

SORBITOL

OVERVIEW

Of all the natural and artificial sweeteners on the market, Sorbitol has definitely gained some popularity within the food and medical community for quite some time. There are concerns regarding this natural sweetener such as, "Is it safe?" and "How much can I take?" Whether for biological research, medical use, or just to make delicious low calorie pastries, it is worth taking the time out to stop and examine the potential concerns, if any, of this interesting little sweetener.

WHAT IS SORBITOL?

Sorbitol is one of many sugar alcohols found in nature that gets metabolized slower in our bodies than other normal dietary sugars. Also known as *glucitol*, sorbitol is a result of the hydrogenation of the aldehyde moiety of glucose, giving glucose a terminal hydroxyl group (*figure 1*). This is significant in its pharmacology and lower caloric yield. The term sugar "alcohol" is not to be confused with any idea that there is any alcohol in sorbitol. Nobody ever got drunk off of ingesting sorbitol. A sugar alcohol is any sugar that has a -CHO (aldehyde) group exchanged for a -CHOH (alcohol) group. This is why sorbitol is absorbed and metabolized more slowly than glucose. Glucose is constantly changing back and forth from its linear (Fischer projection formula) to its cyclic (Haworth projection formula) configuration, but mostly stays in its closed ring / cyclic form. This is how glucose is best recognized by GLUT transport proteins within the gut and target tissues and best absorbed. Sorbitol cannot autocyclize and form the closed ring structure of glucose and thus remains in the linear form. A win-win advantage for humans on low calorie diets is that gustatory receptors still get stimulated via glucose monomer recognition, but metabolizes much slower than glucose and has a lower caloric yield: 2.6Kcal/gm as opposed to 4Kcal/gm.

Sorbitol, as well as some other sugar alcohols, can also be used as a non-stimulant laxative (Islam MS et al., 2006). Our bowels don't like this little molecule hanging around for too long, so the large intestine responds by drawing water into this chamber to dilute and expel it, thereby stimulating bowel movement.

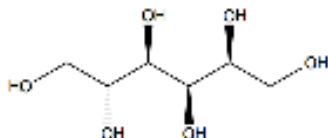


Figure 1 Structural formula of Sorbitol

IS IT SAFE?

There have been rare cases in which ingestion of large amounts of sorbitol (20-30 grams per day) have led to moderate abdominal pain and diarrhea in normal, healthy individuals (Doheney, 2008). This is the only known side effect sorbitol brings about in normal, healthy subjects. Sorbitol should be taken with caution in diabetics, namely diabetes mellitus, as this condition usually causes a deficiency in key enzymes involved in the sorbitol-aldose reductase pathway (Brownlee M, 2001). Although sorbitol is produced endogenously in humans from glucose, a deficiency in aldol reductase leaves too much sorbitol unconverted back to glucose and unable to exit cells of the retina, kidney, and neural tissues. This sorbitol accumulation causes osmotic stress and ultimately causes irreversible damage to the cell. Large amounts of sorbitol would also not be recommended for those who suffer from galactosemia. In light of these isolated cases, sorbitol's safety is highly supported by various studies within scientific literature. During the developing of the U.S.F.D.R., which recognizes sorbitol as "Generally Recognized as Safe", or GRAS, the data were carefully evaluated by qualified personnel of the *Select Committee on GRAS Substances* selected by the FASEB (Federation of American Societies for Experimental Biology). It turns out that in the opinion of this select committee, there was no evidence demonstrating a hazard in which sorbitol was used at levels used currently or expected in the future. The FDA seems to insist on products that contain a potential 50g ingestion/day of sorbitol to carry labels that have the statement: "Excess consumption may have a laxative effect." The actual MSDS for sorbitol shows LD₅₀ for this sweetener to average approximately 17.6g/kg (MSDS, 11/97-01/98), which would mean that the average male adult would have to consume 1.4kg of sorbitol in a single shot and the average female, 0.96kg to do some serious damage to the body. Of course, who could stomach even a fraction of that before even getting close to the danger zone?

CONCLUSION

Despite certain views on natural and artificial sweeteners that tend to downplay or sway toward the over-cautious side, sorbitol seems to be one of the better, safer choices of low calorie sweeteners. With only a few, rare instances where true precautionary measures must be taken, sorbitol along with other sugar alcohols may very well be a novel agent in the quest for safe substitutes for table sugar.

References:

Islam MS, Sakaguchi E; Sorbitol-based osmotic diarrhea: possible causes and mechanism of prevention investigated in rats. *World J Gastroenterol.* 2006 Dec 21;12(47):7635-41.

Kathleen Doheny (2008-01-10). "Sweetener Side Effects: Case Histories". *WebMD Medical News*. Retrieved on 2008-01-10

Brownlee M (2001). "Biochemistry and Molecular Cell Biology of Diabetic Complications". *Nature* 414 (6865): 813–820

Sigma Chemical Co., Aldrich Chemical Co., Fluka Chemical Corp; MSDS. Valid 11/97-01/98