



# Soya and the Health of Young People

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## Summary

- Soya foods are a perfect fit with current dietary recommendations, which encourage more plant-based eating across all ages.
- Soya foods are an excellent source of high-quality protein and polyunsaturated fat, and many are also good sources of fibre.
- Concerns surrounding isoflavones, naturally present in soya, are based primarily on findings from rodent studies, which have limited applicability to humans and contrast with the results from human studies.
- Soya infant formulae, which have been used for decades, have been shown to produce normal growth and development.
- Mineral bioavailability from soya foods, especially with regard to calcium and iron, is more than adequate.
- Health professionals should feel confident when recommending soya infant formulae for medical, dietary or ethical reasons and soya foods during weaning and early childhood.



## Introduction

Foods made from soya beans such as tofu, soya drinks and soya alternatives to yogurt are thought to exert a number of health benefits. Not surprisingly, most of the research upon which conclusions about soya are based involve studies of adults. However, consuming soya foods early in life may be particularly advantageous.

Childhood eating habits track into adulthood, so learning to eat healthfully when young can help to establish beneficial lifelong eating behaviours.<sup>1-6</sup> Furthermore, evidence strongly indicates that healthful behaviours during the first 1,000 days of life, childhood and adolescence can affect the risk of developing chronic diseases later in life.<sup>17-10</sup> In addition, it is recognised that the beginning stages of chronic diseases, such as coronary heart disease, are already apparent in adolescents.<sup>11,12</sup>

Among Asian populations, soya is consumed at very early ages. Traditional soya foods are considered baby foods in Japan; children consume soya products within the first year of life<sup>13</sup> and continue to consume soya throughout childhood.<sup>14-16</sup>

**The purpose of this fact sheet is to provide an overview of the role of soya foods in the diets of young people.**

# Infants and Soya Infant Formulae

## Prevalence of Breast and Formula Feeding

Breast milk is the ideal food for infants for the first six months of life, and mothers should be encouraged to breastfeed in line with the recommendations of the World Health Organization and UK guidance.<sup>17-20</sup> However, some women are unable to breastfeed or choose not to do so. According to UK data, the prevalence of breastfeeding falls from 81% at birth to 45-55% at six weeks.<sup>17,21,22</sup> At six months, only 1% of mothers are exclusively breastfeeding, whilst just over a third of mothers continue to breastfeed alongside formula feeding and /or weaning.<sup>17,22</sup> Thus, many women who do initially breastfeed will switch to formula feeding at some point in the infant's first year.

In the UK, a third of babies are solely or partially fed on infant formula from birth and 88% by six months.<sup>17,22</sup> Commercially-prepared, fortified infant formulae are appropriate to supplement or replace human milk during the first year of life.



## Soya Infant Formula

In the United States, some estimates are that for many years soya infant formula (SIF) represented 20-25% of the formula market, which suggests that approximately 20 million American infants have been fed SIF since the 1970s.<sup>23</sup> More recent data indicate SIF makes up about 13% of the US formula market.<sup>24</sup> A wealth of data shows that there are no significant differences in growth, development or health among infants fed SIF compared with infants fed cow's milk formula during the first year of life.<sup>25,26</sup>

### Clinical Evidence

Despite data showing normal growth and development in infants, there is still some debate about the use of SIF due to concerns that the isoflavones in soya exert adverse effects. There is no dispute that after consumption of SIF, circulating isoflavone concentrations in infants are much higher than the concentrations of isoflavones in adults consuming soya foods.<sup>27</sup> Although isoflavone exposure on a body weight basis in infants fed SIF is high relative to children and adults consuming soya foods,<sup>27</sup> there is little evidence to suggest isoflavones exert physiological effects in infants. Nevertheless, in response to the concerns about isoflavones, the US National Toxicology Program (NTP) decided to evaluate the safety of SIF.

**Importantly, the conclusion of the 14-member panel of independent scientists in charge of this evaluation was that there was “minimal concern” (the five levels of concern are negligible concern, minimal concern, some concern, concern and serious concern) about safety.<sup>28</sup> Furthermore, in response to this conclusion, the American Academy of Pediatrics submitted a letter to the NTP in which they expressed their view that there was negligible concern.**

Although no studies have evaluated the impact of soya on hormone levels in infants, there exists clinical work showing that soya isoflavones do not affect endogenous reproductive hormone levels in young boys and girls.<sup>29,30</sup> Also, cross-sectional studies involving Seventh-day Adventist boys<sup>31</sup> and girls<sup>32</sup> – a high soya-consuming population – found that the age of puberty onset among high-soya-consumers falls well within the normal range.

