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**Does Goat Milk Formula Have a Place in the Management of
Children with Cow Milk Allergy?**

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Does goat milk formula have a place in the management of children with cow milk allergy?

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The premise

Goat milk infant formula has a useful place in the management of infants with cow milk allergy.

The problem

Up to 10% of infants have adverse reactions to cow milk. Breast milk is ideal for these babies as long as the mother eliminates cow milk from her own diet. When these infants are weaned from the breast they need an alternative formula to cow milk. The choices are a hydrolysed cow milk formula (extensively or partially hydrolysed; based on casein and/or whey protein); a soy-based formula; or a goat milk formula. However, adverse reactions are reported to all of these proteins. Where does goat milk fit in?

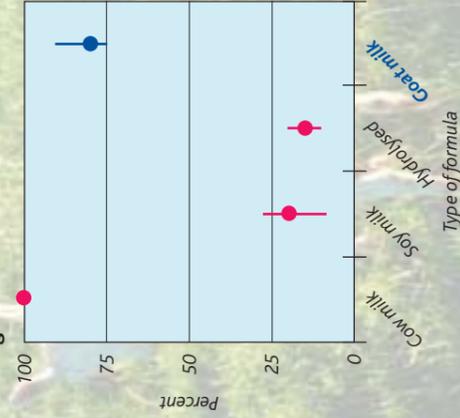
Comparing formulas

The following data comes from clinical studies of goat milk, soy and hydrolysed reactions in infants and children who had Cow Milk Allergy (CMA). These study results have been split into the two types of reaction: Immediate and Slow (Ford 1983).

IMMEDIATE CMA reactions

(First symptoms occur within a few minutes of milk ingestion)
The graph shows the percentage of children reacting to cow milk (100%), soy milk (9-27%) (Zeiger RS et al 1999); cow hydrolysates (10-20%) (Dean et al 1999; Ragnó et al 1993; Klemola et al 2002) and goat milk (75-90%) (Bellioni-Businco et al 1999; Infante et al 2003).

Immediate IgE Cow Milk Reactions



The Conclusion

Comparing the two graphs, it is clear that the choice of alternative formula is to a large extent determined by the type of clinical reaction.

In the **Immediate IgE reactions**, goat milk has a very high crossover reaction with about 80% of children reacting. However, **five times more goat milk was required to give a similar reaction** (Bellioni-Businco et al 1999).

In contrast, when the **Slow NON-IgE reactions** are considered, a goat milk reaction is seen in about half, which means that half of these infants can tolerate goat milk. Goat milk has the same magnitude of reaction to soy milk in this group of infants.

Final comment

Goat milk formula is a safe and nutritious food for weaned infants. It has a useful role in the feeding of infants who have slow-onset reactions to cow milk proteins.



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The confusion – two types of reaction

Confusion has come from studies that have not distinguished between the immediate IgE-based reactions and the slow NON-IgE reactions to cow milk.

Features	Immediate IgE cow milk reactions	Slow NON-IgE cow milk reactions
Skin prick tests	Positive	Negative
Atopic child	Yes	No
Speed of reactions	Quick	Slow
Symptoms	Mostly skin: Urticaria Oedema Vomiting Anaphylaxis Wheeze	Mostly gut: Diarrhoea Vomiting Inconsolable crying Gastro-oesophageal reflux (GORD) Constipation

Protein profile of goat milk

Goat milk is the sole source of protein for infant formula based on goat milk. The protein profile of goat milk is closer to that of human milk than cow milk:

Table 1: Protein profile of human milk, goat milk, cow milk and infant formulae

	Protein (g/100g)	Individual proteins (% of total protein)					
		Casein proteins		β-lacto-globulin		α-lact-albumin	
		cs1	cs2	β	κ		
Goat milk	26	3	18	51	10	13	4
Cow milk	26	26	14	29	12	16	4
Goat infant ¹ formula	11	4	17	48	13	14	5
Adapted cow milk infant formula ²	12	14	7	17	7	40	11
Human milk ³	9				31	10	30

¹ Goat milk as sole protein source (Dairy Goat Co-operative (NZ) Ltd)
² Based on defatted milk and demineralised whey protein concentrate from cow milk (Wyeth, New Zealand)

³ Also contains 30% high molecular weight whey proteins (lactoferrin, IgA)
Source: AgResearch, New Zealand, 2003. The individual proteins in human milk, goat milk powder, cow milk powder, goat milk infant formula and cow milk infant formula were quantified and expressed as a percentage of total protein concentration.

