

Sanford Medical Center

Aunt Cathy's Guide to:

Choosing Appropriate Infant Milks and Formulas



Aunt Cathy

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Part 3: Cow's/Goat's Milk and Evaporated Milk Formulas as the Primary Feeding Product for Infants.

Cow's milk and goat's milk are inappropriate for use as the primary feeding product in place of human milk or commercial formula. They fall outside of the "desirable range" of carbohydrate, protein and fat, and can present problems for some infants.

This is especially true for very young babies or for those who have special health problems. In addition, 2% (low fat) and skim milk provide inadequate calories (about 15 and 11 calories per ounce, respectively), so babies tend to drink even more of these products than they would whole milk, formula or human milk, which all provide about 20 calories per ounce.

Percent of calories from:	CHO	PRO	FAT
Desirable range:	35 - 65	7 - 16	30 - 55
Cow's milk: Whole:	30	20	50
2% :	38	26	36
Skim :	57	40	3
Goat's milk:	27	19	54

Are there any other problems?

At a time when many American infants were being fed skim milk, Fomon et al, (1974) showed that young infants fed skim milk as their major food drank about 1.5 times the amount normally taken, in an effort to get adequate calories. As you can see on the chart above, the amount of protein would be very high, and since so much of the baby's energy would be derived from protein,

there would be a large amount of nitrogenous waste produced that must be excreted via the kidney (i.e., a high "Renal Solute Load.")

This has the potential to result in dehydration because of the obligatory loss of water to excrete the waste products. Sometimes the loss of fluid can be more than the baby can afford. In very young infants or in those with special health problems, including those with growth failure, diarrhea, or fluid limits, a high "**Renal Solute Load**" can be dangerous.

These milks are also less than ideal because they contain up to 8 times as much sodium as is in human milk and formula. If skim milk is used as described above, that can mean a sodium intake of 12 times the amount in human milk, since the baby will drink so much more of it.

In addition, these milks do not provide complete nutrition, because they are poor sources of iron, vitamins C and B-6, copper, zinc and essential fatty acids. Vitamins A and D are also low unless they are added in processing.

Most commercial milk has vitamin D added, but milk obtained directly from a dairy farm or the family barnyard often has none. As a result, **severe vitamin D deficiency** is not uncommon among many "farm" children, especially in the north [*Rickets in the Dairy State*. Wisconsin Medical Journal. 2004;103:84-87. 7.]

In addition to these problems, goat's milk (but not cow's milk) is also naturally too low in folic acid (a B-vitamin especially important during periods of rapid growth because of its role in DNA production), and offers no special advantage over cow's milk. Many commercially canned goat's milks do have folic acid added. Babies who are allergic to cow's milk protein are often allergic to goat's milk, too.

I was involved in the care of an infant whose exclusive ("natural") diet of raw goat's milk landed him in the hospital at age 4 months, very near death, with overt scurvy, anemia and neurologic problems from deficiency of folic acid, vitamins C, B6, D, iron, zinc and several other nutrients. Fortunately, emergency treatment saved this baby's life, but there is no way to determine if there will be any long-term consequences of such severe malnutrition of multiple nutrients during infancy. These are serious issues.

Unpasteurized milks are not recommended due to the risk of bacterial contamination. This includes conditions like listeria, brucellosis and salmonella, to mention just a few. Heat treatment also improves the digestibility of the milk, but the milk fat remains much harder for babies to digest than the fat in human milk or commercial formulas, and it is a poor source of linoleic and alpha-linolenic acid, the essential fatty acids.

Some babies appear to have a sensitivity to unheated cow's milk (but usually not to formula) that causes bleeding from the intestine. The amount of blood loss is often so small as to be unnoticeable in the stool, but it can result in a serious loss of iron. This blood loss, along with the poor iron content of cow's milk and its impairment of iron absorption from other sources, can contribute to the development of anemia.

I have seen young children with this kind of “cow’s milk anemia” related to these factors plus a diet pattern that provided too much of the child’s calories in the form of milk/yogurt/cheese, etc., and very little other foods. Interestingly, several children had been identified as anemic, but the solution recommended was just to give a supplement of inorganic iron (e.g. ferrous sulfate.) This is particularly unlikely to be very helpful because:

- 1) milk impairs absorption of inorganic iron and
- 2) the basic problem of dietary imbalance is not addressed so multiple other critical (but less likely to be tested for) nutritional inadequacies remain uncorrected. For example, this dietary pattern would also lead to relative inadequacy of zinc and copper, both of which can be very serious inadequacies.

