

Received: July 15, 2017  
Accepted: July 20, 2017  
Published: August 01, 2017

## The Role of Nutrition in The Treatment of Chronic Musculoskeletal Diseases

Szilvia Boros\*

Institute of Health Promotion & Sport Sciences, ELTE, Eötvös Loránd University, Hungary

\*Corresponding author: Dr. Szilvia Boros, Institute of Health Promotion & Sport Sciences, ELTE, Eötvös Loránd University, Hungary. E-mail: [mailto:szilviaboros@gmail.com](mailto:mailto:szilviaboros@gmail.com)

### 1 Editorial

Chronic musculoskeletal diseases demonstrate a high prevalence, especially amongst the older population [1]. Diet therapy might have several purposes in the treatment of chronic musculoskeletal diseases. It may play a role in the suppression of chronic inflammation and pain. Nutrition might be an aid in improving bone, cartilage structure and function, and in immune modulation as well [2].

Foods, herbs, spices, marine species, and biologically-active compounds may have impacts on musculoskeletal health [3]. Vegetarian, Mediterranean diet, and fasting may help in the improvement of chronic musculoskeletal disease conditions [4,5].

Amongst elderly populations, the proper consumption of those nutraceuticals that play a role in musculoskeletal health and cognitive function is essential. Sixteen different micronutrients can be characterized as having evidence-based scientifically beneficial effects on musculoskeletal health and cognitive function in the elderly, such as beta-alanine, calcium, creatine, fluorides, leucine, magnesium, omega-3 fatty acids, potassium, vitamin B6, vitamin B9, vitamin B12, vitamin C, vitamin D, vitamin E, vitamin K2, and zinc [3].

Rheumatoid arthritis and osteoarthritis have a different nutritional approach, due to the variety of disease causalities [4,6,7]. Whereas diet therapy of degenerative joint diseases is based on targeting and maintaining normal Body Mass Index, in rheumatoid arthritis nutritional intervention focuses on reducing symptoms and preventing disease progression. Vegetables, fruits, polyunsaturated fatty acids (n-3, n-6, n-9), vegetarian, Mediterranean diet, and food-supplementation might be essential [8].

In the 19th century, Jonathan Hutchinson was amongst those doctors who advised lifestyle interventions and marine fish oil as a supplemental therapy for systemic lupus erythematosus (SLE) [9]. Nowadays, it has been scientifically proven that moderate energy intake, antioxidant rich diet, and the consumption of fish oil may help in the reduction of inflammation and the treatment of comorbidities that occur in SLE [10]. Regarding the delay of degenerative joint diseases, it is essential to target normal BMI

(20-25kg/m<sup>2</sup>), although there are some cases where physical activity might be more important than body weight loss itself [11]. Alternate-day fasting (one day 25% of energy requirement, the following day 75-90% of total energy requirement, consumed) might be effective in weight reduction [12].

Instead of making drastic changes in diet, it is more effective to increase the consumption of fruits, vegetables, grains, and fish and reduce the consumption of meat, refined sugar, white flour, salt and saturated fatty acid [13,14]. In the delay or elimination of chronic inflammation, elimination diet, vegetarianism, and fasting might be effective [4,5,15].

Food supplementation with omega-3 fatty acids, glucosamine, and chondroitine sulphate may play a central role in the delay of osteoarthritis [16]. Evening primrose oil, borage oil, omega-3 fatty acid, gamma-linolenic acid, ginger, curcumin, bromelain (found in pineapple), and polyphenol compounds such as quercetin may improve musculoskeletal disease conditions [17,18].

