mineral density is dual-energy x-ray absorptiometry (DEXA) that measures the mineral content of bone. The measurements, known as T-scores, determine which category - osteopenia, osteoporosis, or normal - a person falls into (see pic 1).A T-score ranging from -1 to -2.5 is classified as osteopenia. The lower the score, the more porous your bone(2).

Statistical analysis:

The data were presented as means ± SE. Statistical analysis was performed using computerized Statistical Package of Social Sciences (SPSS) program version 24 analysis of variance (ANOVA) followed by Duncan's multiple range tests(15) .

RESULTS

Eighteen subjects were included in the final measurements to explain the effect of flaxseed oil and walnut on bone minerals density.

Table (1) shows that the majority of intervention group ages were between 40-59 had bachelor and high school degree and average income. There is a parallel relationship between age and low bone mineral density.

Table 1: Distribution of osteopenia women according to socio-demographic characteristics.

		Flaxseed Oil (n=8)		Walnut (n=5)		Total	
		No.	%	No.	%	No.	%
Age	< 40	1	12.5	0	0	1	7.7
	40-49	5	62.5	0	0	5	38.5
	50-59	2	25	4	80	6	46.2
	≥ 60	0	0	1	20	1	7.7
Social Status	Married	6	75	4	80	10	76.9
	Divorced	0	0	0	0	0	0
	Widow	1	12.5	1	20	2	15.4
	Single	1	12.5	0	0	1	7.7
Education Level	Bachelor	3	37.5	3	60	6	46.2
	High school	4	50	1	20	5	38.5
	Middle school	1	12.5	1	20	2	15.4
	Elementary	0	0	0	0	0	0
Income	Above average	2	25	1	20	3	23.1
	Average	5	62.5	4	80	9	69.2
	Below average	1	12.5	0	0	1	7.7

Table (2) illustrates that the majority of participants who were not exposed to sunlight had osteopenia. Interestingly most participant with osteopenia did not have history of fracture. There is strong relationship between sun exposure and bone mineral density.

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Table 2: Distribution of women with osteopenia according to exposure to sunlight, history of fracture, and allergy to walnut.

Questions	Yes			No		
	t-score <-1	t-score >-1 - <-2.5	t-score > -2.5	t-score <-1	t-score >-1 - <-2.5	t-score > -2.5
Sun exposure (Q1)	0	1	0	2	9	1
History of fracture (Q2)	0	2	0	2	8	1
Allergy to walnut (Q3)	0	1	0	2	9	1

*The numbers in table referred to number participants.

Table (3) illustrates that majority of participants who had osteopenia consumed milk once a day meanwhile minority of osteoporotic subjects consumed milk 4-5 times daily. Surprisingly, all participants with normal BMD reported an intake of yogurt only once daily. At the same time, most osteopenia subjects consumed yogurt one time a day. All women included in this study were consuming vegetables and fruits at least once daily. Even women with osteopenia consumed vegetables 4-5 time a day. Normal BMD subjects reported a daily intake of fruits with no more than three times but majority of osteopenia women consumed only once a day. Almost all subjects with osteopenia were eating foods high in protein between two to three times every day. Finally, all subjects drank soda daily but majority consumed 2-3 times daily especially who had osteopenia. In conclusion, there is a strong correlation ($P<0.05$) between intake of protein and DEXA at baseline but not with milk, yogurt, vegetables, fruits and soda.

Table 3: Distribution of women with osteopenia according to food consumption pattern

Type	4-5 times /day			2-3 times /day			1 time /day			Never			significance
	t-score <-1	t-score >-1 - <-2.5	t-score > -2.5	t-score <-1	t-score >-1 - <-2.5	t-score > -2.5	t-score <-1	t-score >-1 - <-2.5	t-score > -2.5	t-score <-1	t-score >-1 - <-2.5	t-score > -2.5	
Milk	0	1	1	0	2	0	1	6	0	1	1	0	0.219
Yogurt	0	1	1	0	1	0	2	6	0	0	2	0	0.307
Vegetables	0	5	1	1	2	0	1	3	0	0	0	0	0.552
Fruits	0	2	1	1	3	0	1	5	0	0	0	0	0.390
Protein	0	1	1	0	8	0	2	1	0	0	0	0	0.009
Soda	0	2	0	0	6	1	2	2	0	0	0	0	0.203

*The numbers in table referred to number participants.
*Significance if p-value < 0.05

Table (4) shows that there were no significant differences between all group either in DEXA 1(before intervention) (P-valve >.05) or DEXA 2 (after intervention) (P-valve >.05). Means of flaxseed oil and walnut groups were increased (by 0.3 and 0.2, respectively) compared to baseline results. This was due to low duration and low sample size. In figure (1) the means of both flaxseed oil and walnut groups were slightly decreased. Whereas the mean of control group was increased.

