Iowa Beef Center
Iowa State University

Understanding Hormone Use In Beef Cattle

Q&A

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Q Why do cattle farmers use "hormones" or "growth promotants" in modern beef farming?

Most of the beef in the United States today is "grain-fed" or "grain-finished." Consumers of beef in the United States traditionally have preferred the tender beef from young steers and heifers. These cattle spend most of their lives grazing on grass in pastures but are "finished" for the last 120-200 days in a feeding operation where they are fed a balanced diet of grains, harvested forages, and nutrient supplements (vitamins and minerals).

Most male cattle (bulls) are neutered early in life and become steers. Bulls produce natural male hormones that can cause aggressive behavior and injury to themselves and others. But these hormones cause bulls to grow faster, produce more muscle and protein and deposit less fat than steers.

Heifers also produce hormones, but young heifers produce much less than older or pregnant heifers. Providing small amounts of these or similar hormones to young steers and heifers allows them to regain some of the growth rate of bulls and older heifers. This occurs even though the amounts of hormones given are a fraction of the natural production of mature bulls or heifers.

Q What are growth promotants and how are they given?

Growth promotants are primarily given to cattle in the form of small pellets placed under the skin in the animal's ear. These ear implants dissolve slowly over a 100-120 day period. The ear is used because ears do not enter the food supply.

The active ingredients – most of which are naturally occurring hormones – are either estrogens or androgens. The estrogens can be natural, synthetic or plant-based. The androgens may be either natural or synthetic. The synthetic androgen used in implants (trenbolone acetate) has less of the negative aggressive male behavior effects and more of the muscle enhancing effects compared to natural androgens.

Depending on the implant, and the age and sex of the animal, implants will improve growth rate from 10 to 20 percent and decrease the cost of beef production by 5 to 10 percent. Studies show that the benefits of lower costs are passed on to the consumer. More efficient beef production requires less feed and land resources.

Q How do growth promotants work?

Implants work by changing what happens to the nutrients that cattle eat. Muscle growth is enhanced at the expense of fat deposition. Because muscle is more efficient for the animal to produce compared to fat, the animal grows faster with less feed consumed.

One benefit for the consumer is that at the same weights, implanted cattle will be leaner and the beef will have fewer calories than non-implanted beef. Since the USDA quality grades are based on marbling, which is internal fat in the ribeye muscle, implanted cattle need to be fed to heavier weights or they will have a lower quality grade.

Q Are growth promotants safe?

Hormone implants are regulated by the Food and Drug Administration and extensive toxicological testing is conducted prior to the approval of any new growth promotant. This toxicological testing by the FDA also includes assessments of the breakdown of these products before they enter the environment. Residues of the synthetic hormones are routinely monitored by the Food Safety Inspection Service of the USDA to ensure safety of the beef. The natural hormones are not tested since they are not different than those naturally produced by the animal and the quantities are a small percentage of what is normally produced.

The natural human production of both androgens and estrogens is several thousand times the content of a generous serving of beef produced with hormone implants. Also other common foods are naturally much higher in estrogen than implanted beef including eggs and milk. Soybean flour can contain several thousand times the estrogen activity as the same quantity of implanted beef. Shown in Tables 1 and 2 are the estrogen activity of common foods and the natural estrogen production of people.

Common consumer questions about hormones in beef often relate to cancer and early puberty in children. Exposure to high levels of hormones through implanted beef has never been implicated in early puberty in young girls although factors such as height, weight, diet, exercise and family history have (see references). In the 1970's diethylstilbesterol (DES), a human hormone supplement, was found to be carcinogenic. Low doses of DES were used as a growth promotant for cattle at that time. DES was banned for use in cattle in 1979.

Table 1. Estrogenic activity of common foods (ng/500g)

Food	Estrogenic Activity
Soy flour defatted	755,000,000
Tofu	113,500,000
Pinto beans	900,000
White bread	300,000
Peanuts	100,000
Eggs	555
Butter	310
Milk	32
Beef from implanted steer	7
Beef from non-implanted steer	5

Hoffman and Eversol (1986), Hartman et al (1998), Shore and Shemesh (2003), USDA-ARS (2002). Units are nanograms of estrone plus estradiol for animal products and isoflavones for plant products per 500 grams of food

Table 2. Estrogen production in humans, and potential estrogen intake from implanted beef

Item	Estrogen Amount
Pregnant woman	19,600,000 ng/day
Non-pregnant woman	513,000 ng/day
Adult man	136,000 ng/day
Pre-puberal children	41,000 ng/day
500 g of beef from implanted cattle	7 ng

Hoffman and Eversol (1986)

Q What about natural beef?

Beef marketed under the label of "naturally raised" must be grown without growth promotants and verified by enrollment in a process verification program administered by the USDA. These cattle must also have been fed without antibiotics and animal by-products. Beef marketed as organic beef also is not implanted and must adhere to strict organic guidelines including the feeding of organically grown feeds. Consumers who are concerned about the use of implants can find beef through labeling which verifies that implants have not been used. However, since implants reduce the cost and resources used in the production of beef, consumers should be prepared to pay a premium for these products.

Suggested Resources

Gandhi, Renu and Suzanne Snedeker. 2000. Consumer Concerns about Hormones in Food. Cornell University Program on Breast Cancer and Environmental Risk Factors in New York State. Fact Sheet #37. http://envirocancer.cornell.edu/Factsheet/Diet/fs37.hormones.cfm

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Doyle, Ellen. 2000. Human Safety of Hormone Implants used to Promote Growth in Cattle. A Review of the Scientific Literature. Food Research Institute , University of Wisconsin. http://fri.wisc.edu/docs/pdf/hormone.pdf

Acevedo, Nicolas, John D. Lawrence and Margaret Smith. 2006. Organic, Natural and Grass-Fed Beef: Profitability and constraints to Production in the Midwestern U.S. Iowa Beef Center white paper. Iowa State University. http://www.iowabeefcenter.org/Docs_econ/Organic_Natural_Grass_Fed_Beef_2006.pdf

Hoffman, B. and Eversol. In Drug Residues in Animals, A. G. Rico (Ed.), pp. 111-146. Academic Press, New York (1986)

Hartmann, S., M. Lacorn and H. Steinhart. 1998. Natural occurrence of steroid hormones in food. Food Chemistry 62:7-20.

Shore, L. S., and M. Shemesh. 2003. Naturally produced steroid hormones and their release into the environment. Pure Appl. Chem. 75:1859-71.

U.S. Department of Agriculture, Agricultural Research Service. 2002. USDA-Iowa State University Database on the Isoflavone Content of Foods, Release 1.3 - 2002. Nutrient Data Laboratory website: http://www.nal.usda.gov/fnic/foodcomp/Data/isoflav/isoflav.html