Essential Fatty Acid Deficiency

Of the linoleic acid found in butterfat (the fat in cow’s milk,) it appears that only 50-80% of the total amount is in the form of linoleic acid that is biologically active (Fomon 93), so the values shown on the chart on the next page overestimate the actual amount of linoleic acid available for metabolic uses. This is another clear indication why cow’s milk or goat’s milk should only be used as a part of a child’s diet and certainly not as the main source of calories.

Other forms of fat need to be included in an infant’s diet, as cow’s milk fat alone can actually result in essential fatty acid deficiency. I once observed this situation in a child admitted to the intensive care unit in our hospital with a variety of unusual symptoms. A careful diet assessment revealed that nearly all of his fat intake was in the form of dairy fat. A laboratory measurement of the triene:tetraene ratio then confirmed the suspected EFA deficiency.

Note that the table on the next page addressing the relative inadequacy of linoleic acid (the omega-6 essential fatty acid.) It does not address the additional inadequacy of linolenic acid (the omega-3 essential fatty acid) discussed earlier as being so important for making substances such as EPA and DHA. Further, most vegetable oils are not well-balanced in the ratio of omega-6 to omega-3 fatty acids. The essential fatty acids in corn oil, for example, are almost all omega-6.

[For additional information on this issue please see
“All Those Lipids: Recommendations for Using Different Types of Vegetable Oils
(Omega-3, Omega-6 and Monounsaturated Oils.)”]

Essential Fatty Acids

**Suggested Intake: (FAO/WHO) and regulation level for formulas is 1.2 % of energy as Linoleic Acid.
Goal is to provide 500 mg/day (Foman 93)**

<u>Linoleic Acid per 100 kcals & intake per 18 or 24 oz milk/day</u> (Fomon 93)	<u>Linoleic Acid as a Percent of Total Fat</u> (Worthington Roberts 96)	<u>Total PUFAs mg/oz</u> (Pennington: Bowes & Church 94)	<u>Total PUFAs as a Percent of Total Fat</u>
Cow 's milk:			
Whole: 1.12 mg/100 kcals 18 oz = 4.1 mg 24 oz = 5.4 mg	1%	37	4
2% : 0.92 mg/100 kcals 18 oz = 2.5 mg 24 oz =3.3 mg	1%	25	4
Skim : 0.02mg/100 kcals 18 oz = 0.04 mg 24 oz =0.05 mg	1%		
Human milk:	5%	200	14.3

So why do people want to use cow's milk for infants?

Some people have the mistaken notion that unpasteurized cow's milk or goat's milk is somehow more nutritious or "natural" . . . which it is for baby cows and goats. For human infants it is significantly less appropriate than human milk or formula, and as already described, it is potentially dangerous. The major reasons for switching from commercial formula to cow's milk (pasteurized or not) during the first year are cost and convenience factors.

For young infants or those with health problems, this practice should not be encouraged. However, if the infant is at least six months old, is a healthy baby, and is eating the equivalent volume of 2-1/2 to 3 jars of baby food daily, some of the problems with whole cow's milk can be tempered.

For example, by adding three 4-oz servings of cereal, fruit, or vegetables daily, the carbohydrate portion of the diet moves into the acceptable range, and the protein percentage decreases down to the acceptable range. By filling up on other foods, the baby will probably also drink less milk, which will also decrease the protein and sodium intake. If one selects the other foods carefully (including meats and a wide variety of other nutrient-dense foods), some of the other nutritional shortcomings can be remedied as well, such as decreasing the high sodium content and improving the vitamin /mineral content of the diet.

Because of the observations about inadequacy noted above, a few years back (about 30, actually) when I was first working for the (brand new) WIC Program, the American Academy of Pediatrics decided that switching from human milk or formula to whole milk would be acceptable after age six months “for babies who were eating a variety of foods.”

However, studies were done that showed that although it is possible to achieve a balanced diet this way, most babies who had been put onto whole milk, in fact did **not** receive a balanced and appropriate diet. So the recommendation of human milk or formula for the first year of life was re-instituted. The more recent questions about the safety of pasteurized cow's milk products during infancy (e.g. yogurt, cottage cheese and ice cream) as adjunct foods do not represent a major policy change. [Interestingly, during the AAP's “6-months-is-ok” period, WIC held its ground and continued to provide only iron-fortified formula to non-breastfeeding infants for the entire first year of life. Way to go, WIC!]

One further caution before switching to cow's milk or goat's milk is to be sure that the baby regularly eats table foods that contain some (especially omega-3 rich) vegetable oils in order to obtain appropriate levels of essential fatty acids. Most baby foods are extremely low in fat, as are many of the “starter” table foods like fruit, crackers and cereals. Other dairy foods like cheese, butter or yogurt provide only the same limited amount as milk does, even when the total fat content is high.