Table 4: Effect of flaxseed oil, walnut and bisphosphonate on BMD.

Groups Parameter	Flaxseed Oil (n=8)	Walnuts (n=5)	Control (n=5)	p-value
DEXA 1 Mean ± SD	1 ± 0.53	0.80 ± .45	1.40 ± 0.54	0.20
DEXA 2 Mean ± SD	1.25 ± 0.71	1 ± 0.0	1 ± 0.71	0.68

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Mean ± SD is significance if p-value < .05
DEXA 1 = Before
DEXA 2= After

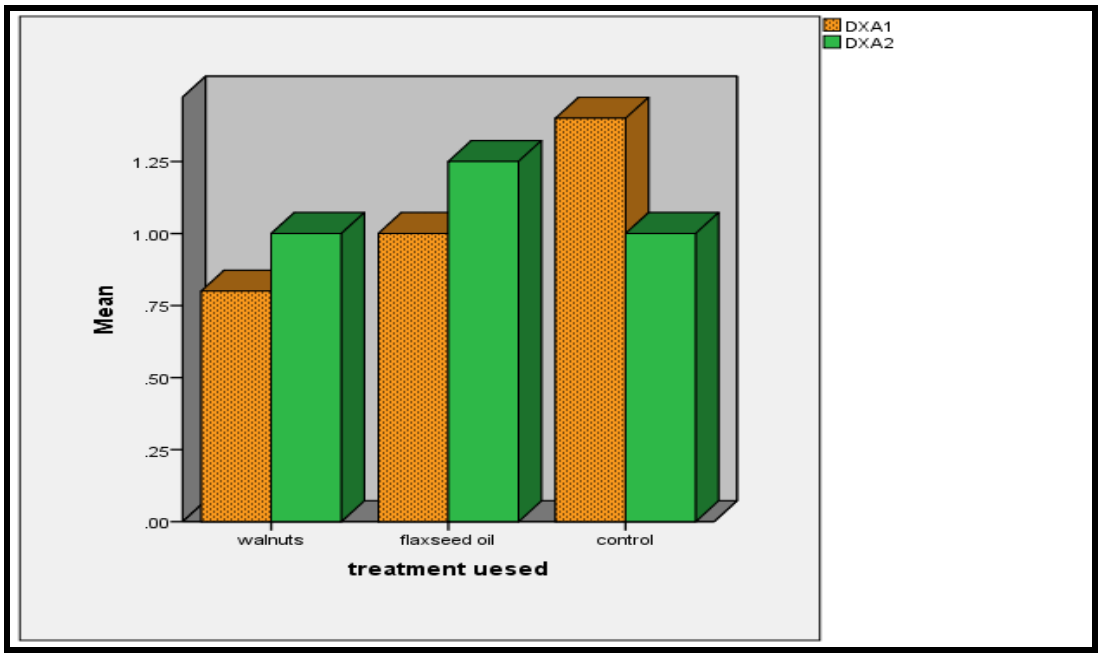

Figure 1: Effect of flaxseed oil, walnut and bisphosphonate on BMD.

In table (5) and (6) there were no significant difference between the two groups (intervention groups and control group) either in DEXA 1 (P-valve >.05) nor DEXA 2 (P-valve >.05).

Table 5: Effect of flaxseed oil and bisphosphonate on DEXA 1 and DEXA 2

Groups Parameter	Flaxseed Oil (n=8)	Control (n=5)	p-value
DEXA 1 Mean ± SD	1 ± 0.54	1.40 ± 0.55	0.22
DEXA 2 Mean ± SD	1.25 ± 0.71	1 ± 0.71	0.55

Mean ± SD is significance if p-value < .05
DEXA 1 = Before
DEXA 2= After

Table 6: Effect of walnut and bisphosphonate on DEXA 1 and DEXA 2

Groups Parameter	Walnut (n=5)	Control (n=5)	p-value
DEXA 1 Mean ± SD	0.80 ± 0.45	1.40 ± 0.55	0.09
DEXA 2 Mean ± SD	1 ± 0.0	1 ± 0.71	1

Mean ± SD is significance if p-value < .05
DEXA 1 = Before
DEXA 2= After

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In table (7) PTH (parathyroid hormone) means were increased in flaxseed oil and control groups which associated with increase in bone resorption. However, PTH mean was decreased in walnut group. Nevertheless, DEXA means increased in both flaxseed oil and walnut and decreased in control group.

