

Possible relationships of selected food items to osteoporosis among a group of Iraqi women

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Abstract:

Background: Osteoporosis is a global health problem which is estimated to affect more than 200 million people worldwide, especially postmenopausal women. It is characterized by decreased bone mineral density leading to fragility and increased risk of fractures.

Objective: This study was conducted to explore the consumption of inappropriate foods related to osteoporosis among a group of Iraqi women.

Patients and methods: A cross sectional study of 140 females aged ≥ 40 years attending polyclinics in Al-Dora sector in Baghdad city from 18th January to 24th April 2021. The bone mineral density was measured by portable quantitative calcaneal ultrasound machine (osteosystem) and the bone was assessed for osteoporosis by T-score. Food frequency questionnaire was used for collecting data related to food consumption.

Results: Out of the total sample, 74 (52.9%) were found to be osteoporotic. There was a significant association with high salt and coffee consumption with the occurrence of osteoporosis (77.3% and 83.3%, respectively, $p = 0.001$), compared to those who did not consume caffeinated drinks. Participants with daily consumption of caffeinated drinks had a highly significant association with osteoporosis (21.8% vs 100%, $p = 0.001$).

Conclusion: Excessive consumption of salty foods and caffeinated beverages appears to exert a negative effect on bone mineral density and the occurrence of osteoporosis among the studied group of Iraqi women.

Keywords: Osteoporosis, bone mineral density, salty foods, caffeinated drinks.

Introduction:

Osteoporosis is a common disorder among the older population characterized by a systemic impairment of bone mass resulting in fragility and fractures. Demographic transition in developing countries i.e. prolonged life expectancy, might increase the prevalence of geriatric diseases including osteoporosis (1, 2, 3). Published work in Iraq documented that osteoporosis in postmenopausal women was highly prevalent (3, 4). The changes in the political regime led to the redistribution of wealth which in turn caused people to consume unhealthy foods. This might increase the occurrence of osteoporosis in Iraq. This situation was the impetus to conduct on this study, which aimed at exploring the consumption of inappropriate foods and its relation to osteoporosis among the studied group of Iraqi women. These selected foods are:

Salty Food: A high salt content is present in processed foods, canned foods (vegetables and fruits), fast foods and salt added to the foods each day. The aim is to consume no more than 2,300 mg of sodium per day, which is equal to a teaspoon of salt

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(5). Beans (Legumes): While beans contain calcium, magnesium, fiber and other nutrients, they are also high in substances called phytates that interfere with the absorption of calcium (6). Meat: High protein diets can also cause the body to lose calcium. Meat protein contains high amounts of sulfur-containing amino acids. To cope with this influx, the body dissolves calcium from the bones and releases it into the blood stream. Red meat should be limited to two times a week and portions should be kept small (4 to 6 ounces) (7, 8, 9). Fish: Recent studies suggested that diet rich in polyunsaturated fatty acids (omega 3) is associated with higher bone mineral density and decreased bone loss. However, this is still controversial (10, 11). Wheat Bran: Like beans, wheat bran contains high levels of phytates which can prevent the body from absorbing calcium (12). Caffeine: Coffee, tea and soft drinks (sodas) contain caffeine, which may decrease calcium absorption and contribute to bone loss. Drinking more than three cups of coffee every day (> 300 mg/day) and/or tea may interfere with calcium absorption and cause bone loss (13, 14). The caffeine and phosphorous commonly found in cola and soda drinks may cause bone loss. Drinking seven or more colas per week is associated with a reduction in bone mineral density and increases the risk of fracture (15). Smoking: cigarette smoking is a reversible risk factor for osteoporosis. It increases the risk of fractures by

reducing bone mineral density through alteration the calciotropic hormones (16).

Patients and methods:

A cross-sectional study was conducted between 18th January and 15 June 2021. A total of 140 women aged ≥ 40 year were randomly selected from attendants of polyclinics in Al-Dora sector in Baghdad to be included in the study. Weight and height of the participants were measured to calculate the body mass index (BMI). The bone mineral density (BMD) was measured by portable quantitative calcaneal ultrasound machine (osteosystem) (17) and the bone was assessed for osteoporosis by T-score (it is a status of bone mass related to bone mass of a healthy 30 years old female). It was classified as normal (T-score ≥ -1.0), osteopenia ($-2.5 < T\text{-score} < -1.0$) and osteoporosis ($T\text{-score} \leq -2.5$) (18). The consumption of the selected food items were explored by using food frequency questionnaire. The Chi square test was used to test the association of consumption of the selected food items with osteoporosis. The P-value of < 0.05 was considered significant. Pearson's correlation was used to assess the relationships between the T- score and participants, age and BMI.

