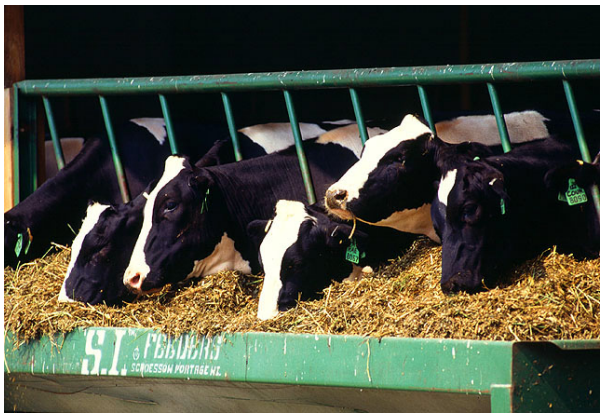
Bovine somatotropin

Bovine somatotropin (abbreviated **bST** and **BST**), also known as **bovine growth hormone**, or **BGH**, is a protein hormone. BST is naturally occurring in cattle, and plays a role in the growth and development of the organism. Since 1994 it has been possible to synthesize the hormone using recombinant DNA technology to create **recombinant bovine somatotropin** (**rBST**), **recombinant bovine growth hormone** (**rBGH**), or **artificial growth hormone**. Monsanto was the first to develop the technology and marketed it as "Posilac" - a brand now owned by Elanco Animal Health, a division of Eli Lilly and Company.



rBST is a product primarily given to dairy cattle by injection to increase milk production.

The United States is the only developed nation to permit humans to drink milk from cows given artificial growth hormone.[1] Posilac was banned from use in Canada, Australia, New Zealand, Japan and all European Union countries (currently numbering 27), by 2000 or earlier.

In the United States, public opinion has caused a number of products and retailers to become rBST-free.[2] [3] [4] [5]

Posilac

In 1937, the administration of BST was shown to increase the milk yield in lactating cows by preventing mammary cell death in dairy cattle. Until the 1980s, there was very limited use of the compound in agriculture as the sole source of the hormone was from bovine cadavers. During this time, the knowledge of the structure and function of the hormone increased.[6] Monsanto developed a recombinant version of BST, brand-named Posilac, in 1994,[7] which is produced through a genetically engineered *E. coli*. A gene that codes for the sequence of amino acids that make up BST is inserted into the DNA of the E. coli bacterium. The bacteria are then broken up and separated from the rBST, which is purified to produce the injectable hormone. Growth hormones associated with injections given to dairy cows to increase milk production are known under an assortment of terms, but these terms, in general, refer to the Monsanto product. The Monsanto fact sheet on its proprietary product states that, when injected into dairy cattle, the product can increase milk production by an average of more than 10% over the span of 300 days.[8]

Use of Posilac

A 2007 USDA Dairy Survey estimated rBGH use at 15.2% of operations and 17.2% of cows.[9]

An average dairy cow begins her lactation with a moderate daily level of milk production. This daily output increases until, at about 70 days into the lactation, production peaks. From that time until the cow is dry, production slowly decreases. This increase and decrease in production is partially caused by the count of milk-producing cells in the udder. Cell counts begin at a moderate number, increase during the first part of the lactation, then decrease as the lactation proceeds. Once lost, these cells generally do not regrow until the next lactation.

To apply Posilac for maximum effect, farmers are recommended to make the first Posilac application about 50 days into the cow's lactation, just before she peaks. The Posilac then sustains already-present mammary cells, limiting the rate of production decrease after production peaks. After the peak, production declines with or without application of Posilac, but declines more slowly with Posilac than without. This decrease in the rate of production decline permits dairy cows to produce more milk over the span of a lactation - at its best, this will be seen by seven to eight more pounds of milk being produced per day than would be produced without Posilac.

Comparison with non-rBGH milk

On September 30, 2010, a U.S. court of appeal found based on studies presented that there is a "compositional difference" between milk from rBSG-treated cows and untreated milk. The court found that studies have shown that rBST milk has: increased levels of the hormone IGF-1; lower nutritional quality when produced at certain points in the cow's lactation cycle; and more pus in the milk (increased somatic cell counts), which "make the milk turn sour more quickly and is another indicator of poor milk quality."[1]

Controversy

Use of BST is controversial primarily due to concerns over potential effects on animal and human health.

Animal health

Two meta-analyses have been published on rBST's effects on bovine health.[10] [11] Findings indicated an average increase in milk output ranging from 11%-16%, a nearly 25% increase in the risk of clinical mastitis, a 40% reduction in fertility and 55% increased risk of developing clinical signs of *lameness*. The same study reported a decrease in body condition score for cows treated with rBST even though there was an increase in their dry matter intake.