Table 7: Effect of Flax seed Oil, Walnut and Bisphosphonate on Ca, P, PTH and DEXA.

Parameters	Flaxseed Oil(n= 8)		Walnut (n=5)		Bisphosphonate (n=5)	
	Baseline Mean ± SD	After one month Mean ± SD	Baseline Mean ± SD	After one month Mean ± SD	Baseline Mean ± SD	After one month Mean ± SD
Ca	8.025 ± 2.30	8.831 ± 0.29	9.24 ± 0.12	8.31 ± 1.46	9.22 ± 0.63	7.04 ± 4.51
P	3. 438 ± 0.44	4.515 ± 2.11	4 ± 0.30	4.08 ± 0.23	3.34 ± 0.73	3.30 ± 0.61
PTH	8.41 ± 2.47	8.44 ± 2.66	9.29 ± 3.09	9.22 ± 3.22	-0.33 ± 1.48	5.43 ± 6.61
DEXA	1 ± 0.54	1.25 ± 0.71	0.80 ± 0.44	1 ± 0.00	1.40 ± 0.54	1 ± 0.70

PTH = Parathyroid Hormone

DISCUSSION

The present study was performed to elucidate the effect of flaxseed oil and walnut among postmenopausal osteoporotic women during the experimental period (30 days). Biochemical markers such as bone mass density by DEXA, parathyroid hormone (PTH) and calcium in serum were measured by specialists from the king Fahad university hospital, Saudi Arabia, before, and after the interventions.

The present study showed that intake of milk was not associated with BMD although several studies have proved the opposite. A cross sectional study suggested that milk consumption have positively correlated with bone mineral density among elderly and middle-aged women (16). Another finding conducted that milk consumption among female adolescent had an effect of greater BMD later (17). Milk consumption and regular exercise have been proved to prevent bone loss associated with menopause (18). Another important dairy product is yogurt; present study's finding suggested that association was observed between eating yogurt and better BMD in participants. Meanwhile some researchers concluded that consuming yogurt results in higher BMD in teenagers and adults (16), (19). Moreover, fruits and vegetables had been thought to be important for skeletal health among young women (20). Five servings of fruits and vegetables seem to have a positive effect on bone density of human (21). On the other hand, a cross-sectional study concluded that there is no correlation between bone health and intake of fruits and vegetables (22). Results of this study showed no association between daily consumption of fruits and vegetables and BMD. Interestingly, this study reported a significant association between eating high protein foods and t-score of BMD. Another study reported a positive relationship between protein and reduced risk of osteoporosis (23). Although some studies suggested a negative effect of protein on density of bone (24).The present study demonstrated that there is no association between drinking soda and t-score of BMD. In addition, some findings found that consumption of carbonated beverages should be avoided due to it harmful effect on bones (25). In contract, soft drinks may not be associated with higher risk of fracture in children (26).

This study showed no significant improvement in bone minerals density after consumption of flaxseed and walnut compared with control groups.

These findings are in agreement with a study on the effects of diets supplemented by flaxseed oil on blood lipids and bone minerals content in osteoporotic ovariectomized women. (27)

Other studies also confirmed a beneficial effect (28 and 29). The most likely reason that we could not replicate their results is the short duration of the study as well as the small number of participants.

Papoutsi et al., (2007) reported that the walnut extract had a high remarkable osteoblastic activity, an effect mediated, at least in part, by its major component ellagic acid. Such findings implicate the beneficial effect of a walnut-enriched diet on cardio protection and bone loss (30).

CONCLUSION

In conclusion, there was no significant improvement in BMD in the intervention groups. Although, flaxseed oil had a positive effect on BMD for some participants. Whereas walnuts had negative impact on BMD. More research needed to prove the effect of walnuts and flaxseed oil on adult female bone health.

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