Graphing this data

Figure 1: Casein profile (% of total casein)

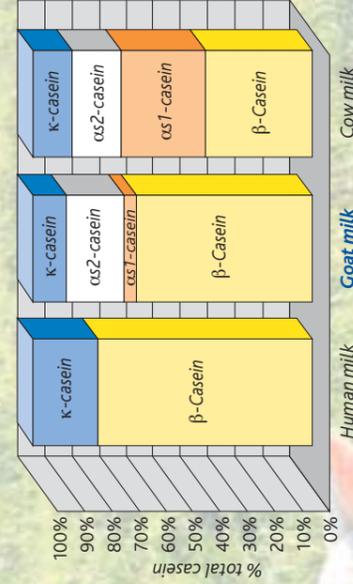
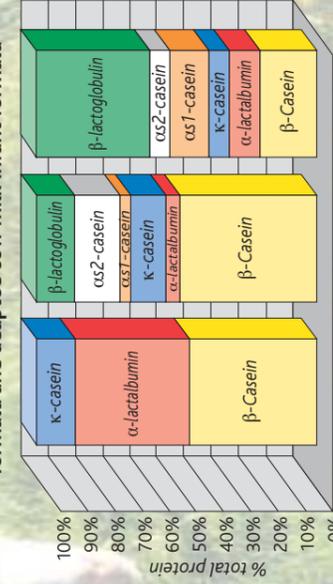


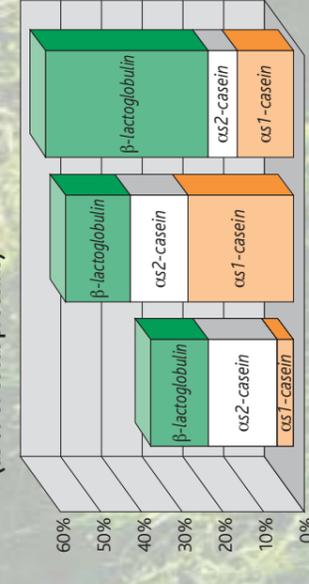
Figure 2: Protein profile of human milk, goat milk infant formula and adapted cow milk infant formula



Note: Human milk contains 30% high molecular weight whey proteins (lactoferrin, IgA) that are not included in protein profile depicted in this graph.

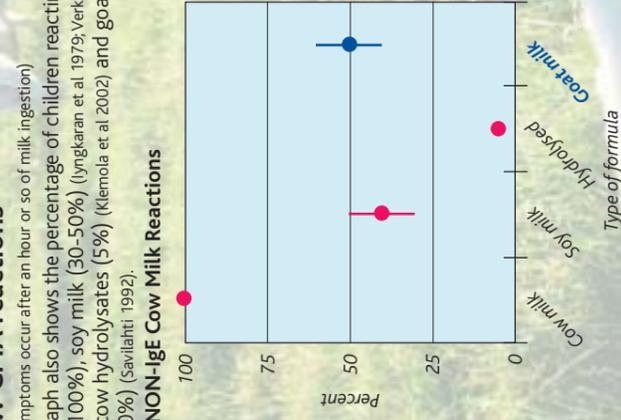
The protein content of goat milk is closer to that of human milk than cow milk and has a significantly lower allergenic burden than cow milk with respect to α-lactalbumin and β-lactoglobulin.

Figure 3: Types of protein not present in human milk (as % of total proteins)



SLOW CMA reactions
(First symptoms occur after an hour or so of milk ingestion)
The graph also shows the percentage of children reacting to cow milk (100%), soy milk (30-50%) (Iyngkaran et al 1979; Verkasalo et al, 1981); cow hydrolysates (5%) (Klemola et al 2002) and goat milk (40-60%) (Savilahi 1992).

Slow NON-IgE Cow Milk Reactions



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