Results:

The SD of age in the study group was 56.6 ± 9.12 years. Their SD of weight was 80.3 ± 15.61 kg, and SD of height was 160.6 ± 6.56 cm with a SD of BMI of 31.2 ± 5.61 . The SD of T-score was -0.2 ± 3.05 (table 1). The distribution of the study groups according to dietary and other variables is shown in (table 2). Out of the total participants, 74 (52.9%) were osteoporotic. Out of those consuming high salt/day, 68 (77.3%) were osteoporotic compared to 6 (11.5%) low salt consumers was significantly associated with osteoporosis ($\chi^2 = 56.7$, d.f = 1, P= 0.001). Of those consuming legumes 3-4 times /week, 18 (48.6%) were osteoporotic compared to 56 (54.4%) of those with low consumption (1-2 times /week) or none, with no significant association ($\chi^2 = 0.6$, d.f =2, p= 0.7). Out of those consuming wheat bran 20 (57.1%) were osteoporotic compared to 54 (51.4%) of the non-consumers with no significant association ($\chi^2 = 0.3$, d.f = 1, P= 0.6). Of those consuming red meat almost daily 19 (46.3%) were osteoporotic compared to 37 (53.6%) of less frequent consumers (2-4 times /week) and 18 (60%) among non-consumers with no significant association ($\chi^2 = 1.3$, d.f = 2, P= 0.5). Out of women consuming fish 3-4 times /week 3 (60%) were osteoporotic compared to 37 (56.9 %) of less frequent and 34 (48.6%) of non- consumers with no significant association ($\chi^2 = 1.1$, d.f = 2, P= 0.6). Out of those drinking coffee 55 (83%) were osteoporotic compared to those not drinking coffee 19 (25.7%), which was significantly associated ($\chi^2 = 46.5$, d.f.=2, P= 0.001). Of those with low level of drinking of tea day (≤ 3 cups /day) 60 (54.5%) were osteoporotic compared to high level of drinking tea (> 3 cups/day) 14 (46.7%) with no significant association ($\chi^2 = 0.6$, d.f.=1, P= 0.5). Of those consuming caffeinated drinks almost daily 17 (100%) were osteoporotic

compared to those consuming them 2-4 times /week 45 (66.2%) and those almost not consuming them 12 (21.8%) with a highly significant association ($\chi^2 = 41.3$, d.f= 2, P= 0.001)- (table 3). Age showed a significant negative correlation with T score, $R = -0.639$, p value = 0.001, i.e., T score decreases with ageing (figure 1). BMI showed a significant positive correlation with T score, $R = 0.475$, P value 0.001, i.e., T score increases with increasing BMI (figure 2).

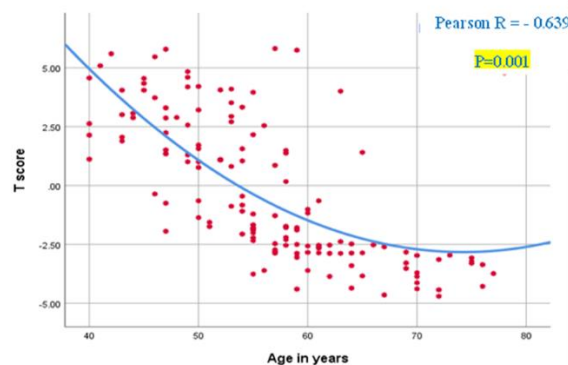


Figure 1: Pearson's correlation between age and T score for osteoporosis

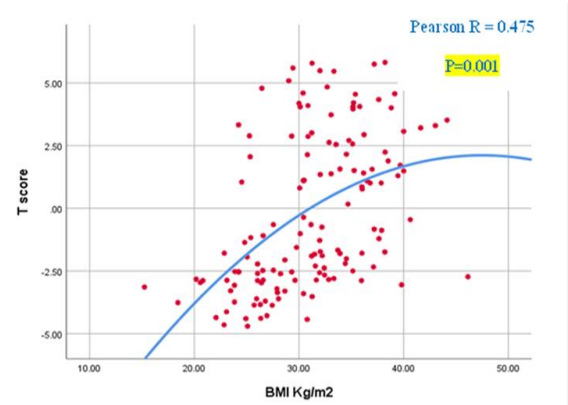


Figure 2: Pearson's correlation between BMI and T score for osteoporosis

Table 1: Mean and SD of selected variables in the study group

	Mean	±SD	Minimum	Maximum
N= 140				
Age in years	56.6	9.12	40	78
Weight in kg	80.3	15.61	39	120
Height in cm	160.6	6.56	136	173
BMI	31.2	5.61	15.23	46.14
T score	-0.2	3.05	-4.70	5.82

