

November 2006

Paediatric Policy

Soy Protein Formula

Suggested citation: Soy Protein Formula, Sydney: RACP 2006

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Acknowledgements

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1. Background

The use of a soy based formula was first reported in the 1920s as a milk substitute for infants who could not tolerate a dairy based formula. Over time the formulation has changed considerably, with introduction of soy flour in the 1950s, and replacement with soy protein isolate in the 1960s. The carbohydrate content of soy formula is usually a mixture of sucrose and corn syrup although maltodextrins are used in one preparation. There is no evidence that any of these carbohydrate sources is superior to another.

The number of infants fed soy formula is approximately 10 per cent in Australia and around 3 – 5 per cent in New Zealand. In New Zealand the proportion has fallen considerably over the last decade, as the New Zealand Ministry of Health has advised health professionals to restrict its use to medical indications only.

Use of soy formula in cow's milk allergy and intolerance

Since it contains no cow's milk protein or lactose, soy formula has been commonly used for the treatment of cow's milk protein intolerance (CMPI), IgE mediated milk allergy, and post infectious lactose intolerance.

The incidence of CMPI in our communities is around 2.0 per cent.¹ Soy protein can cause non-IgE related intolerance reactions with gastrointestinal symptoms and up to 40 per cent of infants intolerant of cow's milk also develop soy protein intolerance. IgE mediated cow's milk allergy has a similar prevalence, affecting around two per cent of children.^{2,3} The antigens are the common proteins in cow's milk including casein, lactalbumin and lactoglobulin. Soy allergy probably has a similar prevalence, and the major antigens in soy are the conglycinin and glycinin proteins.⁴ If cow's milk allergy is suspected consider skin-prick testing against the alternatives available locally rather than undertaking repeated empirical trials.

A number of studies have examined soy intolerance in infants with cow's milk allergy, and reported rates of up to 60 per cent. However only about 10 to 15 per cent of children with soy intolerance will have an IgE mediated allergy, and the remainder will have a non-IgE mediated enterocolitis.⁵ Infants with proven CMPI and soy allergies who are not breastfed have been shown to improve clinically on a diet of extensively hydrolysed casein based formula.⁶

About half the children consuming soy formula are doing it because the parents believe that it may prevent or treat food allergy, infantile colic or gastro-oesophageal reflux. Parents who are vegetarians/vegans or who choose not to use dairy products in their children's diet are also relatively common users of soy formula. Commercial soy milk drinks may be useful as part of a varied diet, for children from the age of 1 year with cow's milk allergy who are tolerant to soy. Any commercial soy drinks used must contain adequate protein and calcium for the age of the child. The soy beverages based on soy isolate generally have a better amino acid profile.

A recent systematic review⁷ reported that hypoallergenic formula significantly reduced

infantile colic, but substitution with a soy formula showed no clear benefit. The review supported and endorsed existing recommendations that parental counselling is the most effective intervention for colic.⁸

Use of soy formula in the Prevention of Food Allergy

A recent Cochrane review⁹ advises against the use of soy formula to prevent allergy or food tolerance in infants at high risk of these conditions. This recent, comprehensive review of studies showed that feeding soy formula from birth in infants at increased risk of developing allergy, does not have a beneficial effect, and that prolonged use worsened cumulative incidence of allergy and eczema. The prevention of milk allergy when there is a family history is another area of ongoing research. In high risk infants who are unable to be completely breast fed, prolonged feeding with an extensively hydrolysed casein formula or a partially hydrolysed whey formula may reduce infant and childhood allergy¹⁰. Osborne and Sinn⁹ found no clear differences between the effects of extensive versus partially hydrolysed formula on the development of cow's milk allergy in predisposed infants. There is a considerable cost if an extensively hydrolysed formula is used and it is unclear whether there is a corresponding level of benefit.¹¹

Use of soy formula in the management of lactose intolerance

Primary lactose intolerance is genetic, present from birth, and rare. Persistent hypolactasia may be precipitated by gastrointestinal infection. It is present throughout life, but adults often tolerate a little milk.