There are vitamins, minerals and trace elements that have an impact on the improvement of musculoskeletal conditions:

- Calcium (bone and teeth structure, bone mineralization, muscle contraction) [19,20]
- Magnesium (bone structure, controlling muscle contraction) [21]
- Vitamin-K2 (cofactor of structural and regulation proteins in bone tissue) [20, 22, 23]
- Zinc (stimulation of osteoblast activity and promotion of bone mineralization) [24]
- Vitamin-D (bone formation, maintaining bone mineralization, limiting factor of calcium absorption) [19, 25]
- Copper (collagen and elastine formation, wound healing, immune competence) [17]
- Vitamin-A (bone formation, immune competence) [20]
- Selenium (immune modulation) [26]
- Phosphorus (bone mineralization) [27,28]
- Folic acid (protein synthesis, development of musculoskeletal system) [29]
- Vitamin B1- (collagen synthesis), Vitamin B2- (prevention of fractures) [19], Vitamin B3- (cell division, treatment of os-

teoarthritis) [16,17] Vitamin B5- (protein synthesis, Vitamin B5 combined with glucosamine may reduce pain and joint rigidity in osteoarthritis) [16,17], B12-vitamin (amino acid metabolism) [17] • manganese (proteoglycan synthesis) [17]

- C-vitamin (collagen synthesis, immune competence, reduction of bone loss) [17]
- Vitamin-E (modulates the effect of anti-inflammatory cytokines, suppressing symptoms of osteoarthritis) [16]
- Chromium (cell division and development) [30]
- Iron (muscle function, oxygen transport) [17]

Mediterranean diet (based on the consumption of fresh vegetables, fruits, whole grains, seafood, olive oil, and good quality wine) may help in pain release and reducing inflammation [31] and the treatment of rheumatoid arthritis [32].

Vegetarian diet may be effective in analgesis and anti-inflammation, especially in Rheumatoid Arthritis patients [33]. On the other hand, it might be important in the treatment of comorbidities, such as dyslipidaemia, obesity and hypertension [34].

Kneipp diet is one of the main parts of Kneipp therapy invented by Sebastian Kneipp, a Bavarian priest in the middle 1800s. Kneipp diet focuses on simple meals, fresh fruits, and vegetable soups, with a reduction of salt and meat consumption. Brown and wholegrain bread is consumed instead of white. The Kneipp diet prefers malt-coffee, pumpkin, grapes, lemon, honey, sour cabbage, and cherries. The Kneipp diet may have powerful anti-inflammatory and analgesic effects and may play an important role in the treatment of gout [35, 36].

In conclusion, nutrition has several impacts on the treatment of chronic musculoskeletal diseases due to its anti-inflammatory, analgesic, and immune modulatory properties. It may improve bone and cartilage function and aid in the treatment of comorbidities, such as obesity and dyslipidaemia. Antioxidant-dense food (vegetables, fruits, grains) together with polyunsaturated fatty acids (n-3) have complex favorable effects on musculoskeletal conditions. Nutraceuticals, vitamins, minerals and trace elements improve musculoskeletal conditions especially in the elderly population. In consequence, a variety of foods, a vegetable, fruit and grain-based diet, supplemented with fish oil and other nutraceuticals might be essential in the treatment of chronic musculoskeletal diseases.

## 2 References

1. Hirase T, Kataoka H, Inokuchi S, Nakano J, Sakamoto J, and Okita M. Factors associated with chronic musculoskeletal pain in Japanese community-dwelling older adults: A cross-sectional study. *Medicine*. 2017;96(23):e7069. Doi:10.1097/MD.0000000000007069
2. Babulka P, Boros S. *Gyógynövények, természetes hatóanyagok a mozgásszervi betegségek kezelésében*. Budapest: SpringerMed. 2015
3. Iolascon G, Gimigliano R, Bianco M, DeSire A, Moretti A, Giusti A, et. al. Are Dietary Supplements and Nutraceuticals

Effective for Musculoskeletal Health and Cognitive Function? A Scoping Review. *The Journal of Nutrition. Health Aging*. 2017;21(5);527–538. Doi:10.1007/s12603-016-0823-x