Table 2: Distribution of study group according to dietary and other characteristics and their association with osteoporosis

Table 3: Association between osteoporosis and study group (n=140) factors		Total	Osteoporosis	
			Freq.	%
Menopause status	premenopausal	35	1	2.9
	postmenopausal	105	73	69.5
			$\chi^2=46.82$	d.f.=1 P=0.001*
Smoking status	yes	11	8	72.7
	no	129	66	51.2
			$\chi^2=1.9$	d.f.=1 P=0.17
Salt intake/day	Low (≤ 2300 mg)	52	6	11.5
	High (> 2300 mg)	88	68	77.3
			$\chi^2=56.7$	d.f.=1 P=0.001*
Legume intake/ week	none	26	13	50.0
	1-2 times	77	43	55.8
	3-4 times	37	18	48.6
			$\chi^2=0.6$	d.f.=2 P=0.7
Wheat bran intake	yes	35	20	57.1
	no	105	54	51.4
			$\chi^2=0.34$	d.f.=1 P=0.56
Meat intake	almost none	30	18	60.0
	2-4 times	69	37	53.6
	almost daily	41	19	46.3
			$\chi^2=1.3$	d.f.=2 P=0.5
Fish intake /week	none	70	34	48.6
	1-2 times	65	37	56.9
	3-4 times	5	3	60.0
			$\chi^2=1.1$	d.f.=2 P=0.6
Coffee intake/day	yes	66	55	83.3
	no	74	19	25.7
			$\chi^2=46.5$	d.f.=2 P=0.001*
Tea intake/day	≤ 3 cups	110	60	54.5
	> 3 cups	30	14	46.7
			$\chi^2=0.6$	d.f.=1 P=0.4
Caffeinated intake /week	drinks almost none	55	12	21.8
	2-4 times	68	45	66.2
	almost daily	17	17	100
			$\chi^2=41.3$	d.f.=2 P=0.001*

Discussion:

This study revealed that high salt consumption was significantly associated with osteoporosis which is consistent with published literature indicating the negative effect of sodium chloride on bone health (19, 20, and 21). In Iraq, a trend is developing in the community to reduce salt intake which in turn may contribute to a reduction in prevalence of osteoporosis. The risk of osteoporosis increased with increasing caffeine consumption through coffee and caffeinated drinks which is consistent with the result of a cohort study conducted on postmenopausal women, which revealed a statistically significant association between increasing intake of caffeinated drinks and decreasing BMD (13). Another cross-sectional study conducted on women aged 65-77 years showed the same result (14). Consumption of legumes was not significantly associated with osteoporosis. Until recently there had been no

definitive information indicating that legumes affect bone density. Studies on rats suggest that consumption of legumes has a positive effect on bone mass (22). there was no statistically significant association between wheat bran consumption and osteoporosis, which is consistent with the results of another study conducted on 237 men and women aged 40-80 years who were supplemented with wheat bran fibers and had their BMD measured (12). No Statistically significant association was detected between high levels of meat consumption and bone loss, which is supported by the results of a study from California which revealed that increasing protein consumption was beneficial for bone health (23). The present study found that women consuming low or no meat were at a higher risk of osteoporosis, which is in agreement with the result of an observational study suggesting that greater dietary protein intake has a protective effect on bone health (9). The present study shows that a minimum intake level of fish might protect against bone loss and osteoporosis, although not statistically significant. The results of a cross-sectional study conducted on Chinese men found that fish consumption was positively significantly correlated with T score (11). Tea consumption was not associated with the status of bone mass which is in agreement with the result of another study which showed a small effect of tea drinking on bone density not altering the risk of fractures among the US postmenopausal women (24). Other authors documented a contradictory finding that regular tea drinking may reduce the risk of osteoporotic hip / femur fractures in middle-aged and elderly men (25). This difference might be attributed to cultural differences (time of taking tea in relation to meals, or with traditions of eating during tea time which might increase weight that is protective against osteoporosis). The present study revealed that increased (BMI) was positively correlated with bone density which is consistent with the results of a cross-sectional study on 649 Qatari women (26), and another case-control study conducted on Iraqi postmenopausal women(27). The current study found no statistical association between smoking and osteoporosis in contradiction to the results of many studies indicating that smoking is a major risk factor for low BMD and future fractures (28, 29, and 16).