So, especially when the baby is eating commercial baby foods as a major part of the diet and has switched to milk, extra care must be taken to provide sufficient essential fatty acids. Fortunately, this can be done quite easily when one is aware that it is an issue. **Hydrogenated oils like margarine and shortening should not be considered as sources of essential fatty acids because the hydrogenation process significantly decreases the essential fatty acid content of the product.** This is in addition to the well-known concerns about partially hydrogenated oils forming trans fat.

What about evaporated milk formula?

Many people have been raised on home-made evaporated milk formula, although it is rarely used today. Its major advantage is its lower cost than commercially made formulas, while being better suited to infants than regular cow's milk. Because it is canned, it has been sterilized and the heat treatment makes the protein more digestible.

Corn syrup or sugar has traditionally been added to adjust the proportion of carbohydrate, protein and fat, as shown below. Water is added to adjust the calories to 20 calories per oz, (the same calories as in human milk, formulas and whole milk). (See the chart on below)

Percent of calories from:	CHO	PRO	FAT
Desirable range:	35 - 65	7 - 16	30 - 5
Evaporated Milk Formula made with Corn Syrup:	45	15	40

Digestion and absorption are still not as good as is seen with human milk and formula, because the form of fat is more difficult for babies to digest in addition to being a poor source of essential fatty acids. Milk fat can be quite constipating for some children, but the corn syrup usually has an osmotic laxative effect to counter it. (Somehow that arrangement does not sound optimal!)

In the 1980s a concern was raised about the safety of corn syrup for small infants (*J. Food Protect.* 1989:45,1028.) Some samples were found to contain heat-resistant spores of *Clostridia botulinum*, a type of bacteria that has been associated with a form of SIDS (Sudden Infant Death Syndrome). It was estimated that about 5% of SIDS cases at that time may have been due to "infant botulism" linked to the use of corn syrup or honey in young infants.

For this reason it was suggested that when this type of formula is used, the corn syrup or honey should be replaced by table sugar. Since then, manufacturing techniques have improved and corn syrup no longer is regarded as a risk factor for developing infant botulism (*J Food Protect.* 1991), although honey should continue to be avoided in the first year of life. [Note: Honey baked into foods like graham crackers is safe because the high temperature of preparation kills the spores. This question still comes up often.]

Human milk or commercial infant formulas are still preferred over evaporated milk formula because of their more complete nutrition and better digestibility. As with any cow's milk product, evaporated milk formula is naturally low in iron, copper, selenium, zinc, essential fatty acids, and vitamins C and B-6. Vitamins A and D are usually added, but might not be. This product should be of historical interest only. It belongs to what I call the "This is white ... just feed it to 'em School of Nutrition"

Because of the great potential for nutrient inadequacy, a registered dietitian or physician who is knowledgeable about these issues should look carefully at a baby's whole feeding plan to assess its adequacy. A supplement should be recommended if other foods are not providing these missing nutrients. However, my experience has been that **nobody looks at this issue at all, so careful nutrient supplementation in this situation is theoretically possible but practically non-existent.** And, as the babies do not "look funny" their deficiency state usually remains unrecognized.

And finally, I found on the internet a blog from a woman who has discovered **the joys of making one's own evaporated milk infant formula.** The main benefit she cited was that it was much cheaper than regular formula. [But not as cheap as breastfeeding! ☺] The best part: she is quite comfortable about using it for her baby because **she has "talked to some people over fifty and they seem to be OK."**

As it happens, I was fed evaporated milk formula with corn syrup in 1950 and I lived to tell about it. But in those days we were not fed that product exclusively ... **we were also fed iron-fortified cereal practically before we left the hospital, and right away we were regularly fed egg yolks and liver as well.** The yolks were also given "for iron," since then (as now) that was about the only nutrient ever evaluated so anemia was actually sometimes recognized as a problem. But it turns out that the iron was not wonderfully absorbable from either the cereal or the yolks.

In retrospect, the yolks turned out to have lots of other good things we didn't even know existed, like choline. **Choline** is looking like a very important nutrient for brain function (as in the neurotransmitter "acetylcholine") and providing some ready-made choline to babies looks like a very good idea. Pre- and Postnatal Health: Evidence of Increased Choline Needs. JADA August 2010)

And thank heaven for that liver, which provided actually absorbable iron and zinc, plus lots of choline and vitamins A and D and many other nutrients!

Using the classical (translation: "old") evaporated milk formula with today's typical feeding patterns (e.g. waiting to introduce other foods until 4-6 months) has the potential to do significant harm to that baby.

And even if some of us over-fifty people are actually "OK," it is really quite foolish to trust that precious baby's health and development to our scientific knowledge base of 60 years ago. We old folks didn't have seat belts either and we're still here. Well ... at least, **SOME** of us are!