PJN
ISSN 1680-5194

PAKISTAN JOURNAL OF NUTRITION

ANSInet
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan
Mob: +92 300 3008585, Fax: +92 41 8815544
E-mail: editorpjn@gmail.com

Pakistan Journal of Nutrition 8 (3): 218-221, 2009
ISSN 1680-5194

Nutrient Intakes Affecting Bone Formation Compared with Dietary Reference Intake (DRI) in Sabzevar Elderly Subjects

Akram Kooshki[1] and Mehdi Golafrooz[2]
[1]Department of Basic Sciences, [2]Department of Nursing,
Faculty Member of Sabzevar University Medical Sciences, Sabzevar, Iran

Abstract: Nutrition is an important and modifiable factor in growth and preservation of bone was as well as prevention of osteoporosis. This research was conducted to survey the status of nutrient affecting bone formation with reference to DRI. This descriptive - analytical study was conducted on 100 healthy elderly subjects in Sabzevar, Iran.Their weight and height were measured and 24 hour recall of nutritional intake were filled out in 3 successive days. All food were encoded in food processor software to assess the amount of nutrients. One - sample t - test, independent sample t - test and descriptive statistics were used in SPSS for data analysis. Fifty one men and and fourty nine women participated in the study; their mean age were 69.82± 6.87 and 67.34± 5.62 and their BMI were 22.92±3.16 and 22.19 ± 3.43 kg/m^2 respectively. Nutritional intake of PUFA, vitamins C, K, E, D and as well as mineral such as Ca, P, Mg, K, Zn, and Cu were less than DRI standards (p= 0.0001) while protein and Fe intake were higher (p=0.0001). Also, a significant difference was found between men and women in their intake of PUFA (p=0.04) and protein (p=0.03). The findings revealed that the intake of most nutrients, with the exception of sodium, iron and protein, is less than DRI standards in the elderly subjects. Therefore, they are recommended to protect themselves against bone loss to some extent by a diet of food variety, fruit, vegetables, and low-fat dairy products that are rich in bone-forming nutrients.

Key words: Nutrition, bone formation, nutrient intake, Sabzevar

Introduction

The world population is currently so increasing in size and age that it is called the century of the aged. According to WHO statistics, 900 million men and women of above 65 years old will be living in the world by, 2050. However, the elderly population growth does not only involve developed countries as it is estimated that 72% of the elderly will be living in developing countries by 2050.(Mahan and Escott-Stump, 2004). Therefore, it is vitally important to study the problems of this target group. One of the threatening factors of this group, which is also of high prevalence, have been osteoporosis and loss of bone mass. (Nieves and Osteoporosis, 2005) .

Osteoporosis, along with cancer, cardiac arrestand stroke, has been announced by WHO as four major threats for human life and its annual mortality rate has been still higher than cancer. Recently, the association of bone mass loss and loss of survival has been noticed as shortest life span has been observed in men and women with lowest bone mass density; accordingly, it is considered now as a better predictor of death than blood pressure and cholesterol (Jamshidion and Azadbazht, 2000).

Osteoporosis etiology is complex but nutrition is considered as one of the most important and modifiable elements in the growth and preservation of bone mass and in the prevention of osteoporosis. Numerous studies have indicated that adequate nutrition can cause increase bone mass in youth and reduce the bone loss rate in menopause and the prevent osteoporosis in the elderly (Tamaki and Ikim, 2005).

In addition to calcium and vitamin D, the role of proteins, PUFA, fiber, magnesium, Fluor, Copper, iron, zinc, buron and vitamins A, E, K and C in the bone health have also been surveyed (Nieves and Osteoporosis, 2005; Miggiano and Gagliardi, 2005; Tamaki and Ikim, 2005; Macdonald *et al*., 2005; Mccabe *et al*., 2004; Macdonald *et al*., 2004). As no comprehensive study including all nutrients has not been conducted in Iran, we carried out this descriptive analytical study to study the nutritional status of nutrients affecting bone formation in Sabzevar elderly population and its comparison with DRI.