Secondary lactose intolerance may complicate recovery from a gastrointestinal infection in 10-20% of infants but is variable in severity and most formula fed infants usually recover rapidly on their normal infant formula. Short term use of a soy formula or lactose free dairy based formula may be useful in children with symptomatic post-infectious lactose intolerance. Breastfed infants should continue breastfeeding as tolerated throughout acute gastrointestinal infections.¹²

Use of soy formula in the Management of Galactosemia

In Australia and New Zealand, soy based infant formula is the feed of choice for the management of the infants and children with Galactosemia.¹³

2. Nutritional aspects of soy formula

Current evidence indicates that that soy formula is nutritionally equivalent to cow's milk formula for normal infants. Studies which have compared soy and dairy based infant formula have shown no difference in infant growth and development.

Earlier preparations of soy protein contained only one-third of available nitrogen as essential or semi-essential amino acids¹⁴ and therefore had a lower biological value than milk protein, however more modern soy protein isolates are closer in nutritional value to cow's milk protein. Soy may cause loss from the gut of vitamins, minerals and trace elements. Soy formula also contains phytate, which is capable of chelating divalent metal ions such as zinc, thus reducing the absorption of these essential micronutrients from the infant gastrointestinal tract.¹⁵ Manufacturers compensate for these potential problems in a variety of ways such as by adding extra protein, calcium and other minerals, chloride, methionine and iodine to soy formula.

3. Use in preterm infants

A number of studies^{16,17} have shown that soy infant formula is associated with osteopenia in preterm infants, even when supplemented with Vitamin D and calcium. A recent study has suggested that the use of Palm Olein as the lipid component of soy infant formula, may also contribute towards calcium malabsorption.¹⁸

High aluminium content has also been documented in soy formula¹⁹ but has not been proven to cause clinical problems in infants with normal renal function, and the levels have been reduced in some soy formula available in New Zealand and Australia. Despite this, reports of a significant adverse correlation between neuromotor development in preterm infants and increasing aluminium content of formula²⁰ and precautionary considerations with respect to aluminium body burden²¹ have led to recommendations that it not be fed to premature infants.

4. Phytoestrogens

Soy is a rich source of phytoestrogens (nonsteroidal estrogens of the isoflavone class). There is good evidence that these compounds are absorbed and metabolised by infants, but little evidence to date which shows unequivocally that compounds are pharmacologically active at the levels found in infants. There is conflicting evidence from studies of human populations and animal studies with respect to whether soy isoflavones are beneficial or harmful.^{22,23} Some studies of human populations suggest that routine consumption of soy may reduce endocrine cancers, in particular breast cancer. However the experimental animal literature has reported a number of adverse effects when these compounds are fed to immature laboratory animals including primates, so their safety cannot be taken for granted at this stage.^{24,25} There is also some evidence to suggest that in the presence of iodine deficiency the phytoestrogens in soy formula can affect thyroid hormone synthesis, but the clinical significance of this is unclear.²⁶

Given the relatively few conditions which unequivocally require the use of soy formula, and the concerns raised by recent reviews^{27,28}, a number of regulatory agencies including the New Zealand Ministry of Health²⁹ and the UK Committee on Toxicology,³⁰ have recommended that soy be used only to feed infants with Galactosemia.

5. Recommendations

The RACP:

1. recommends exclusive breastfeeding to 6 months followed by introduction of complementary foods and continued breastfeeding until 12 months of age, and beyond if mother and infant wish.
2. recommends that infants under one year who are not breastfed should be fed an infant formula, not a soy or dairy based milk marketed for older children or adult consumption.
3. notes that soy formula has not been shown to be effective at preventing the development of atopy in 'at-risk' children, and may worsen atopic illness with prolonged use.
4. recommends the use of extensively hydrolysed infant formula in infants with proven cow's milk allergy or CMPI who are not breast fed.
5. recommends that soy infant formula should not be used for preterm infants.
6. recommends that clinicians treating children for thyroid disorders consider the possible interaction of soy formula with thyroxin replacement therapy.
7. notes that it is appropriate to use Soy infant formula as part of the management of Galactosemia.

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