A European Union scientific commission was asked to report on the incidence of mastitis and other disorders in dairy cows and on other aspects of the welfare of dairy cows.[12] The commission's statement, subsequently adopted by the European Union, stated that the use of rBST substantially increased health problems with cows, including foot problems, mastitis and injection site reactions, impinged on the welfare of the animals and caused reproductive disorders. The report concluded that, on the basis of the health and welfare of the animals, rBST should not be used. Health Canada prohibited the sale of rBST in 1999; the external committees found that, although there was no significant health risk to humans, the drug presents a threat to animal health, and, for this reason, cannot be sold in Canada.[13]

Human health

Human health concerns centre around three areas:

- rBST and its byproducts
- increased levels of IGF
- secondary effects, e.g. the increased use of antibiotics to treat mastitis

IGF is produced by the cow in response to BGH injections,[14] and it is this hormone which increases growth and milk production. Bovine and porcine IGF-I are identical to human IGF-I, while IGF-II differs among animal species.[15]

IGF plays a role in the formation of new tumours [16] [17] [18] and increased levels of IGF-1 may be linked to increased risk of breast, colon, and prostate cancer. [19] [20] However IGF is involved in many biological processes so it is not possible to assign a clear-cut cause and effect relationship. IGF-1 is not denatured by pasteurisation, so consumption of milk from rBST treated dairy cows will increase the daily intake of IGF-I.

Further association of IGF with breast cancer was provided by a 20-year epidemiological study begun in 1976, which was published in 1997.[21]

Lawsuit against WTVT

In 1997, Steve Wilson and Jane Akre were terminated by television station WTVT, a FOX affiliate. They filed suit, claiming the termination was due to their involvement in an investigative report criticizing Monsanto's use of rBGH, which the station did not air. Wilson and Akre claimed the station had engaged "news distortion" under pressure from Monsanto. WTVT later aired a similar report, which included responses from Monsanto. WTVT ultimately won the suit, and the plaintiff's claims were dismissed.[22]

Regulation

Use of the recombinant supplement has been controversial. While it is legal in the United States (though not without reaction) and 1 other industrialized nations (Mexico), it is 90 % banned in Canada, Japan, the European Union, Australia and New Zealand. In Canada, bulk milk products from the United States that have been produced with rBST are still allowed to be sold and used in food manufacture (cheese, yogurt etc.). In the EU, both meat and dairy products from the US are banned from import.

Regulation outside the United States

In Japan, Australia, New Zealand, and Canada, rBST is not approved for use.[23]

In 1990, The European Union placed a moratorium on its sale by all member nations. It was turned into a permanent ban starting from January 1, 2000.[24] An in-depth report published in 1999 analysed in detail the various human health risks associated with rBST.[25]

Canada's health board, Health Canada, refused to approve rBST for use on Canadian dairies, citing concerns over animal health.[13] The study found the occurrence of an antibody reaction, possible hypersensitivity, in a subchronic (90-day) study of rbST oral toxicity in rats that resulted in one test animal's developing an antibody response at low dose (0.1 mg/kg/day) after 14 weeks." However, the board stated that, with the exception of concerns raised regarding hypersensitivity, "the panel finds no biologically plausible reason for concern about human safety if rBST were to be approved for sale in Canada."[26]

The Codex Alimentarius Commission, a United Nations body that sets international food standards, has to date refused to approve rBST as safe. The Codex Alimentarius does not have authority to ban or approve the hormone - but its decisions are regarded as a standard and approval by the Codex would have allowed exporting countries to challenge countries with a ban on rBGH before the WTO.[27]

Regulation inside the United States

In 1995, the product was approved for use in the U.S. by the FDA, and its use began in 1994. The product is now sold in all 50 states.

The Food and Drug Administration stated that food products made from rBST treated cows are safe for human consumption, and no significant difference exists between milk derived from rBST-treated and non-rBST-treated cows.[28] The FDA found BGH to be biologically inactive when consumed by humans and found no biological distinction between rBST and BST.[28] In 1990, an independent panel convened by the National Institute of Health supported the FDA opinion that milk and meat from cows supplemented with rBST is safe for human consumption.[29]

Labeling

The FDA does not require special labels for products produced from cows given rBST but has charged several dairies with "misbranding" their milk as having no hormones, because all milk contains hormones and cannot be produced in such a way that it would not contain any hormones.[30] Monsanto sued Oakhurst Dairy of Maine over their use of a label which pledged to not use artificial growth hormones.[31] The dairy stated that their disagreement was not over the scientific evidence for the safety of rBST (Monsanto's complaint about the label), but "We're in the business of marketing milk, not Monsanto's drugs." The suit was settled when the dairy agreed to add a qualifying statement to their label: "FDA states: No significant difference in milk from cows treated with artificial growth hormones." The FDA recommends this additional labeling but does not require it.[31] [32] The settlement itself caused much controversy, with anti-rBST advocates claiming that Oakhurst had capitulated in response to intimidation by a larger corporation and others claiming that Oakhurst's milk labels were in and of themselves using misleading scare tactics that deserved legal and legislative response.