Materials and Methods

This descriptive analytical study was conducted on health elderly subject from Sabsevar, Iran, who were selected through cluster sampling from all over the city including all areas. Statistician co-researcher supervised the whole sampling and data analysis procedures. The subjects were interviewed in private face-to-face meetings by trained interviewers who used an already pre-tested and verified questionnaire. Personal information including age, gender and so on were first recorded; the weight and height were recorded using a digital scale and tape meter under standard

instructions and minimum clothing and accuracy of 100gram and 1cm respectively. BMI was calculated by weight (kg) divided by square height (m). Required data of nutritional intake were obtained from subjects by 24-hour recall of food in three successive days and food frequency questionnaires (FFQ); they were requested to remember and tell the researcher all foods and drinks taken during the last 24 hours.

To help the subjects easily remember and recall the amount of foods taken, familiar scales and cutlery as used at home were given; the expressed amounts were transformed into gram units using household guide to measures (Ghafarpour *et al.*, 1999). Then, each food was encoded in food processor software and given to FD software to assess the amount of nutrients. However, as vitamins k and D are not taken into consideration in this software, their intake rates were calculated according to what is published in the appendix of Mahan K. Descriptive statistics and one-sample t-test (to be compared with DRI) and independent sample t-test (to be compared with the intake of nutrients between men and women) were used in SPSS for data analysis.

Results

This study was conducted on 100 elderly subjects (49 female and 51 Male) with mean age of 67.34±5.62 and 69.82±6.87 years and BMI 22.19±3.43 and 22.92±3.16kg/m^2 respectively. The intake of nutrients effective in bone formation with reference to DRI has been reported in Table 1 (for men) and Table 2 (for women). As represented in the tables, the intake of all nutrients except for sodium, iron and protein have been less than DRI standards ($p = 0.0001$). The comparison of nutrients in men and women revealed a statistically significant difference between the two groups as for their intake of protein ($p = 0.03$) and PUFA unsaturated fatty acids ($p = 0.04$). However, no such difference was observed in the intake of their nutrients ($P>0.05$).

Discussion

Limited knowledge is available on the role of nutrition on the bone health. A based studies focus on calcium and vitamin D while other nutrients being overlooked (Robins and New, 1997). Therefore in this study we concentrated on nutrients intake affecting bone formation in elderly subjects from Sabzevar, Iran. Studies suggest that, in addition to calcium, phosphorus, vitamin D, magnesium, zinc, Copper, iron, potassium, flour, vitamin A, K and C, (Mahan and Escott-Stump, 2004). non-saturated fatty acids and vitamin E. (Macdonald *et al.*, 2004) are effective in bone formation. Probable role of calcium, phosphorus and vitamin D in the formation of hydroxyapatite crystals and bone mineralization is considered and verified in all studies (New *et al.*, 2000). Over 50% of magnesium exist in bone tissues and low intake of magnesium is associated with vertebral BMD reduction in menopausal women (Mahan and Escott-Stump, 2004). Lack of magnesium is probably responsible for transferring potassium ions into the skeletal bones in exchange for hydrogen ions, interfering with the ATPase enzyme activity, because pH imbalance is accompanied with an increase in bone resorption by regulating alkaline-acid balance, reduction of urinary calcium and reduction of bone resorption (New *et al.*, 2000; Demigne *et al.*, 2004). Causing urinary calcium discharge, sodium brings about osteoporosis in low-calcium diets (Mahan *et al.*, 2004; Miggiano and Gagliardi, 2005). In a cross sectional study, New and colleagues reported that adequate intake of zinc, magnesium, potassium and vitamin C are associated with higher bone mass in elderly menopausal subjects (New *et al.*, 1997). Zinc is essential for osteoblast enzymes that are involved in collagen formation. Moreover, phosphatase alkaline (an important osteoblast enzyme) requires zinc for activation. Also, iron and Copper are necessary for collagen hydroxylation. Iron, furthermore, is required in oxidative phosphorylation of osteoblasts and osteoclasts as well as in the normal bone activity. (Mahan, and Escott-Stump, 2004). Vitamin C has a role in bone formation due to hydroxylation of proline and lysine, which are also involved in bone formation; also, due to its oxidative function protecting the tissues from harmful free radicals; however, few studies have approved this effect. Vitamin C is related with deoxypyridinolin discharge, which is a metabolite rendered from lazily disintegration (Mahan,and Escott-Stump, 2004). Vitamin A is necessary for bone growth and preservation (Miggiano and Gagliardi, 2005; Tamaki and Ikim, 2005; Mahan and Escott-Stump, 2004). Recent studies suggest that excessive use of retinol is related with fractures (Feskainich, 2002). Vitamin K is necessary for osteocalcine formation of bone matrix of proteins since it is the co-enzyme for carboxylase essential in the formation of these proteins and about 50% of elderly people have insufficient intake of green vegetables (Mahan, and Escott-Stump, 2004). Fatty acids omega-3 may cause down-regulation of pre-inflammatory cytokines and reduce loss bone mass by reducing the osteoclast activation and bone resorption (Miggiano and Gagliardi, 2005). The effect of proteins on bones is not verified. Arjmandi *et al.* (2005) pointed out that daily intake of daily 25gram supplementary proteins positively affected bone formation. However, this amount is not totally capable of preventing bone loss in menopausal women (Arjmandi *et al.*, 2005). In the present study, high intake of protein and iron were due to animal protein and red meat, in particular, which is itself a risk factor in the aggravation of bone loss. Over intakes of animal protein is caused increase excretion urinary calcium (Robins

