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## **Glucosamine, Part II: Forms**

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Before we discuss which form of glucosamine to use, we must answer the question, "Does glucosamine work?" Although the answer may seem obvious to those of us in the chiropractic and nutrition communities, many scientists and doctors do not feel glucosamine supplementation is beneficial for arthritis and related connective tissue dysfunction. Editors of both the Harvard and Berkeley health letters last year were not impressed with glucosamine. Both cited lack of research, and the Berkeley letter stated, "American researchers really are searching for an arthritis cure and important studies are underway. Many agents are under intensive study as potential cartilage regenerators. Glucosamine and chondroitin sulfate are not actually very high on this list."<sup>1</sup>

All that most chiropractors want is the truth, and the truth is that there has been very little U.S. research on glucosamine, but the same cannot be said of Europe. There have been more than 300 investigations including 20 double-blind studies in the early 1980s on glucosamine.<sup>2</sup> The Italian company Rotta states that over 6,500 people with osteoarthritis (including 2,000 with knee degenerative joint disease and 2,000 with spinal DJD) have now been studied using glucosamine sulfate with an across-the-board average of 80% of patients reporting benefits from glucosamine. These benefits were the reduction of joint pain and an increase in joint mobility.<sup>3</sup>

Many of the European studies compared glucosamine sulfate to nonsteroid anti-inflammatory drugs (NSAIDs). In those studies the trend was for the nonsteroidal anti-inflammatory groups to feel better initially, but after three to six weeks the glucosamine groups would, on average, feel as good or better than the people taking the NSAIDs. Furthermore, the rate of side effects is consistently much lower in all glucosamine groups. Glucosamine is now registered as an aid for osteoarthritis in over 70 countries and sometimes classified as a "slow-acting" drug for osteoarthritis.

## **Forms of Glucosamine**

1. Glucosamine sulfate (stabilized with sodium chloride). This is usually provided in 500 mg capsules and is the type of preparation used in the vast majority of positive human studies.
2. Glucosamine sulfate (stabilized with potassium chloride). Anecdotal reports from my patients who use this form fall in line with the research on people who used glucosamine sulfate stabilized with sodium chloride; that is, approximately 80% of patients who take it feel a benefit.
3. N-acetyl Glucosamine (NAG). In last year's best seller, *The Arthritis Cure*, by Theodosakis, Adderly and Fox, the authors stated that it did not matter which form of glucosamine a person takes -- they will all work.<sup>4</sup> However, the majority of experts in the field feel that the NAG form is not effective for arthritis and should be avoided. NAG is metabolized differently than other forms of glucosamine. Instead of being absorbed relatively intact, the intestinal bacteria digest it rapidly and other tissues of the gastrointestinal tract absorb it before it can reach cartilage.
4. Glucosamine hydrochloride. Some researchers now feel that glucosamine hydrochloride may be the best form because it has a slightly higher concentration of glucosamine in the molecule (83% versus 80% for glucosamine sulfate) and has better stability.<sup>5</sup>

## **Debate**

There is no argument that almost all of the studies done on oral glucosamine have used a glucosamine sulfate form stabilized with sodium chloride. There is debate about glucosamine sulfate because some bargain basement brands will have 500 mg capsules that contain 20% sulfate and 20% sodium, leaving only 300 mg of elemental glucosamine. Patients who think they are taking 1500 mg per day may actually only be getting 900 mg per day.

Products that cater to health care professionals and are available to chiropractors generally do not have this problem. Good brands will list elemental totals and their base. For example, the product used in my office is 500 mg glucosamine sulfate in a base of 666 mg of glucosamine sulfate, and is stabilized with potassium chloride.

The future for glucosamine hydrochloride looks bright; however, there have been very few human studies on this form. The debate surrounding glucosamine hydrochloride centers around sulfur. Proponents of glucosamine hydrochloride feel that the sulfur portion of glucosamine sulfate is removed during digestion and not utilized by cartilage. The body gets sulfur, which is a critical nutrient for GAG synthesis, from high

energy phosphate compounds, sulfur-containing amino acids, and inorganic sulfate.<sup>6</sup> Proponents of glucosamine sulfate disagree and feel that glucosamine sulfate does provide chondrocytes with a sulfur source required for the manufacture of chondroitin sulfate and keratan sulfate glycosaminoglycans.<sup>7</sup>

## **Conclusion**

When human trials on glucosamine sulfate stabilized with potassium chloride and glucosamine hydrochloride are performed, I expect that these preparations will work as well as the glucosamine sulfate form stabilized with sodium chloride. Based on current research, the N-acetyl glucosamine form is not effective for treating joint problems in humans. There are ongoing studies on various forms of glucosamine. The results of these studies, positive or negative, will be reported in this column. Next month, we will continue our discussion by focusing on dosing, safety and side effects.

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