Tagatose and milk allergy

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Key words: allergy; cows' milk; tagatose.

Tagatose is a new food ingredient being used as a reduced-calorie sweetener in foods and beverages. Tagatose is a six-carbon ketose sugar found naturally in some dairy products and in tropical date trees. As tagatose is incompletely absorbed, it provides only 1.5 cal/g as contrary to 4 cal/g for sucrose. Tagatose has approximately the same sweetness as sucrose. Recently, a manufacturing process for tagatose has been developed allowing the production of increased quantities of tagatose. Tagatose has been affirmed as Generally Recognized as Safe (GRAS) in the US and is approved for use in foods and beverages in the US, Korea, Australia and New Zealand.

Tagatose does not contain milk residues.

Tagatose is a unique ketose sugar manufactured by the isomerization of galactose. The galactose involved in the manufacturing of tagatose is derived from lactose, the disaccharide found in the whey fraction of milk. Lactose is known to contain residual milk proteins including several of the major cows' milk allergens, principally β-lactoglobulin and α-lactalbumin from whey, on occasion (1). Consequently, some questions were raised about the potential allergenicity of tagatose.

Although lactose often contains residual milk allergens, tagatose is much less likely to contain any milk allergens based upon knowledge of the process used to

produce tagatose. The steps involved in the manufacturing of tagatose from lactose are:

(a) lactose is obtained from whey by ultrafiltration;
(b) lactose is hydrolyzed to galactose and glucose by immobilized lactase;
(c) glucose is separated from the galactose by chromatographic separation;
(d) the galactose stream is isomerized to tagatose by adding calcium hydroxide in a process that increases the pH to pH 12 for a prolonged period;
(e) the tagatose stream is demineralized using ion exchangers;
(f) the tagatose stream is purified by chromatographic separation;
(g) the tagatose solution is decolorized using an active carbon filter;
(h) tagatose is crystallized;
(i) the tagatose is dried by fluid-bed drying.

Several steps in this process help denature or remove residual proteins in the lactose starting material. The chromatographic separation steps separate the starting material, galactose, and the finished product, tagatose, from larger protein molecules. The isomerization process at pH 12 affects any residual protein but any effect on the allergenicity of that protein resulting from that treatment would be uncertain. However, tagatose is also crystallized in a process in which only the pure sugar molecules are likely to form crystals.

Despite the high likelihood that protein was removed from tagatose during this commercial process, commercial tagatose was analyzed for residual casein and whey proteins. A commercial enzyme-linked immunosorbent assay (ELISA) kit (Veratox milk assay; Neogen Corp., Lansing, MI, USA) was used for detection of casein (2). An ELISA for whey proteins developed at the Food Allergy Research & Resource Program at the University of Nebraska was also used (3).

Casein and whey protein residues were not found in commercial tagatose at sensitivity levels of 2.5 p.p.m. (mg/kg) for casein and 1.0 p.p.m. (mg/kg) for whey proteins. The minimal eliciting or threshold dose for milk in cows' milk-allergic individuals are estimated to be in the low milligram range (4, 5). Thus, the ingestion of a kilogram of tagatose, which would be virtually impossible, would be required to exceed the observed minimal eliciting or threshold doses for cows' milk. Therefore, tagatose should be safe for milk-allergic individuals and its avoidance by such individuals is not necessary.

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Accepted for publication 29 June 2004
Allergy 2005: 60:412–413

DOI: 10.1111/j.1398-9995.2005.00701.x

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