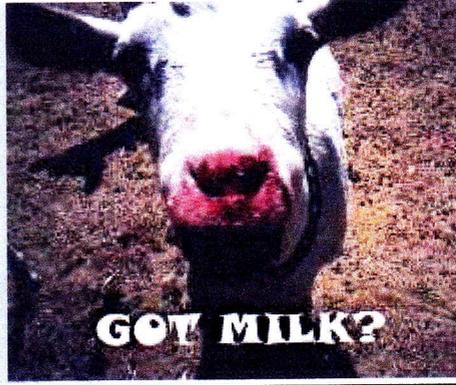


**Comparing Milk:  
Human, Cow, Goat &  
Commercial Infant  
Formula**



**Milk and  
honey are  
the only  
two  
substances  
on Earth  
with the  
sole  
purpose of  
being a  
food!**

Compiled and [referenced](#) by  
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\*

Stephanie Clark will be happy to hear from you regarding the material on this site. However, be advised that she is not a registered dietitian or medical doctor and cannot make recommendations specific to your infants' needs. Stephanie grew up on a small farm in Massachusetts and was active in 4-H with her Nubian goats. Stephanie earned her doctorate in Food Science from Cornell University in 1997 and has been a professor of Food Science at Washington State University since 1998. Food Science is a discipline concerned with all aspects of food, from field to fork. Food Science includes the study of chemistry, microbiology, food processing/engineering, sensory evaluation and product development. For more information about her activities, visit her website listed at the bottom of this page.

Infants below the age of one year should not be fed cow milk, goat milk, or soy beverage. These milks are low in iron and differ in the protein composition compared to mothers milk. Since infants depend so much on milk, it is likely that they will develop an iron deficiency if they consume cow, goat or soy beverage. Really, breast feeding or infant formula are the way to go, with breast feeding most superior. The iron in breast milk is highly bio-available and will cover the needs for the infant until about the age of 6 months. After that, the Academy of Pediatrics suggests, infants should be supplemented with iron-fortified infant cereals (such as rice cereal), while ideally breast feeding should be continued until at least the age of one.

Another reason that infants should not be fed cow or goat milk is because of the protein. Breast milk is higher in whey and much lower in casein compared to cow and goat milks. Casein is more difficult to digest than whey and may lead to internal gastrointestinal bleeding, which again, could lead to iron deficiency.

There are also mineral differences among breast milk, cow milk and goat milk. Goat milk, in particular, is low in the B vitamin folic acid.

Soy beverages provide more iron than cow milk. However, soy is deficient in many other key nutrients. Remember, soy is a plant and by no means can be compared to mammal milks, which are complex foods made to grow baby children/animals. The nutritional composition of soy and mammal milks are very different.

At the age of one, the American Academy of Pediatrics suggests children can be switched to whole milk. Again, soy beverage is not equivalent to milk and thus should not replace milk in the diet.

Finally, raw milk should not be fed to infants. Raw milk commonly contains food-borne illness-causing microorganisms (pathogens). Even low levels of certain pathogens can cause illness. Since infant immunological systems are not fully developed, they are at greater risk for disease and death than those with developed immune systems.

The following is presented for your information. It is not intended to endorse or discourage the feeding of any product, milk, or formula to infants, children or adults. As with any web site, this site can not stake a claim to all wisdom on the subject covered. Please seek additional sources of information before you change anything in your life based on what you read here or anywhere else on the internet.

- [Vitamin comparisons](#)
- [Minerals comparisons](#)

- [Infant recommended daily intake for vitamins](#)
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### Comparing Milk: Human, Cow, Goat & Commercial Infant Formula

Nutritive comparisons of milks based on the needs of 0-6 month old infants. \*

VITAMIN	HUMAN	COW	GOAT	FORMULA *	DEFICIENCIES **
A	64	53	56	65 ug/100g	-
D	0.03	0.03	0.03	0.06 ug/100g	All Lo, except F
C	5.0	1.0	1.3	6.1 mg/100g	C+G very low
E	0.3	0.7	0.7	0.3 ug/100g	-
B1 (thiamin)	140	400	480	68 ug/100g	-
B2 (riboflavin)	36	162	138	101 ug/100g	-
Pantothenic acid	200	300	300	304 ug/100g	-
Biotin	0.8	2.0	2.0	3.0 ug/100g	all OK
Nicotinic acid (niacin)	200	100	200	710 ug/100g	F OK, all other LO, particularly C
Folic Acid	5.2	5.0	1.0	10 ug/100g	F OK, others LO, particularly G
Vitamin B12	0.3	0.4	0.1	0.2 ug/100g	All LO, particularly G
Vitamin B6	11	42	46	41 ug/100g	-
Vitamin K	-	-	-	-	-

\* ug/100g = microgram/100g milk

\*\* Human milk is not considered deficient in any nutrients, but is considered the standard for infant feeding.

	HUMAN	COW	GOAT	FORMULA	DEFICIENCY
Calcium	34	130	120	49 mg/100g	-
Chromium	-	-	-	-	-
Selenium	-	-	-	-	-
Molybdenum	-	-	-	-	-
	HUMAN	COW	GOAT	FORMULA	DEFICIENCY
Protein	1.0	3.3	3.6	2.0	C+G HI
Carbohydrate	6.9	4.7	4.5	7.0	C+G LO
Fat	4.4	3.3	4.1	1.1	Formula LO
Water	87.5	88.0	87.0	80	
Calories (kcal)	70	61	69	60	

\* To compare the milks on a per day basis, /100g values were multiplied by 8 (the average

0-6 month old infant consumes 800 grams of milk/day.

