Steroid Hormones in Food

Steroid hormones are a natural constituent of many foods, and particularly in foods of animal origin. Steroid hormones are also a normal and natural component of both human breast and cow's milk. Like other animals, humans – male and female and both young and old - also produce steroid hormones within their own bodies. In women, for example, estrogen[1] has far-reaching effects on a variety of vital functions in the woman's body. Estrogen is responsible for a wide array of developmental processes in the human female body and is also responsible for the development of reproductive abilities in women.

Most people don't realize that the male body also produces estrogen, although in much smaller quantities than in the female body. There are many variables that influence hormone levels, and include gender, age, pregnancy, menopause and phase of the menstrual cycle. Because estrogen is so closely associated with human sexuality and overall growth and development, some have expressed concern about possible exposure in humans to estrogen from cow's milk.

Meat and milk have small quantities of hormones, but at levels far lower than what humans produce in their own bodies on a daily basis. But what may be less well known is that exposure to estrogen and progesterone from food sources, including milk from cows, is orders of magnitude smaller than what the female and male body produces every day – quite normally and naturally. For example, birth control pills taken by millions of women worldwide everyday typically contain 20,000 to 30,000 nanograms (ng)[2] of estradiol per daily dose, compared to the average 3 ng – 35 ng of estrogen in a glass of whole milk from cows.[3] [4] To put this into another perspective, consider that a typical adult woman would have to drink more than 500 glasses of milk everyday to take in the same quantity of estrogen, as she would have in just one typical birth control pill. Similarly, consider that a prepubertal girl produces 54,000 ng of estrogen everyday, or 1500 times more estrogen than in a glass of milk; put another way, the prepubertal girl would need to drink 1500 glasses of milk per day to equal the amount of estrogen her own body produces daily. And an adult woman produces 630,000 ng per day, which would be equivalent to drinking approximately 18,000 glasses of milk everyday. It has been estimated [5] that prepubertal boys produce approximately 100,000 ng of estrogen each day, compared to intake from all foods, including milk, of approximately 80 ng per

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[1] In the interest of simplicity, the term "estrogen" and "estradiol" are used generically to describe the predominant female steroid hormone.

1 mg = 0.001 gram; 1 μg = 0.000 001 gram; 1 ng = 0.000 000 001 gram

[3] Dr Ann Macrina, Penn State University, "Best Food Facts.org"; accessed May 14, 2014. Personal Communication.

[4] University of Guelph, Food Safety Network, https://www.uoguelph.ca/foodsafetynetwork/safety-canadian-milk; accessed on May 14, 2014.

[5] Sonja Hartmann, Markus Lacorn & Hans Steinhart. Food Chemistry, Vol. 62, No. 1, pp. 7-20, 1998.

day – or more simply stated, their bodies produce 1000 times more estrogen than they take in from all foods, including milk (see Table 1).

Table 1: DAILY HUMAN INTAKE AND PRODUCTION OF ESTROGENS AND PROGESTERONE[6]

Gender	*Estrogen Daily Production (ng/day)*	*Dietary Estrogen Daily Intake (ng/day)*	*Progesterone Daily Production (ng/day)*	*Dietary Progesterone Daily Intake (ng/day)*
Men	140,000	100	420,000	10,600
Women	630,000	80	19,600,000	9,000
Boys (prepuburtal)	100,000	80	150,000	8,900
Girls (prepubertal)	54,000	70	250,000	8,100

1 mg = 0.001 gram; 1 µg = 0.000 001 gram; 1 ng = 0.000 000 001 gram

Even pregnant women produce in the range of 19,600,000 ng per day, or stated another way, a pregnant woman would have to drink 560,000 glasses of milk per day to have an equivalent estrogen exposure to what their own bodies produce in a single day[7] [8].

Similarly, humans produce much more progesterone than they ingest from their total diet, including milk. Progesterone concentrations in milk typically vary from approximately 350 ng in a 250 ml glass of skim milk to approximately 2500 ng of progesterone in a glass of whole milk (concentration varies as a function of the fat content of milk). As can be seen from Table 1, the human body produces up to 2000 times more progesterone everyday (depending on life stage and gender) than is consumed from the total diet; and the human body produces 60 to almost 8,000 times more progesterone daily (depending on life stage and gender) than is consumed from a glass of milk.

It will be apparent that hormonal effects in general, and increased cancer risks specifically, are not expected from exposure to the miniscule amounts of naturally occurring steroids in food, and in particular from milk, compared to the much higher levels of the same hormones produced everyday by the human body. In addition, it is important to also be aware that about 90% of the hormones ingested from food sources are inactivated by the first-pass-effect of the liver, thereby effectively reducing the human exposure to hormones from food sources even further.

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6 Adapted from Sonja Hartmann, Markus Lacorn & Hans Steinhart. Food Chemistry, Vol. 62, No. 1, pp. 7-20, 1998

7 Dr Ann Macrina, Penn State University, "Best Food Facts.org"; accessed May 14, 2014. Personal Communication

8 Sonja Hartmann, Markus Lacorn & Hans Steinhart. Food Chemistry, Vol. 62, No. 1, pp. 7-20, 1998.

Milk is an important source of nutrition and contains protein, carbohydrates, fat, vitamins and minerals. And, importantly, milk contains all four fat soluble vitamins, A, D, E, and K. The water-soluble vitamins present in a liter of whole, raw milk include[9]:

- B1 – thiamine at 450 µg
- B2 – riboflavin at 1720 µg
- B6 – pyridoxine at 500 µg
- B12 – cyanocobalamin at 4.5 µg
- Niacin at 900 µg
- Pantothenic acid at 3500µg
- Folic acid at 35 µg
- Biotin at 35 µg
- Vitamin C at 20 µg

Similarly, milk is also a rich source of all of the 22 minerals essential to maintain human health[10]:

Mineral	Quantity/L	Mineral	Quantity/L
Sodium	350-900 mg	Chloride	900-1100mg
Potassium	1100-1700mg	Calcium	1100-1300mg
Magnesium	90-140 mg	Phosphorus	900-1000 mg
Iron	300-600 µg	Zinc	2000-6000 µg
Copper	100-600 µg	Manganese	20-50 µg
Iodine	260 µg	Fluoride	30-220 µg
Selenium	5-67 µg	Cobalt	0.5-1.3 µg
Chromium	8-13 µg	Molybdenum	18-120 µg
Nickel	0-50 µg	Silicon	750-7000 µg
Vanadium	Trace-310 µg	Tin	40-500 µg
Arsenic	20-60 µg		

(mg =milligram; 1 mg = 0.001 gram; 1 µg = 0.000 001 gram)

It is clear that the amounts of estrogen and progesterone in a glass of milk are very, very small, and biologically trivial, when compared to what is produced by the human body everyday. And the nutrition provided by milk is an important component of good health.

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[9] University of Guelph, Food Safety Network, https://www.uoguelph.ca/foodsafetynetwork/safety-canadian-milk; accessed on May 14, 2014

[10] University of Guelph, Food Safety Network, https://www.uoguelph.ca/foodsafetynetwork/safety-canadian-milk; accessed on May 14, 2014