Table 1: Bone- related nutrients intake in elderly men comparison to dietary reference intake (DRI)

Nutrient	Mean±SD	Mean difference from DRI	P-Value
Protein(gr)	84.65±37.59	28.65	0.0001
PUFA(gr)	10.96±15.03	-13.03	0.0001
Fiber(gr)	5.65±3.11	-24.34	0.0001
Vitamin A (mcg)	137.11±162.19	-762.88	0.0001
Vitamin E (mg)	2.86±3.72	-12.13	0.0001
Vitamin D (mcg)	2.90±1.70	-2.1	0.0001
Vitamin K (mcg)	75.30±50.28	-44.70	0.0001
Vitamin C (mg)	35.08±50.22	-54.91	0.0001
Calcium (mg)	540.15±529.04	-659.84	0.0001
Phosphorus (mg)	378.25±256.55	-321.74	0.0001
Magnesium (mg)	93.77±72.08	-326.22	0.0001
Potassium (mg)	1295.08±337.86	-704.91	0.0001
Sodium (mg)	3993.55±1197	993.45	0.0001
Iron (mg)	18.28±14.21	10.28	0.0001
Zine (mg)	3.80±2.63	-7.19	0.0001
Copper (mcg)	0.61±0.59	-88-99.38	0.0001

Table 2: Bone- related nutrients intake in elderly women comparison to dietary reference intake (DRI)

Nutrient	Mean±SD	Mean difference from DRI	P-Value
Protein (gr)	69.56±32.64	23.56	0.0001
PUFA (gr)	6.30±7.08	-15.69	0.0001
Fiber (gr)	6.57±4.49	-14.42	0.0001
Vitamin A (mcg)	110.28±122.44	-589.71	0.0001
Vitamin E (mg)	2.7±3.42	-12.28	0.0001
Vitamin D (mcg)	3.50±2.20	-1.50	0.0001
Vitamin K (mcg)	65.10±55.20	-34.90	0.0001
Vitamin C (mg)	34.07±41.55	-40.92	0.0001
Calcium (mg)	511.12±281.17	-688.87	0.0001
Phosphorus (mg)	369.73±235.39	-330.26	0.0001
Magnesium (mg)	101.61±78.59	-218.38	0.0001
Potassium (mg)	1205.40±735.36	-794.59	0.0001
Sodium (mg)	3947.34±1459.72	943.76	0.0001
Iron (mg)	16.43±9.65	8.43	0.0001
Zine (mg)	3.32±2.06	-4.67	0.0001
Copper (mcg)	0.65±0.70	-899.34	0.0001