Conclusion:

Excessive consumption of salty foods and caffeinated beverages were negatively associated with BMD and may be determinants of osteoporosis among the groups of Iraqi women studied.

Author's contributions:

Dr. May Fawzi Saleh: study conception, study design, data collection and analysis, interpretation, drafting of manuscript.

Dr. Ammar Hussein Ahmed: help in data collection and providing of ultrasound machine for BMD measuring.

Prof. Jawad k. Al- Diwan: supervisor.

References:

- 1- Rachner TD, Khosla S, Hofbauer LC. Osteoporosis: Now and the future. *National library of medicine*. 2011; 377: 1276–87.
- 2- Black DM. Epidemiology of Fractures and Assessment of Fracture Risk Clinics in laboratory medicine 2000;20: 439-454.
- 3- Tai TH. Serum IL-17 and postmenopausal osteoporosis. *J Fac Med Baghdad* 2015; Vol. 57, No.4.
- 4- Al-Hafidh AH, Al-Ani GTS, Isho F. Prevalence of Osteoporosis and Osteopenia in Iraqi Premenopausal and Postmenopausal Subjects among a Sample of Patients Attending Baghdad Teaching Hospital. *Journal of Global Pharma Technology*;2019;10:27-32
- 5- Jones G, Beard T, Parameswaran V, Greenaway T, von Witt R. A population-based study of the relationship between salt intake, bone resorption and bone mass. *Eur J Clin Nutr*. 1997;51:561–565. [PubMed].
- 6- Kim OH, Booth CJ, Choi HS, Lee J, Kang J, Hur J. et al. High-phytate/low-calcium diet is a risk factor for crystal nephropathies, renal phosphate wasting and bone loss. *eLife* ,National library of medicine.2020; 9:e52709.
- 7- Kerstetter JE, O'Brien KO, Insogna KL. Dietary protein, calcium metabolism, and skeletal homeostasis. *The American Journal of Clinical Nutrition* 2003;78: 584S–592s.
- 8- Philippi JB. Dietary Protein: An Essential Nutrient for Bone Health. *J Am Coll Nutr*. 2005;24:526S-536S.
- 9- Hannan MT, Tucker KL, Dawson-Hughes B, Cupples LA, Felson DT, Kiel DP. Effect of dietary protein on bone loss in elderly men and women: The Framingham Osteoporosis Study. *J Bone Miner Res*. 2000;15:2504–2512. [PubMed]
- 10- Eunjin Ch, Youngsoon P. The Association between the Consumption of Fish/Shellfish and the Risk of Osteoporosis in Men and Postmenopausal Women Aged 50 Years or Older. *Nutrients* 2016; 8:113.
- 11- Li X, Lei T, Tang Z, Dong J. Analyzing the association between fish consumption and osteoporosis in a sample of Chinese men. *Journal of health population nutrition* 2017;36:13.
- 12- Chen Z, Stini WA, Marshall JR, Martínez ME, Jose. M, Roe D, et al. Wheat bran fiber supplementation and bone loss among older people 2004;20:747-751.
- 13- Barrett E, Chang JC, Edelstein SL. Coffee-Associated Osteoporosis Offset by Daily Milk Consumption. *JAMA*.1994;271:280-283.
- 14- Rapuri PB, Gallagher JC, Kinyamu HK, Ryschon KL. Caffeine intake increases the rate of bone loss in elderly women and interacts with vitamin D receptor genotypes. *The American Journal of Clinical Nutrition* 2001;74:694–700.
- 15- Fung TT, Arasaratnam MH, Grodstein F, Katz JN, Rosner B, Willett WC, et al. Soda consumption and risk of hip fractures in postmenopausal women in the Nurses' Health Study. *The American Journal of Clinical Nutrition* 2014; 100 :953-8.
- 16- Yoon V, Maalouf NM, Sakhaee K. The effect of smoking on bone metabolism. *Osteoporosis international*. 2012;23:2081-2092.
- 17- Chin KY and Soelaiman IN. Calcaneal Quantitative Ultrasound as a Determinant of Bone Health Status: What Properties of Bone Does It Reflect? *International J Med Sci*. 2013;10(12): 1778–1783.
- 18- Report of a WHO Study Group: Assessment of fracture risk and its application to screening for postmenopausal osteoporosis. *World Health Organization*. Geneva, 1994 (WHO Technical Report Series, No. 843).
- 19- Sarić M, Piasek M. Effects of sodium chloride on bone health. *Arh Hig Rada Toksikol*. 2005 Mar; 56(1):39-44.
- 20- Nordin BE, Need AG, Morris HA, Horowitz M. The nature and significance of the relationship between urinary sodium and urinary calcium in women. *J Nutr*. 1993;123:1615–1622. [PubMed]
- 21- Caudarella R, Vescini F, Rizzoli E, Francucci CM. Salt intake, hypertension, and osteoporosis. *J Endocrinol Invest*. 2009;32 (4 Suppl):15-20.
- 22- Park Y, Moon HJ, Paik DJ, Kim DY. Effect of dietary legumes on bone-specific gene expression in ovariectomized rats, *Nutr Res Pract*. 2013 ; 7:185–191.
- 23- Promislow JHE, Goodman-Gruen D, Slymen DJ, Barrett-Connor E. Protein Consumption and Bone Mineral Density in the Elderly: The Rancho Bernardo Study. *American Journal of Epidemiology* 2002;155: 636–644.
- 24- Chen Z, Pettinger MB, Ritenbaugh C. Habitual tea consumption and risk of osteoporosis: A prospective study in the women's health initiative observational cohort. *Am J Epidemiol* 2003;158:772–81.
- 25- Huang C, Tang R. Tea drinking habits and osteoporotic hip/femur fractures: A case-control study. *Pak J Med Sci* 2016;32:408–12.
- 26- Migliaccio S, Greco EA, Fornari R, Donini LM, Lenzi A. Is obesity in women protective against osteoporosis? *Diabetes Metab Syndr Obes*. 2011;4:273-282.
- 27- Al-Habbo DJS, Saeed IE, Al-Obaidy WAK. Association between obesity and osteoporosis. *Iraqi medical Journal*. 2018;64:2.
- 28- Iki M. Osteoporosis and smoking. *Clinical Calcium*. 2005 Jul;15(7):156-158.
- 29- Kyae H. K. The Effect of Smoking on Bone Health. *Journal of the Korean Society for Research on Nicotine and Tobacco* 2013;4:20-27.