Demand for milk without synthetic hormones has increased substantially in the US since Monsanto introduced their rBST product; organic milk is now an important sector of the organic food market.[33]

Labeling in Pennsylvania

In 2007, the U.S. state of Pennsylvania adopted a regulation that would have banned the practice of labeling milk as derived from cows not treated with rBST. This prohibition was to go into effect January 1, 2008, but was delayed to February 1, 2008 in order to give interested parties more time to submit comments to the state's Department of Agriculture. Milk producers are now able to distinguish between milk produced by cows treated with rBST and cows receiving "natural" BST treatment or no treatment.[34]

Response from commercial groups

Several milk purchasers and resellers have elected not to purchase milk produced with rBST. The nation's largest dairy processor, Dean Foods, no longer sells milk from rBST-treated cows though an email from Dean Foods received by a consumer on September 23, 2010, states, "At Dean Foods, we believe that our dairy producers have the right to produce safe, high-quality milk using any approved and available technology..." which would include Artificial Growth Hormones or rBST/rBGH. The top 3 grocery retailers in the nation, Wal-Mart, Kroger, and Costco have pledged not to sell such milk in their stores. Specific examples include:

- Winder Farms, a home delivery dairy and grocer in Utah and Nevada, sells rBST-free milk.
- Guernsey Farms, a dairy farm and distributor located in Northville, Michigan sells and distributes rBST-free dairy products in Southeastern Michigan. Their milk has been labeled rBST free for a number of years.[35]
- Safeway in the northwestern United States stopped buying from dairy farmers that use rBST in January 2007.[2] The two Safeway plants produce milk for all of Oregon, Southwest Washington, and parts of northern California. Safeway's plant in San Leandro, CA had already been rBST-free for two years.[3]
- Chipotle Mexican Grill has also announced it will serve rBST-free sour cream at its restaurants.[3]
- Kroger has banned rBST-derived milk from all its stores (including its subsidiaries such as Ralphs) as of February 2008,[4]
- Publix announced it has been rBST-free since May, 2007.[36]
- Braum's has also issued a press release stating its milk is rBST-free.[37]
- Starbucks Company has as of January 2008 made all dairy in beverages rBST free.[38]
- Wal-Mart and Sam's Club stores featured artificial-hormone-free "Great Value" brand milk, but did not label it as such in 2008.[39]
- Ben & Jerry's ice cream uses milk and cream from dairy farms that have pledged not to use rBST.[40]

Monsanto has responded to this trend by lobbying state governments to ban the practice of distinguishing between milk from farms pledged not to use rBST and those that do. According to *The New York Times*,[41] a pro-rBST

advocacy group called Afact has been most active in these lobbying efforts.

Thus far, a large-scale negative response to legislative and regulatory efforts has kept state regulators from pushing through strictures that would ban hormone-free milk labels, though several politicians have tried, including Pennsylvania's (see the Pennsylvania section above) agriculture secretary Dick Wolff, who tried to ban rBST-free milk on the grounds that it would alleviate consumer confusion. Proposed labeling changes have been floated by lobbyists in New Jersey, Ohio, Indiana, Kansas, Utah, Missouri and Vermont. So far, however, this effort has been unsuccessful.

Sustainability

Sustainability is an important aspect of agricultural production. There is an emphasis on keeping up with the demand for human food while reducing the environmental impact. "The present study demonstrates that use of rbST markedly improves the efficiency of milk production and mitigates environmental parameters including AP, (acidification) EP, (eutrophication) greenhouse gas emisions, and fossil fuel use."[42] Results of the study clearly show rbST is a valuable tool for increasing dairy production.

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External links

- Public Health on "Public Health Aspects of the Use of Bovine Somatotrophin" (http://ec.europa.eu/food/fs/sc/scv/out19_en.html)
- Labeling Issues, Revolving Doors, rBGH, Bribery and Monsanto (http://www.sourcewatch.org/index.php?title=Labeling_Issues,_Revolving_Doors,_rBGH,_Bribery_and_Monsanto)
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