and New, 1997). In our study, the intake of all nutrients were less than DRI except for iron and protein, which is indeed consistent with most other studies (Mahan and Escott-Stump, 2004; Nieves and Osteoporosis, 2005; Jamshidion and Azadbazht, 2000; Macdonald *et al*., 2005; Mccabe *et al*., 2004; New *et al*., 2000). Food frequency questionnaires elderly subjects in Sabzevar indicated that most of them did not consume adequate amounts of fruit, vegetables, dairy products and fish in their diet and even some of them suffered from low-nutrient (less than 1000Kcal daily) foods and preferred watery and less nutritious foods. Loneliness, financial dependence, disability and bad dental quality were some of the effective factors in the nutrition inadequacy of them. It is to be admitted that low-nutrient diets in elderly people will be followed by the deficiency of nutrients which are directly or indirectly involved in the formation and preservation of bone mass. Therefore, this group must be under special care by the family and the government as the high costs of disability and treatment of osteoporosis will impose a heavy burden on the community.

Conclusion: The finding revealed that in the elderly population of Sabzevar, the intake of all nutrition, essential in bone formation, are less than standard except for iron and protein and this aggravates bone loss and osteoporosis. As chances of osteoporosis in women are four times more than men, elderly subjects, especially women, are advised to include abundant fruit, vegetables and dairy products that are rich in nutrient contribution to bone improvement. Also, low consumption of animal products especially red meat is stressed.

Acknowledgment

The authors would like to thank Mr. Nematullah Shomoossi for his help and Reviewing this article.

Refrences

Arjmandi, B.H., E.A. Lucas and D.A. Khalil, 2005. One year soy protein supplementation has positive effects on bone formation markers but not bone density in post menopounsal women. Nutr. J., 4: 8.

Demigne, C., H. Sabboh, C. Remesy and P. Meneton, 2004. Protective effects of high dietary potassium: nutritional and metabolic aspects. J. Nutr., 134: 2903-2906.

Feskainich, D., 2002. Vitamin A intake and hip fractures among post menopouse woen. Jama, 287: 47.

Ghafarpour, M., A. Hoshyard and H. Kianfar, 1999. Guidline of domestic scales,coefficient conversaion and edible percent of food. Agri. Sci., Tehran.

Jamshidion Tehrani, M. and L. Azadbazht Elderly, 2000. Osteoporosis and Nutriton. Proceeding of the 5th Iranian congress. Tehran, 258-266.

Miggiano, G.A. and I. Gagliardi, 2005. Diet, Nutrition and Bone health. Clin. Tre., 156: 47-56.

Macdonald, H.M., S.A. New, W.D. Fraser and M.K. Campbell, 2005. Low dietary potassium intake and high dietary estimates of net endogenous acid production are associated with low bone mineral density in premenopausal women and increased markers of bone resorption in postmenopausal women. Am. J. Clin. Nutr., 81: 923-933.

Macdonald, H.M., S.A. New and M.H.N. Golden, 2004 Nutritional associations with bone loss during menopausal transition: evidence of a beneficial effect of calcium, alcohol and fruits and vegetable nutrient and of a determinal effect of fatty acids. Am. I. Clin. Nutr., 79: 155-165.

Mahan, K. and S. Escott-Stump, 2004. Krauses food, nutrition diet therapy. 11th, Saunders Company, Philadelphia,: 650-654.

Mccabe, L.D., B.R. Martin and G.P. Mccab, 2004. Dairy affect bone density in the elderly. Am. J. Clin. Nutr., 80: 1066-1074.

New, S.A., S.P. Robins and M.K. Campbelll, 2000. Dietary influences on bone mass and bone metabolism: further evidence of a positive link between fruit and vegetable consumption and bone health. Am. J. Clin. Nutr. 71: 142-151.

New, S.A., C. Balton-Smith, D.A. Grabb and D.M. Reid, 1997. Nutritional influences on bon mineral density: a cross-sectional study in premenopousal women. Am. J. Clin. Nutr., 65: 1831-1839.

Nieves, J.W. Osteoporosis, 2005. The role of micronutrients. Am. J. Clin. Nutr., 81: 1232.

Robins, S.P. and S.A. New, 1997. Marker of bone metabolism. Pro. Natr. Soc., 56: 977-987.

Tamaki J. Ikim, 2005. Evidence-based, best-practice guildelines for primary prevention of osteoporotic fractures. Clin. Calcium, 15: 1312-8.