

# USANA Technical Bulletin

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## Glucosamine

### Technical Background

- Glucosamine is a simple amino-sugar. It is synthesized from glucose (a sugar) and glutamine (an amino acid).<sup>1</sup>
- Glucosamine is wide-spread in nature. It is a basic building block of chitin, the polymeric molecule that forms the cell walls of fungi and the external skeletons or shells of insects, shrimp, and crabs.<sup>1</sup>
- Glucosamine is also a basic building block of animal and human cartilage, the tissue that lines, cushions, and lubricates skeletal joints. Cartilage is a complex matrix of collagen fibers interwoven with proteoglycan molecules. Proteoglycans provide a framework for the collagen matrix and hold water, giving the cartilage flexibility, resiliency, and resistance to compression.<sup>2,3</sup>
- Because of its important role in regulating cartilage formation, glucosamine has been used clinically in the treatment of osteoarthritis.<sup>4</sup> Clinical trials have found that oral administration of glucosamine sulfate at dosages of 1200-1500 mg per day leads to reduced joint pain and stiffness, improved joint mobility, and reversal of cartilage loss.<sup>5</sup> Few, if any, negative side effects have been reported. Recent studies indicate that glucosamine may also be able to ameliorate some of the symptomatic effects of rheumatoid arthritis.<sup>6</sup>
- A variety of glucosamine supplements are available on the market today. The better formulations contain one or more of the nutrient cofactors required for cartilage formation: vitamin C, manganese, and silicon.
- Many glucosamine supplements also contain chondroitin sulfate. Chondroitin is one of the long chain polymers that make up proteoglycans, but there is significant doubt as to whether oral chondroitin passes through the wall of the gut to become available for cartilage synthesis. Preliminary studies suggests that glucosamine alone is every bit as effective as the combination product.

### Sources and Recommended Intake

- Glucosamine has no established Recommended Dietary Allowance (RDA).
- Foods that contain polymerized glucosamine in the form of chitin or cartilage include mushrooms, whole shellfish, whole chicken, beef, and fish. It is debatable whether significant amounts of simple glucosamine are made available during cooking of these foods. Some animal gelatin preparations may contain significant amounts of free glucosamine.
- Clinical research on the benefits of oral glucosamine supplements for osteoarthritis have typically shown that 1,500 mg per day is an effective dose.

## Abstracts

**Bruyere O, Pavelka K, Rovati LC, Deroisy R, Olejarova M, Gatterova J, Giacobelli G, Reginster JY. Glucosamine sulfate reduces osteoarthritis progression in postmenopausal women with knee osteoarthritis: evidence from two 3-year studies. *Menopause*. 2004 Mar-Apr;11(2):138-43.** OBJECTIVE: To investigate the effect of glucosamine sulfate on long-term symptoms and structure progression in postmenopausal women with knee osteoarthritis (OA). DESIGN: This study consisted of a preplanned combination of two three-year, randomized, placebo-controlled, prospective, independent studies evaluating the effect of glucosamine sulfate on symptoms and structure modification in OA and post-hoc analysis of the results obtained in postmenopausal women with knee OA. Minimal joint space width was assessed at baseline and after 3 years from standing anteroposterior knee radiographs. Symptoms were scored by the algo-functional WOMAC index at baseline and after 3 years. All primary statistical analyses were performed in intention-to-treat, comparing joint space width and WOMAC changes between groups by ANOVA. RESULTS: Of 414 participants randomized in the two studies, 319 were postmenopausal women. At baseline, glucosamine sulfate and placebo groups were comparable for demographic and disease characteristics, both in the general population and in the postmenopausal women subset. After 3 years, postmenopausal participants in the glucosamine sulfate group showed no joint space narrowing [joint space change of +0.003 mm (95% CI, -0.09 to 0.11)], whereas participants in the placebo group experienced a narrowing of -0.33 mm (95% CI, -0.44 to -0.22;  $P < 0.0001$  between the two groups). Percent changes after 3 years in the WOMAC index showed an improvement in the glucosamine sulfate group [-14.1% (95%, -22.2 to -5.9)] and a trend for worsening in the placebo group (5.4% (95% CI, -4.9 to 15.7) ( $P = 0.003$  between the two groups). CONCLUSION: This analysis, focusing on a large cohort of postmenopausal women, demonstrated for the first time that a pharmacological intervention for OA has a disease-modifying effect in this particular population, the most frequently affected by knee OA.

## References

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- <sup>3</sup> Sledge CB. Arthritis Surgery Chapter 1: Biology of the joint. Philadelphia PA: W.B. Saunders Co; 1994. Pp 1-21.
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- <sup>5</sup> Fabbender HM et al. Glucosamine sulfate compared to ibuprofen in osteoarthritis of the knee. *Osteoarthritis and Cartilage* 1994;2:61-69.
- <sup>6</sup> Nakamura H, Masuko K, Yudoh K, Kato T, Kamada T, Kawahara T. Effects of glucosamine administration on patients with rheumatoid arthritis. 2007. *Rheumatology Int* 27(3):213-218.