There is no doubt that rigorous investigation of SIF will continue. Some of the most interesting ongoing research is being conducted at the University of Arkansas in the US – the Beginnings Study.

The **Beginnings Study** is evaluating a range of health outcomes among a group of infants fed SIF, cow's milk formula or breast milk. Some of the outcomes, such as reproductive organ size, body fat content and speech recognition, have the potential to provide unique insight. The study has been underway for almost a decade and thus far, results do not reveal any clinically relevant differences among the three groups; measurements for infants fed SIF fall well within the normal ranges.<sup>33-37</sup> For example, at age five years there were no significant differences in reproductive organ volumes (breast buds, uterus, ovaries, prostate, and testicular volumes) among children fed SIF, cow's milk formula or breast milk, which suggests SIF was not exerting oestrogenic effects on the organs studied. The follow-up of these children through puberty is planned and should help delineate potential early infant feeding effect on reproductive function later in life.

## Isoflavones Explained

Isoflavones have structural similarities to the hormone oestrogen (17 $\beta$ -oestradiol).

Although classified as phytoestrogens, they behave differently than oestrogen in the body.

At the molecular level, isoflavones differ from oestrogen because of the two known oestrogen receptors (ER), ER $\alpha$  and ER $\beta$ .

- Isoflavones preferentially bind to and activate ER $\beta$ , whereas oestrogen binds to and activates each receptor equally.<sup>38</sup> This difference is important because, when activated, these two receptors can have different and sometimes opposite physiological effects.

In addition to being phytoestrogens, isoflavones are classified as natural selective oestrogen receptor modulators (SERMs).

- SERMs exert oestrogenic effects in some tissues, anti-estrogenic effects in others, and no effect at all in some tissues affected by oestrogen.
- SERMs developed by the pharmaceutical industry, such as tamoxifen and raloxifene, are designed to have some of the benefits of oestrogen without the adverse side effects.

Much of the concern about isoflavones can be attributed to the results of rodent studies. Rodent studies are of questionable utility for providing insight into human nutrition due to the significant physiological differences between the two species. Rodents are especially of limited value for evaluating isoflavones because rodents metabolise isoflavones very differently to humans.<sup>39-45</sup>

## Soya Infant Formula and Cow's Milk Protein Allergy

Estimates are that 2-6% of UK children are diagnosed with cow's milk protein allergy (CMPA) which is most prevalent during infancy and early childhood.<sup>46</sup> In non-breastfed or mixed infants, the use of hypoallergenic formula or SIF should be a clinical decision based on a number of factors including clinical presentation, presence of multiple allergies, the taste acceptance, compliance and cost.<sup>47-49</sup> Although specialised hypoallergenic formula is the first option, SIF is popular – particularly in infants over 6 months of age and without concomitant soya allergy.<sup>50-52</sup> It is generally agreed that SIF is considerably more palatable and less expensive than hypoallergenic formula and can be effective in children with CMPA, depending upon age and diagnosis.<sup>47,53-55</sup>

One study found that growth parameters of 168 infants with CMPA given either SIF or extensively hydrolysed formula did not differ significantly by the age of two years.<sup>56</sup> In addition, no difference in iron and zinc levels between the two groups was observed. The conclusion of this study was that the



nutritional status and growth of both groups were well within reference values, and that the selection of formula can largely be made on the basis of the infant's tolerance to the formula.

### IgE vs non-IgE-mediated CMPA.

The prevalence of concomitant soya allergy in infants with CMPA differs between IgE and non-IgE-mediated diseases. Estimates are that 10-14% of infants with IgE-mediated CMPA have concomitant soya allergy, whereas up to 50% of infants with non-IgE-mediated CMPA are allergic to soya.<sup>51,52,57,58</sup> The World Allergy Organization published guidelines recommending hypoallergenic formula as the preferred choice for infants with CMPA. However, in infants over six months with IgE-mediated CMPA and without concomitant soya allergy, SIF can be used – especially in older infants who refuse hypoallergenic formula.<sup>47</sup>

### Soya Allergy

The relative number of children allergic to soya protein is small. According to a systematic review, the prevalence of soya allergies among the general population (including infants and young children) ranges from 0.3-0.6%.<sup>46</sup> Furthermore, 70% of children outgrow their soya allergies by age 10.<sup>59</sup>