العلاقات المحتملة لمواد غذائية مختارة بهشاشة العظام بين مجموعة من النساء العراقيات

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الخلاصة:

الخلفية: يعتبر مرض هشاشة العظام من المشاكل الصحية العالمية التي تصيب ما يقارب 200 مليون شخص في العالم خاصة النساء في فترة إنقطاع الطمث. يتصف المرض بقلة كثافة العظم مما يؤدي الى ضعفه و زيادة خطر حدوث الكسور.

الهدف: أجري هذا البحث لدراسة بعض الاغذية غير المناسبة لصحة العظم وعلاقتها بحدوث مرض هشاشة العظام لدى مجموعة من النساء العراقيات. **الحالات و المنهجية:** شملت الدراسة (الحالات و الشواهد) 140 أنثى تتراوح أعمارهن من 40 سنة فما فوق ممن يراجعن المجمعيات الطبية في منطقته الدورة للفترة من 18 كانون الثاني الى 24 نيسان 2021. وقد تم إجراء فحص كثافة عظم الكاحل بواسطة جهاز قياس هشاشة العظام وترجمت النتائج باستخدام الإنحراف المعياري لكثافة العظام .

النتائج: بينت الدراسة أن 74 (52.5 %) من العدد الكلي للعينة لديهم هشاشة العظام. وأن هناك تأثير كبير لاستهلاك نسبة عالية من الملح والقهوة على حدوث المرض (77.3%, 83.3%).

كذلك وجد أن النساء اللاتي يستهلكن المشروبات التي تحتوي على كمية كبيرة من الكافيين (الببسي والكولا) لديهن نقص في كثافة العظام مقارنة بالنساء اللاتي لا يستهلكن المشروبات التي تحتوي عليها (100% , 21.8%).

الاستنتاج : الاستهلاك الكبير للملح والمشروبات التي تحتوي على الكافيين لها تأثير سلبي على كثافة العظم وبالتالي حدوث مرض هشاشة العظام لدى النساء العراقيات.

مفتاح الكلمات: هشاشة العظام , كثافة العظم , الملح , الكافيين.