4. Kok F, Bouwman L, and Desiere F. *Personalized nutrition: principles and applications*. Boca Raton; Fla CRC Press:2008.
5. Boeing H, Bechthold A, Bub A, Ellinger S, Haller D, Kroke A, et al. Critical review: vegetables and fruit in the prevention of chronic diseases. *Eur J Nutr*. 2012;51(6):637–663. Doi: 10.1007/s00394-012-0380-y
6. Truswell AS. *ABC of nutrition*, 4th Ed, BMJ Publishing Group:2003.
7. Lipski E. *Digestive wellness*. 4th ed, USA;McGraw Hill Co:2011.
8. Mudambal SR, Rajagopal MV. *Fundamentals of nutrition, food and diet therapy*. 5th ed. Indaia; New Age International (P) Ltd., Publishers:2007.
9. Sukkar SG, Rossi E. Oxidative stress and nutritional prevention in autoimmune rheumatic diseases. *Autoimmunity Reviews*. 2004;3(3):199–206. Doi: 10.1016/j.autrev.2003.09.002
10. Klack K, Bonfa E, and Borba Neto EF. Diet and nutritional aspects in systemic lupus erythematosus. *Revista Brasileira De Reumatologia*. 2012;52(3):384–408.
11. Chughtai M, Khlopas A, Newman JM, Curtis GL, Sodhi N, Ramkumar PN. What is the Impact of Body Mass Index on Cardiovascular and Musculoskeletal Health? *Surg Technol Int*. 2017;30.
12. Varady KA, Bhutani S, Klempel MC, Kroeger CM, Trepanowski JF, Haus JM, et al. Alternate day fasting for weight loss in normal weight and overweight subjects: a randomized controlled trial. *Nutrition Journal*. 2013;12:146. Doi: 10.1186/1475-2891-12-146
13. Rinzler AC. *Nutrition for dummies*, 2nd ed. UK; Wiley Publishing Inc: 2006.
14. Berube LT, Kiely M, Yazici Y, Woolf K. Diet quality of individuals with rheumatoid arthritis using the Healthy Eating Index (HEI)-2010. *Nutrition and Health*. 2017; 23(1), 17–24. Doi: 10.1177/0260106016688223
15. Longo VD, Mattson MP. Fasting: molecular mechanisms and clinical applications. *Cell Metabolism*. 2014;19(2):181–192. Doi: 10.1016/j.cmet.2013.12.008
16. Zimmermann M. *Burgenstein's Handbook of human nutrition, Micronutrients in the prevention and therapy of diseases*. New York; Thieme Stuttgart: 2001.

