

## Mind The (Risk Perception) Gap On BPA

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### Summary

It is commonly perceived that natural chemicals are safe while manmade substances may be harmful. These perceptions, however, if not supported by scientific evidence, can result in risk perception gaps that can cause us to worry more than warranted by the evidence.

A current example of a risk perception gap is the common belief that naturally occurring chemicals known as isoflavones, which are present at significant levels in some foods, are safe or even beneficial to health. In contrast, the manmade chemical bisphenol A (BPA), which may be present at lower levels in some foods, is commonly believed to be harmful.

Recent pharmacokinetic studies from the U.S. Food and Drug Administration suggest that these beliefs are inverted. The pharmacokinetic data on BPA indicate that it is not likely to be harmful due to efficient metabolism and rapid elimination from the body. In contrast, data from a recent study suggests that isoflavones could pose a higher potential health risk compared to BPA. Understanding the difference between real risk and perceived risk is important for consumers to make sound choices based on facts rather than fears.

### Background

The chemical [bisphenol A \(BPA\)](#) has been a popular topic for discussion in recent years in both consumer and scientific publications. In many, probably even most, of these discussions, the term risk is used in close proximity to BPA.

In scientific publications, risk is a technical term that refers to the likelihood of a health effect occurring due to exposure, in this case to BPA. Risk is generally understood to be a quantifiable measure that is based on an objective analysis of scientific facts. Of perhaps more importance for consumers is the concept of risk perception. In sharp contrast, risk perception is a subjective measure in which scientific facts are interpreted through an emotional and instinctive psychological lens that considers both facts and fears.

The distinction between risk and perception often leads to a [risk perception gap](#), a term that has been studied and popularized by the risk perception [consultant](#) and [scholar](#) David Ropeik, affiliated with Harvard. The gap between facts and fears can cause us to worry about something more, or less, than warranted by the evidence.

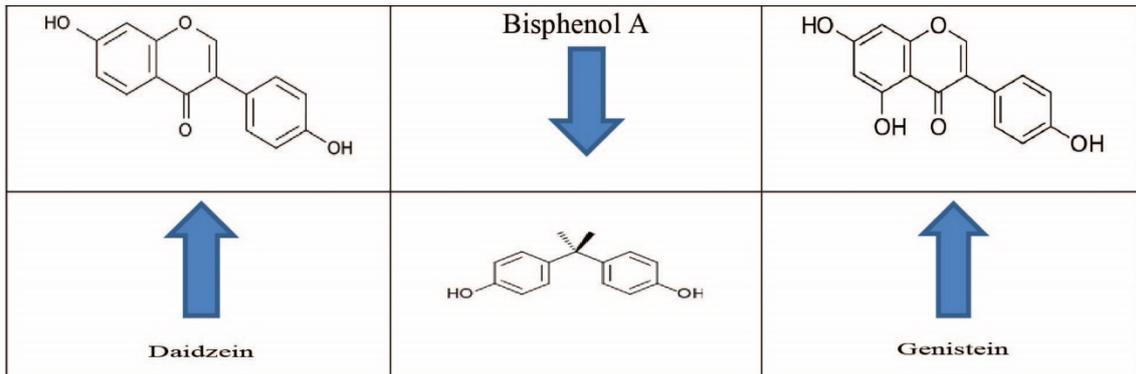
A number of emotional factors have been identified that help explain why some risks are feared more than others. One factor is that we tend to be more afraid of manmade risks compared to natural risks. A good example of a risk perception gap based on this factor was highlighted in a recent study of natural chemicals known as isoflavones that occur at significant levels in a wide range of foods, in particular soy-based food products.

### **New Study on Isoflavones**

Isoflavones are well known to be estrogenic, which raises the potential for interference with the body's endocrine system and resulting health effects. Soy infant formula is of particular interest since it may be the sole source of nutrition for some infants, leading to relatively high exposure to isoflavones at a sensitive age of development.

The [new study](#), conducted by the U.S. Food and Drug Administration (FDA), examined the pharmacokinetic properties of two prototypical isoflavones (genistein and daidzein) in neonatal and adult rhesus monkeys, which are a good experimental model for humans. Pharmacokinetic studies do not test toxicity directly, but provide information on the potential for toxicity by monitoring what happens to a chemical once it enters the body. For example, pharmacokinetic studies measure how much of a chemical is absorbed, where it goes in the body and in what form, how long it lasts in the body, and how it is eliminated.

For comparison, FDA previously conducted a similar pharmacokinetic [study on BPA](#). Similar to isoflavones, it is well known that BPA is weakly estrogenic. In contrast to natural isoflavones, which are widely believed to be safe or even beneficial to health, BPA is a manmade chemical that is believed by many to be unsafe. In this context of risk perception, the comparison of pharmacokinetic properties between isoflavones and BPA is particularly informative.



### Implications for Real Risk vs. Risk Perception

The two studies found that both isoflavones and BPA are metabolized and eliminated from the body after oral exposure. Beyond general similarities though, there are several important pharmacokinetic differences between isoflavones and BPA, in particular when studied in neonatal monkeys.

An important pharmacokinetic parameter is how much of a substance enters the bloodstream in its parent form (i.e., unmetabolized), which is the biologically active form. This is referred to as the internal exposure or dose of the substance. In neonatal monkeys, the internal dose of the isoflavones was found to be about 5,000 times higher than the internal dose of BPA, as measured by maximum blood concentration of the parent substances. This suggests significant differences in the physiological systems for metabolism and clearance of isoflavones compared to BPA.

A similar difference was found in the length of time the substances remain in the body before elimination, with isoflavones staying in the body longer. This difference suggests immaturity in the physiological systems for elimination of isoflavones compared to BPA. Overall, the pharmacokinetic profile of BPA suggests that it is unlikely to cause health effects at typical human exposure levels, which are very low. As stated by the FDA researchers:

*“Despite repeated determinations of safety by major food regulatory bodies, including the U.S. Food and Drug Administration and European Food Safety Authority, a high degree of risk perception is often associated with children's ingestion of BPA ... Such an exposure produces low internal exposures in newborn monkeys (0.01-0.02 nM peak serum concentration per mg/kg bw ingested) ... This*

*contrasts with the perceived safety of soy formula ... despite the much larger doses of soy isoflavones consumed ... that produce substantially higher internal exposures (50-100 nM peak serum concentration per mg/kg bw ingested) ... This dichotomy likely reflects the roles that natural vs. synthetic chemicals and individual vs. corporate choices predictably play in shaping risk perception and the limited ability of public institutions to bridge "The Risk Perception Gap" engendered by basic cognitive processes shared by different groups within scientists and the lay public alike (Ropeik, 2015)."*

As noted above, pharmacokinetic studies do not directly measure toxicity, but the significant pharmacokinetic differences suggest that isoflavones have a higher potential for risk to human health compared to BPA. This is particularly important since human exposure to isoflavones (e.g., infant exposure through soy-based formula) is quite a bit higher than human exposure to BPA.

The perception of risk for isoflavones and BPA is precisely the opposite, with isoflavones perceived to be safe or beneficial while BPA is perceived to be a risk to human health. Understanding both risk and risk perception is important to support sound choices based on facts rather than fears.