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## Cows' Milk in Complementary Feeding

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### Introduction

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If breastfeeding is continued at a high rate into the second year of life, and if the complementary diet contains reasonable amounts of animal protein from meat, fish, or eggs, most infants will thrive without cows' milk. This is the situation in some traditional societies, where milk is not available or where there is no tradition for feeding cows' milk. However, in most populations in the world there is a strong tradition of using cows' milk as an important part of the complementary diet. This article will discuss different aspects of the use of cows' milk in complementary feeding ([Table 1](#)) and will highlight areas where there is a need for further research. The use of infant formula and follow-up formula will not be covered, despite the fact that they are usually based on cows' milk.

**TABLE 1**

**View this table:** Positive and Negative Aspects of the Use of Cows' Milk During the Period of Complementary Feeding  
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### Homemade Infant Formula

There is universal agreement that homemade formula based on unmodified cows' milk should not be used as a breast milk substitute, especially during early infancy because the composition differs considerably from breast milk. Homemade formula is used in some populations because of economic constraints or tradition, and is less harmful than unmodified cows' milk. For this reason, the recipe for making a homemade formula is given in the recent Canadian recommendations for infant feeding<sup>1</sup> and in the new WHO/UNICEF recommendations for infant feeding for the European Region.<sup>2</sup> As a minimum, an iron supplement should be given as well to prevent the development of iron deficiency anemia.

### **Nutritional Characteristics**

Because cows' milk is intended for calves, which have a much higher growth velocity than infants, the content of nutrients essential for growth, like protein and some minerals are much higher (typically 2-3 times) than in human milk. Therefore, cows' milk has a very high renal solute load that might cause dehydration and hypernatremia during illness (see the article on renal solute load by Fomon in this supplement). The high protein content will contribute considerably to the total protein intake, if milk intake is high. During the complementary feeding period, some infants have an excessive protein intake, which might have adverse effects (see article on the risks of excessive protein intake by Michaelsen in this supplement). Cows' milk also has a low content of essential fatty acids, zinc, vitamin C, and niacin and a high content of saturated fatty acids. Cows' milk has a negative effect on the iron status of the infant. The iron content is low, it is poorly absorbed, and cows' milk that has not been heat-treated, can cause gastrointestinal bleeding, especially during the first 6 months of life. There is uncertainty about how important this problem is during the last half of infancy.<sup>3,4</sup>

### **At What Age Should Cows' Milk Be Introduced?**

In the United States and in the United Kingdom, it is recommended that cows' milk should not be used as the main milk drink before the age of 12 months.<sup>5,6</sup> In Denmark<sup>7</sup> and Canada<sup>1</sup> it is recommended that cows' milk can be introduced gradually from the age of 9 months, in Sweden<sup>8</sup> from 10 months. The main reason for delaying the introduction of cows' milk is to prevent the development of iron deficiency. Recommendations on age of introduction will have to take into account the risk of iron deficiency in the population, the iron content of the remaining diet, alternatives to cows' milk, and the amount of milk given.

### **Fat Quantity and Quality**

When is it appropriate to introduce cows' milk with a reduced fat content? In several countries the recommendation is that fat reduced milk should not be introduced during the first 2 to 3 years of life, while others recommend that semi-skimmed milk can be introduced from the age of 12 months.<sup>9</sup> In the United Kingdom it is recommended that semi-skimmed milk (1.5-1.8 g per 1000) should not be introduced before 2 years and skimmed milk (<0.3 g) not before 5.<sup>6</sup> There is a concern that reducing the dietary fat content might also reduce total energy intake.<sup>9,10</sup> On the other hand, the high intake of saturated fatty acid from milk might increase cardiovascular risk. In a large study from Finland (The STRIP Baby Trial) the intervention group was recommended to use skimmed milk from the age of 7 months and to compensate the low fat intake by adding vegetable oil to the diet.<sup>11</sup> The evidence that there are any adverse long-term effects of a high intake of milk fat in early life is, however, weak.<sup>10</sup>

### **The Amount of Milk**

Some infants consume large volumes of milk, so-called milkaholics. A high milk intake leaves less room for a diversified diet and therefore increases the risk of nutritional deficiencies, especially of iron. One liter of cows' milk will cover about two-thirds of the energy requirement of a 12-month-old infant. Only few countries have recommended an upper limit to milk intake during the complementary feeding period.

### Toddlers, Formula

It has been suggested that a special milk for young children (toddlers' milk) would be beneficial. Such a milk will typically be iron-fortified, have a low protein content and have some of the milk fat exchanged with vegetable fat. There is however, no convincing evidence that such a milk would have beneficial effects, when compared with a prudent diet with a moderate amount of unmodified cows' milk and a reasonable amount of foods that are good iron sources like meat and fish.

### Cows' Milk and Diabetes

Several studies have shown that insulin-dependent diabetes is less common in infants who were breastfed than in formula-fed infants. It is not known whether the reason is a protective effect of the immune substances in breast milk or an adverse effect of cows' milk proteins.<sup>12</sup>

### Fermented Milks

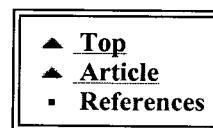
In some populations there is a tradition of giving fermented milk, including yogurt, to infants and young children. Several recent studies have suggested beneficial (probiotic) effects of using fermented milks with a change in intestinal microflora<sup>13</sup> that might reduce the prevalence and duration of diarrhea and stimulate the immune system. There is, however, a need for more studies, before fermented milk can be recommended as a part of a complementary diet.

### Research Questions

1. What is an appropriate age for the introduction of cows' milk?
2. What is a reasonable daily amount during "late" lactation, and when the diet has been diversified?
3. Is there a need for special modified formulas for young children (toddlers' formulas)?
4. Is there an effect of the fatty acid composition of cows' milk on the risk of developing cardiovascular disease later in life?
5. Do fermented milk products have significant positive effects on morbidity and growth in countries with poor hygiene, or in industrialized countries?
6. Does cows' milk protein have a role in the development of diabetes?

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