

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

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

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### 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 elastin 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.

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