17. Shepherd P. Nutrition. *Medicine of the future*, Online nutritional resources, Books for health.2010
18. Jakobson U. Pain Management Among Older People in Need of Help With Activities of Daily Living, *Pain Manag Nurs*. 2004;5(4):137-143.
19. Yaegashi Y, Onoda T, Tanno K, Kuribayashi T, Sakata K, Orimo H. Association of hip fracture incidence and intake of calcium, magnesium, vitamin D, and vitamin K. *Eur J Epidemiol*. 2008; 23(3):219-225. Doi: 10.1007/s10654-008-9225-7
20. Morgan SL. Nutrition and bone: it is more than calcium and vitamin D. *Womens Health (Lond Engl)*. 2009; 5(6):727-737. Doi: 10.2217/whe.09.64
21. Cheng SM, Yang LL, Chen SH, Hsu MH, Chen IJ, Cheng FC. Magnesium sulfate enhances exercise performance and manipulates dynamic changes in peripheral glucose utilization. *Eur J Appl Physiol*. 2010; 108(2):363-369. Doi: 10.1007/s00421-009-1235-y
22. Olson RE. Osteoporosis and vitamin K intake. *Am J Clin Nutr*. 2000;71:1031-1032.
23. Genuis SJ, Schwalfenberg GK. Picking a bone with contemporary osteoporosis management: nutrient strategies to enhance skeletal integrity. *Clin Nutr*. 2007;26(2):193-207. Doi: 10.1016/j.clnu.2006.08.004
24. Yamaguchi M: Role of nutritional zinc in the prevention of osteoporosis. *Mol Cell Biochem*. 2010;338(1-2):241-254. Doi: 10.1007/s11010-009-0358-0
25. Kalyani RR, Stein B, Valiyil R, Manno R, Maynard JW, Crews DC. Vitamin D treatment for the prevention of falls in older adults: systematic review and meta-analysis. *J Am Geriatr Soc*. 2010;58(7):1299-1310. Doi: 10.1111/j.1532-5415.2010.02949.x
26. Thomson CD, Campbell JM, Miller J, Skeaff SA, Livingstone V. Selenium and iodine supplementation: effect on thyroid function of older New Zealanders. *Am J Clin Nutr*. 2009;90(4):1038-1046. Doi: 10.3945/ajcn.2009.28190
27. Uenishi K. Phosphorus intake and bone health. *Clin Calcium*. 2009;19(12):1822-1828. Doi: CliCa091218221828
28. Arnaud CD, Sanchez SD. Calcium and Phosphorus. In: Ziegler EE, Filer LJ, eds. *Present Knowledge in Nutrition*. Washington, DC: ILSI Press; 1996:245:684.
29. Katz J, Khattry SK, Leclercq SC, Mullany LC, Yanik EL, Stoltzfus RJ, et. al. Daily supplementation with iron plus folic acid, zinc, and their combination is not associated with younger age at first walking unassisted in malnourished preschool children from a deficient population in rural Nepal. *J Nutr*. 2010;140(7):1317-1321. Doi: 10.3945/jn.109.119925
30. Mertz W. Chromium in human nutrition: A review. *J Nutr*. 1993;123(4):626-633.
31. Bonaccio M, Pounis G, Cerletti C, Donati M, B, Iacoviello L, de Gaetano G. Mediterranean diet, dietary polyphenols and low-grade inflammation: results from the moli-sani study. *British Journal of Clinical Pharmacology*. 2016;83(1):107-113. Doi: 10.1111/bcp.12924
32. Fernández-Llanio Comella N, Fernández Matilla M, Castellano Cuesta JA. Have complementary therapies demonstrated effectiveness in rheumatoid arthritis? *Reumatología Clínica*. 2016;12(3):151–157. Doi: 10.1016/j.reuma.2015.10.011
33. Rojahn R. Dietary interventions for rheumatoid arthritis. *The American Journal of Nursing*. 2011;111(3):69. Doi: 10.1097/10.1097/01.NAJ.0000395250.78014.2c
34. Chuang SY, Chiu TH, Lee CY, Liu TT, Tsao CK, Hsiung CA, et. Al. Vegetarian diet reduces the risk of hypertension independent of abdominal obesity and inflammation: a prospective study. *Journal of Hypertension*. 2016;34(11):2164-2171. Doi: 10.1097/HJH.0000000000001068
35. Zhang Y, Neoghi T, Chen C, Chaisson C, Hunter DJ, Choi HK. Cherry consumption and decreased risk of recurrent gout attacks, Arthritis and rheumatism. 2012;64(12):4004-4011. Doi: 10.1002/art.34677
36. Locher C, Pforr C. The legacy of Sebastian Kneipp: linking wellness, naturopathic, and allopathic medicine. *Journal of Alternative and Complementary Medicine*. 2014;20(7):521–526. Doi: 10.1089/acm.2013.0423

Role of Nutrition in the Prevention of Musculoskeletal Disease. Nutrition interacts with musculoskeletal disease. The role of nutrition in the development of musculoskeletal disease in growing dogs has been recognized for decades. Developmental orthopedic disease refers to a group of skeletal abnormalities (e.g., osteochondritis dissecans, hip dysplasia, wobblers™ syndrome, ligamentous laxity, and hypertrophic osteodystrophy) that affect primarily rapidly growing, large- and giant-breed dogs. less, had better body condition scores, and had longer delay to treatment of chronic disease including osteoarthritis.<sup>21</sup> In addition the restricted fed group had a lower incidence of osteoarthritis in most major joints, and if it occurred, it was less severe. The Role of Exercise in Treating Diabetes Mellitus. For years, the traditional cornerstones of therapy for patients with DM have been dietary modification and medication. Exercise also has been encouraged in patients with DM because regular physical activity may help to control hyperglycemia through improved glucose utilization. These changes include the development of new muscle capillaries and increases in the quantity of mitochondrial enzymes (9). Studies have also demonstrated that regular endurance exercise training increases the concentration of GLUT4 mRNA and protein in skeletal muscle. GLUT4 is a protein that serves as a glucose transporter.