Salt and osteoporosis / CASH.

Published January 2010

Salt and Osteoporosis

Introduction

Osteoporosis is a condition involving the thinning of bones (bone demineralisation), leaving them brittle and more susceptible to fracture. 99% of calcium is stored in the bones, so sufficient calcium is therefore important in order to maintain or reach peak bone mass (PBM).

In the UK, an estimated 3 million people are suffering from osteoporosis, with 1 in 2 women and 1 in 3 men over 50 years old breaking a bone at least once, mainly due to poor bone health. Each month, 1,150 people die as a result of a hip fracture. Osteoporosis mainly effects the older population, with 19.8 million people over the age of 50 in the UK. Since the 1960's there has been a 7 times increase in the number of osteoporosis cases. Each year osteoporosis costs the NHS approximately 2.3 billion pounds (1).

How does Salt Contribute?

Studies dating back to the 1980's have found possible links between salt intake and urinary calcium (Ca) excretion. A high salt intake increases calcium losses in the urine (calciuria), some of which will be directly from the bones. One study found that for each 100mmol increase in salt intake, urinary Ca is increased by 1.4mmol (2, 3). If this loss is assumed to be from the bone, then this equates to about 1% extra loss of bone/year (*4*). Over extended periods would lead to the weakening of bones and ultimately osteoporosis.

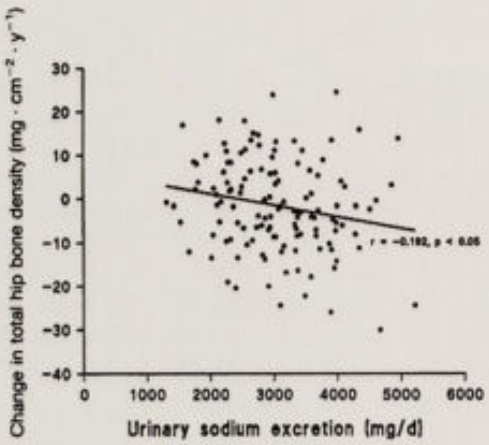

Fig. 1. Source: Devine et al, 1995

Both epidemiological studies and randomised trials have shown that a decrease in salt intake reduces urinary calcium excretion. A study in post-menopausal women showed that the loss of hip bone density over 2 years was related to 24-hour urinary sodium at entry to the study, and was as strong as that relating to calcium intake. It was calculated that a reduction in salt intake from 10 to 5 g/day would have the same effect on hip bone density as an increase in calcium intake of 1000mg/day, a difficult amount to achieve without resorting to supplements (Fig 1. *6*). Another study has suggested that in postmenopausal women with a sodium intake of more than or equal to 3.4g/day (8.5g salt), a reduction in salt intake would benefit their bone health (7).

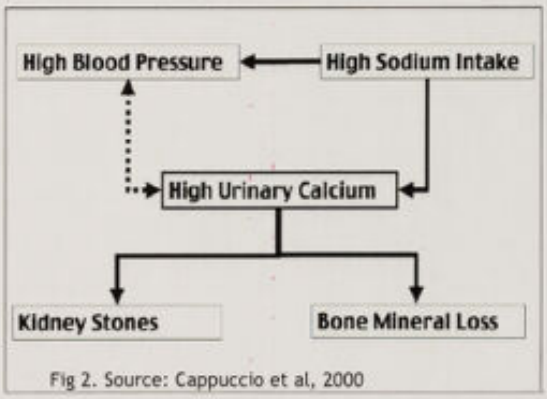

Fig 2. Source: Cappuccio et al, 2000

Blood Pressure, Osteoporosis and Kidney Stones

Salt intake and blood pressure are strongly linked, and it is also believed that patients with high blood pressure excrete more calcium in the urine and are, therefore, at higher risk of osteoporosis and kidney stones. Recently, *Woo et al (2009)* showed sodium to be a major linking factor between blood pressure and osteoporosis. The authors found that hip and spine Bone Mass Density (BMD) were inversely correlated with a higher sodium excretion, i.e. the higher the salt intake,

the lower the BMD. They concluded that the increase in calcium excretion is obligatory as a result of the increased sodium in the diet (Fig 2). *Blackwood et al, 2001* showed that a 20mmHg increase in BP is associated with 0.28mmol/day increase in Urinary Ca.