It is important to note that the bioavailability of each vitamin or mineral may differ. The above numbers do not indicate bioavailability, but research has shown that the iron and B12 in breast milk are significantly more bioavailable than in formula or cow milk (this has not been studied for goat milk).

Infant recommended daily intake for vitamins	
Vitamin A	0.4 mg (400 ug, 1500-2000 IU)
Vitamin D	0.01 mg (10 ug, 400 IU)
Vitamin C	35 mg (35000 ug)
Vitamin E	4 mg (4000 ug)
Vitamin B1 (thiamin)	0.3 mg (300 ug)
Vitamin B2 (riboflavin)	0.5 mg (500 ug)
Pantothenic acid	2500 ug
Biotin	40 ug
Niacin	6 mg (6000 ug)
Folic Acid	0.04 mg (40 ug)
Vitamin B12	0.0006 mg (0.6 ug)
Vitamin B6	0.4 mg (400 ug)
Vitamin K	12 ug

Infant recommended daily intake for minerals	
Calcium	360 mg
Chloride	275-700 mg
Copper	0.5-0.7 mg
Magnesium	50 mg
Phosphorus	240 mg
Potassium	350-925 mg
Sodium	115-350 mg
Zinc	3 mg
Iron	10 mg
Iodine	40 ug
Manganese	0.5-0.7 mg
Fluoride	0.1-0.5 mg
Chromium	0.01-0.04 mg
Selenium	0.01-0.04 mg
Molybdenum	0.03-0.06 mg

**These requirements generally increase after the first 6 months of life.** Infants consume about 750-800 g/day for the first 4-5 months (450-1200g/day range).

Note that most of the minerals in goat and cow milk are significantly higher than in human milk. This, coupled with the higher protein of cow and goat milks (more than 3% compared to about 1.3%), make dilution necessary so as to avoid hypertonic dehydration (a result of high solutes in urine). But, after dilution, carbohydrate should be added to cow or goat milk because human milk contains 7.0 g/100g lactose compared to about 4.5 g/100g lactose found in cow and goat milks.

#### **Distinguishing between allergies and lactose intolerance:**

Allergies and lactose intolerance are different things.

An allergic reaction is the body's response to a foreign body (antigen), typically proteins. Goat milk proteins have slightly different amino acid structures than cow milk proteins. Thus, a person who produces antibodies to cow milk proteins, may not produce antibodies to goat milk proteins. However,

there is no guarantee that a person who is allergic to cow milk will not be allergic to goat milk, because the milks are similar.

Lactose intolerance or lactose maldigestion result from a person's inability to completely digest lactose. Because microorganisms in the gut will produce gas, symptoms of lactose intolerance include cramps, flatulence and bloating. Lactose is present in all milks. Thus, goat milk can not successfully be substituted for cow milk in cases of lactose intolerance.

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**A note about goat milk digestibility:**

Goat milk's tendency to be more easily digested than cow milk is due to its protein make-up. Goat milk has low levels of the protein alpha s1-casein, a protein that is involved in curd formation. Cow milk has higher quantities of alpha s1-casein than goat milk. In fact, some goats naturally produce very little alpha s1-casein. The higher proportion of small milk fat globules present in goat milk compared to cow milk may also contribute to goat milk's tendency to be more easily digested.

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**Perhaps you've heard that goat milk is 'naturally homogenized':**

Because fat is lighter than water, the cream portion of milk floats on top of the skim portion of milk. Most cows milks in the store are homogenized so that we do not see the two phases of milk. The milk is forced through tiny pores under high pressure to break the fat into smaller sized globules. Small globules distribute in milk and do not float as readily. One reason goat milk does not have to be homogenized is because it has a high proportion of small fat globules. The other reason is that goat milk lacks the protein agglutinin. Agglutinin makes fat globules stick together and float.



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**Publications by Dr. Clark**  
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**References and sources:**

- 1-'Milk and Dairy Products in Human Nutrition', Prof. Dr. Edmund Renner, 1983.
- 2-'Breastfeeding', by Ruth Lawrence, 1989.
- 3-'Nutrition during Lactation', The Institute of Medicine, 1991.
- 4-'Longitudinal Study of male exclusively breast - and formula- fed infants and chemical maturation at 2.5 months', a Thesis by Denise Alvarez, 1994.
- 5-Dietary Reference Intakes for Thiamin, Riboflavin, Niacin, Vitamin B6, Folate, Vitamin B12, Pantothenic Acid, Biotin and choline. A Report of the Standing Committee on the Scientific Evaluation of Dietary Reference Intakes and its Panel on Folate, Other B Vitamins, and Choline and Subcommittee on Upper Reference Levels of Nutrients. Food and Nutrition Board. Institute of Medicine. National Academy Press. Washington, D.C. 1998.
- 6-Dietary Reference Intakes for Calcium, Phosphorus, Magnesium, Vitamin D and Fluoride. Standing Committee on the Scientific Evaluation of Dietary Reference Intakes. Food and Nutrition Board. Institute of Medicine. National Academy Press. Washington, D.C. 1997.