Safety of soy-based infant formulas containing isoflavones: the clinical evidence


**Introduction**

Isoflavones are a naturally-occurring plant compound found in all soy-based infant formulas. Because isoflavones are a type of phytoestrogens, and largely as a result of research in animal models, concerns have been voiced about the safety of isoflavone-containing, soy protein-based formulas.

**Clinical Review Purpose**

This review presents the clinical data relevant to controversial aspects of feeding infants soy protein-based formulas. The five areas of interest addressed by this review include:

- Nutritional adequacy
- Reproductive development
- Neurobehavioral development
- Immune function
- Thyroid disease

**Review Summary**

This paper systematically explores the debates surrounding soy protein-based infant formula:

- **Nutritional adequacy**: extensive clinical data have shown that soy protein-based formulas provide good nutrition to the infant even during the most rapid phase of growth. No adverse effects on growth have been observed in infants while consuming soy protein-based formula or after consumption of soy protein-based formula.\(^1\)\(^3\)

- **Reproductive development**: there is complexity in applying observations of isoflavone exposure in animal models to human populations. Knowledge gaps that limit the ability to learn from some animal studies include between-species metabolism differences and differences in exposure levels of isoflavones between animal models and humans.\(^4\)\(^5\)

*A phytoestrogen* is a chemical compound that occurs naturally in plants, such as soybeans, or plant products, such as whole grain cereals, and has estrogenic properties.
- **Neurobehavioral development**: a large, retrospective cohort study (n=811) of adults who had consumed either soy protein-based formula or cow milk-based formula as infants showed no difference in educational outcome (as measured by level of highest education) between these two groups.³

- **Immune function**: some studies based on mice or early studies using soy flour-based formula had shown reduced immune function (in mice) or poor response to polio vaccine (in human infants). The mouse studies were not controlled (i.e. no untreated mice, or mice treated with a placebo) and did not take into account the stress of the actual testing (daily injections for 35 days); the early studies of soy flour-based formula are no longer relevant. More recent studies of modern soy protein-based formula showed that these formulas supported normal immune system development in young, growing infants—including normal immune response to oral polio vaccine.¹,⁶–⁸

- **Thyroid disease**: most thyroid issues were associated with the use of soy flour-based formulas. These formulas were replaced in the 1970s with soy protein isolates fortified with iodine.

**Review Findings**
In all five areas addressed, in-depth reviews of published preclinical and clinical study results have found that there is no conclusive evidence from animal or human adult or infant populations to indicate that dietary isoflavones may adversely affect human health, development, or reproduction.

**Discussion**
Soy protein-based infant formula has a long history of safe use as a plant-based protein alternative for infants. While large prospective or retrospective long-term studies involving more than a few hundred infants fed soy protein-based infant formula do not exist, all of the available evidence indicates that these formulas are safe.

**Conclusions**
Soy-based infant formula is well recognized as a healthy alternative to human or cow’s milk. Recent in-depth reviews of the safety of dietary isoflavones in soy have found that there is no conclusive evidence from animal, human adult, or infant populations to indicate that dietary isoflavones adversely affect human health development or reproduction.
References