Who is at risk?

The older population are more at risk of osteoporosis because bones naturally become thinner as we get older. Post-menopausal women are particularly at risk of osteoporosis because of the decrease in the female hormone, oestrogen. Those with higher salt intakes are increasing the amount of bone demineralisation that takes place.

Studies have also demonstrated that there is a correlation between salt intake and calcium excretion in young and adolescent girls. It has been suggested that this may result in a reduced peak bone mass, which would increase the risk of osteoporosis later in life. Consuming a low salt diet during adolescent years may therefore be important, to reduce the risk of osteoporosis later in life.

Current Salt Intake & Dietary Advice

Almost everyone in the UK (and the rest of the Western world) eats too much salt. The daily recommended amount in the UK is no more than 6 grams a day, the current average salt intake is 8.6g salt a day although many people are eating more than this.

People with or considered at risk of osteoporosis should ensure that they keep their salt intake below the recommended maximum of 6g. This can be achieved by simple changes, such as consuming less processed foods and checking product labels before purchase. Consuming low salt dairy products such as milk will also help maintain bone mass. Caffeine and fizzy drinks are thought to reduce bone mass, and therefore should be kept to a minimum. An increase in Vitamin D, Zinc and Copper may also be of help (13).

For more information and advice on how to reduce your salt intake, please visit our website www.actiononhealth.org.uk

References

(1) National Osteoporosis Society Figures, 2009. http://www.nos.org.uk/NetCommunity/admin/Document.Doc?id=47 [accessed 04/09/09]
(2) Ho SC, Chen Y-M, Woo JLF, Leung SSF, Lam TH, Janus ED. Sodium is the leading dietary factor associated wih urinary calcium excretion in Hong Kong chinese adults. Osteoporosis International. 2001;12:723-731
(3) Nordin CBE, Need AG, Morris HA. Horowitz M. The nature and significance of the relationship between urinary sodium and urinary calcium in women. The Journal of Nutrition. 1993;123:1615-1622
(4) Evans CEL, Chughtai AY, Blumsohn A, Giles M, Eastell R. The effect of dietary sodium on calcium metabolism in premenopausal and postmenopausal women, European Journal of Clinical Nutrition. 1997;51:394-399. (review article)
(5) He 2010
(6) Devine A, Criddle RA, Dick IM, et al: A longitudinal study of the effect of sodium and calcium intakes on regional bone density in postmenopausal women. Am J Clin Nutr 62:740-745, 1995.
(7) Carbone LD, Barrow KD, Bush AJ, Boatright MD, Michelson JA, Pitts KA, Pintea VN, Kang AH, Watsky MA. Effects of a low sodium diet on bone metabolism. J Bone Miner Metab. 2005. 23(6). 506-13

(8) Woo J, Kwok T, Leung J, Tang N. Dietary intake, blood pressure and osteoporosis. Journal of Human Hypertension. 2009; 23:451-455

(9) Blackwood Am, Sagnella GA, Cook DG and Cappuccio FP. Urinary calcium excretion, sodium intake, and blood pressure in a multi-ethnic population: results of the Wandsworth Heart and Stroke Study. Journal of Human Hypertension. 2001;15:229-237

(10) Cappuccio FP, Meilahn E, Zmuda JM, Cauley JA. High Blood Pressure and bone-mineral loss in elderly white women: a prospective study. The Lancet. 1999;354:971-75

(11) Matkovic V, Ilich JZ, Andon MB, Hseih LC, Tzagournis MA. Urinary calcium, sodium and bone mass of young females. American Journal of Clinical Nutrition. 1995. 62:417-425
(12) O'Brien KO, Abrams SA, Stuff JE, Liang LK, Welch TR. Variables related to urinary calcium excretion in young girls. Journal of pediatric gastroenterology and nutrition. 1996;23(6):8-12
(13) National Osteoporosis Society (2008) Healthy Bones - facts about food. http://www.nos.org.uk/NetCommunity/Document.doc?id=395 [accessed 04/10/2009]

For further information contact CASH
Email cash@qmul.ac.uk
Website www.actiononsalt.org.uk