World Congress on Osteoporosis in Florence
Plant-based diets and bone health

Report by Hans Kraak, nutritionist/journalist, The Netherlands

Osteoporosis is a growing European epidemic that is reducing life expectancy and placing a huge burden on health care costs. Scientists concur that the role of exercise and diet – especially vitamin D, calcium and protein are critical for bone health throughout the lifecycle and a more plant-based eating approach may offer additional benefits. Osteoporosis expert, professor René Rizzoli, chaired the Alpro Foundation sponsored Satellite symposium – *Plant-based diets and bone health* at the World Congress on Osteoporosis which took place in Florence, Italy between 5th and 8th May 2010. The following article summarises the proceedings of the symposium where five leading experts examined the scientific evidence for plant-based eating and bone health.

In Europe, a bone fracture occurs every thirty seconds as a consequence of osteoporosis (see figure), which hugely impacts on quality of life and health care costs. The incidence of osteoporotic fractures is forecast to rise further in the future. Professor Jean-Yves Réginster, *Professor of epidemiology at the University of Liege and President of the European Society for Clinical and Economic Aspects of Osteoporosis and Osteoarthritis*, highlighted the fact that for women, the risk of death from hip fractures is as great as the risk of death from breast cancer. There are now more women over 45 years being treated in hospital for osteoporotic fractures than for heart attacks or breast cancer. Despite the fact that most women understand the seriousness of osteoporosis, 8 out of 10 are not aware that they are at risk.

Prof. Réginster focused on the good news! Osteoporosis can to some extent be prevented by optimising peak bone mass (PBM). PBM can be measured by relatively simple means, and poor PBM can be treated. Dietary intervention for optimizing PBM and helping to prevent osteoporotic fractures should focus on the correct balance of proteins, calcium and vitamin D. A higher intake of protein is associated with a higher bone density for women as they grow older whilst higher calcium and vitamin D intakes are associated with reduced bone fracture risk.

Do vegetarians have a normal bone mass?

Dr. Susan Lanham-New, University of Surrey, began her presentation by commenting on a recent study which claimed that vegetarians have a lower bone density compared to those following an omnivorous diet and highlighted that the differences between groups were too small to be of clinical significance and stated, "*vegetarianism does not put you at risk of osteoporotic bone fractures and many vegetables and fruit are alkali-rich and provide countless micronutrients (such as vitamin K). It is plausible that they have an effect on bone tissue*."

Dr. Lanham-New, continued to review the growing body of evidence demonstrating that vegetable and fruit intakes have a positive effect on bone health and investigated the continuing debate with regard to the best protein source for bone health – animal vs. plant.

Although the mechanisms remains unclear, it is thought that plant-based diets impact on bone health occurs by maintaining the body's acid-base balance. An imbalance towards a more acid environment results in active bone resorption to release calcium and a consequent loss of bone tissue. Therefore, foods which increase the body's acid environment would exacerbate bone calcium losses compared to food that can reduce the acidity (alkaline foods).

All speakers concurred that although animal proteins do have an acidic effect, it is important to remember that so do some vegetables.

Soya Foods and Bone Health

The American researcher, Amy Lanou – University of North Carolina-Asheville – explored the evidence for soya food and bone health. Numerous Asian epidemiological studies demonstrate a higher bone density in Chinese and Japanese women with higher soya intakes when compared to those with low intakes. A long-term Chinese population study associated higher soya intakes with a lower risk of bone fractures in women, but not in men. Interestingly, the studies which show no correlation between soya intake and bone health have mainly been conducted in population groups who's soya intake is extremely low e.g. in Europe and the United States. Lanou went on to investigate which component within soya is responsible for bone benefits – soya protein, soya isoflavones or something else?

It is generally accepted that osteoporosis in women is exacerbated by falling levels of oestrogen during the menopause. Due to the similarity in chemical structure of soya isoflavones to oestrogen and their ability to attach to beta oestrogen receptors found on bone tissue, isoflavones are often seen as the bone beneficial component of soya. Unfortunately, randomised controlled trials using isoflavones supplements have demonstrated mixed findings.

Some studies associate animal and dairy protein rich diets with higher calcium excretion whilst soya protein-rich diets are associated with lower calcium excretion. Studies have also demonstrated 50-70% lower osteoporotic fracture rates in Asian populations regularly consuming soya foods compared to European and US populations. Lanou emphasised that the intake of calcium alone or other single nutrients does not contribute to a reduction in osteoporosis and that research needs to focus on the interaction between various dietary components rather than the single component. With regard to soya foods, Lanou feels the evidence strongly indicates that soya foods, as an integral part of a diet with various plant-based components and a limited amount of animal-based foods are essential for optimal bone health.

Bone health during the menopause

Dr. Bess Dawson-Hughes – Bone Metabolism Laboratory, Tufts University Boston, USA – focused on bone health during the menopause and begun by pointing out that bone calcium absorption did not only fall significantly in post-menopausal women but that the same pattern is observed in men in their fifties. This does highlight that menopause alone and the consequent drop in oestrogen is not be the only trigger for an increased risk of osteoporosis.

Dawson-Hughes stressed that calcium intake alone does not lead to maximum bone density. Studies show that calcium intakes do increase calcium accumulation in bone but have little or no effect on calcium loss.

The body's acid-balance also changes with aging towards a more acid environment with the diminishing function of the kidneys. The intake of non-acid-producing foods, such as fruit and vegetables, is often too low to neutralise the acidity that contributes to bone loss. A recent study with women over fifty (post-menopausal), who were given alkali (bicarbonate) over a period of three months, showed a beneficial effect on bone tissue retention, however, the long-term effect has yet to be investigated.

Bone health dietary recommendations around the globe

Professor Jean-Philippe Bonjour of the University of Geneva highlighted the importance of reaching the highest possible PBM (see figure) if we are to reduce the osteoporotic epidemic in Europe. This is not only influenced by diet, but also by genetic factors, hormones and exercise. For children between 3 and 5 years, calcium absorption is maximised with exercise. Prof. Bonjour comments that as far as diet is concerned, it is not so much the type of food that is important, but the nutrients they provide, such as vitamin D, calcium and the right proteins. In view of the complexity of the interaction of all the factors influencing PBM, it is difficult to come to a global consensus on exact recommendations for specific nutrient intakes. This is highlighted by the huge discrepancies around the world with regard to calcium dietary recommendations.

Dietary consensus around the world does exist with regard to the importance of consuming adequate protein and calcium for optimizing PBM and maintaining better bone health throughout the lifecycle.

Conclusion

René Rizzoli brought the symposium to a close by highlighting that there is still a need for more studies to unequivocally decide on global dietary recommendations for optimum bone health.

What is osteoporosis?

Bone tissue is metabolically active - old bone is constantly being removed and replaced with new bone tissue throughout the lifecycle. When the rate of bone loss exceeds the rate of bone formation, bone density decreases. This is the normal process that gradually occurs as we age leading to the bone becoming more porous due to the loss of minerals especially calcium which, in turn makes bones more brittle. Osteoporosis does not manifest itself until a fracture occurs, usually at the wrist or hip, or the spinal vertebrae gradually collapse. Bone density reaches its optimum around the age of thirty - known as the Peak Bone Mass (PBM) - after which bone mass slowly deteriorates. For some people this process will be a little quicker than for others. Post-menopausal women will suffer more loss of bone tissue as oestrogen levels drop.

There are various (medicinal) treatments for osteoporosis, but recent attention has focused on prevention where exercise and a varied diet with adequate protein, calcium and vitamin D are seen as key factors.