## Soya and Children One Year and Older

Short-term studies show that soya foods support the normal growth and development of children<sup>60</sup> and improve growth when substituted for legumes in the diets of malnourished pre-schoolers.<sup>61,62</sup> Soya foods provide high-quality protein and are generally low in saturated fat.<sup>63</sup> Plus, the fat in soya is comprised primarily of polyunsaturated fatty acids.<sup>64</sup>

### Soya Protein

Soya protein is a high-quality protein. It provides all of the essential amino acids in sufficient quantities to meet the body's requirements when consumed at the recommended levels for total dietary protein intake.<sup>65,66</sup> The quality of soya protein is similar to animal protein and higher than protein from nearly all other plant sources. Irrespective of the protein quality scores of individual foods, it has been shown that diets based entirely on plant food sources of protein which meet energy needs can provide all essential amino acids.<sup>67</sup> Protein intakes in

the majority of children in the UK exceed recommendations,<sup>68</sup> and some evidence indicates consuming protein above recommendations enhances the favourable impact of physical activity on bone mineral density.<sup>69,70</sup>

A specialised soya drink for children aged 1-3 years is now on the market. This soya drink is specifically designed to meet the nutritional needs of children more than one year of age. As such, it is more calorically dense and fortified with iron, iodine, calcium and vitamin D.<sup>71</sup>

### Soya Protein and Cholesterol Levels in Children

Meta-analyses of the clinical data consistently show that soya protein directly lowers circulating low density lipoprotein cholesterol (LDL-C) levels.<sup>72,73</sup> Not surprisingly, these analyses have included studies involving adults. However, although very limited, the data show that, as with adults, soya protein favourably affects lipid levels in children.<sup>74-78</sup> In the most recent study to be conducted, when soya protein (average intake 0.5g/kg body weight) was incorporated into the diets of children and adolescents (mean age 8.8 years; range 4-18 years) with familial and polygenic hypercholesterolemia, LDL-C decreased by 6.4% beyond the 11% decrease that occurred in response to the adoption of a standard low-saturated fat diet during the three-month run-in period.<sup>78</sup> Because of the favourable change in fatty acid intake, substituting soya foods for commonly consumed sources of protein will also help to lower LDL-C.<sup>72</sup>



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## Mineral Balance

Since meat is a good source of iron, and zinc and dairy products good sources of calcium, some consideration should be given to the impact of replacing these foods with soya foods on mineral balance. Getting sufficient calcium without dairy is relatively easy because most soya drinks and soya alternatives to yogurt are fortified with this mineral. Importantly, the calcium in these products is as well absorbed as the calcium in dairy products.<sup>79-81</sup> Plant-based diets are actually quite high in iron and there is evidence that iron absorption from soya is much better than initially thought because much of the iron is in the form of ferritin, which may not be subject to the inhibitory effects of phytate.<sup>82</sup> Furthermore, relatively new research shows that over time in response to a high-phytate diet, the inhibitory effects of phytate on mineral absorption is greatly mitigated.<sup>83</sup>

## Early Soya Intake and Breast Cancer

There is growing evidence that the consumption of as little as one serving of soya per day during childhood and/or adolescence may reduce risk of developing breast cancer by 25-50% later in life.<sup>84-88</sup> Evidence suggests that exposure to isoflavones causes cells in the developing breast to be changed in a way that makes them permanently less likely to be transformed into cancer cells. This “early intake” hypothesis has been investigated for more than 20 years.<sup>89</sup> The notion that soya intake early in life is protective against breast cancer is consistent with the recognition that childhood and adolescent lifestyle and environmental exposures influence subsequent risk of developing a range of cancers arising in adulthood.<sup>90</sup>



## Summary and Conclusion

Soya foods can make important contributions to an overall healthy balanced diet and complement the latest dietary guidelines encouraging more plant-based eating. Soya foods provide high-quality protein and ample amounts of polyunsaturated fats, and many are also good sources of fibre.

There is no doubt that investigation of soya infant formula will continue. And while more research is welcomed, there is little question that the available evidence indicates that soya infant formula is safe and produces normal growth and development. It has been used for decades, and when used may be the sole source of nutrition for infants, and yet no adverse effects on growth and development have been observed. The lack of reported adverse effects certainly speaks to the safety of soya infant formula.

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