

Beware of the risk of liver toxicity from overconsumption of foodstuffs or food supplements containing cinnamon

Cinnamon bark, especially from Chinese cinnamon, contains high levels of coumarin, which is toxic to the liver in large doses. There is no maximum regulatory level for coumarin in food supplements, despite the fact that consumption of food supplements containing cinnamon can lead to the Tolerable Daily Intake (TDI) for coumarin being greatly exceeded. ANSES therefore recommends a maximum daily intake of coumarin in food supplements of 6 mg for a 60-kg adult, and advises against their consumption by people with a history of liver disease. Lastly, ANSES also recommends taking special care with regard to the oral intake of cinnamon essential oils for dietary purposes.



Coumarin, a compound found in varying levels in certain plants

Coumarin is a compound occurring naturally in certain plants such as **cinnamon**, tonka bean and sweet clover. The coumarin content in these plants or their essential oils is highly variable. In food, maximum levels [1] of coumarin have been set for food ingredients where it occurs naturally. However, these plants and essential oils are sometimes used in food supplements without any coumarin content being specified. Coumarin is also used in some cosmetic and household products (perfumes, air fresheners, etc.), where human exposure is not negligible [2].

Cinnamon is considered to be the main dietary source of coumarin. The cinnamon used in foodstuffs and food supplements is usually the bark of Chinese cinnamon (*Cinnamomum cassia* (L.) J.Presl) or Indonesian cinnamon (*Cinnamomum burmanni* (Nees & Nees)). These cinnamons have a far higher coumarin content than Ceylon cinnamon.

Plants containing coumarin, in particular cinnamon, are most often found in food supplements claiming to "maintain blood sugar levels".

Toxicity of coumarin

When taken in high doses, coumarin poses a **risk of liver toxicity**. This is manifested by abnormal liver biology (increase in circulating concentrations of liver enzymes), which is reversible after cessation of exposure. At very high doses, it causes more serious liver damage (hepatic cytolysis, liver failure) [4].

To limit dietary exposure, the European Food Safety Authority

(EFSA) has set a TDI of 0.1 mg/kg of body weight per day for coumarin [3].

Adverse effects identified by the vigilance schemes for food supplements

Between January 2006 (date of the first case reported to poison control centres) and February 2020, 66 cases of adverse effects associated with the consumption of food supplements containing coumarin were recorded in the poison control centres' information system. Of these, 52 (79%) involved essential oils. Around 40% of these reported adverse effects were digestive disorders (abdominal pain, vomiting, diarrhoea, etc.).

Eighteen percent of the cases involved otorhinolaryngologic disorders (oropharyngeal pain or irritation), 13% had general symptoms (headache, dizziness, etc.) and 11% concerned neurological disorders (drowsiness, loss of consciousness, etc.).

In addition, ANSES's nutrivigilance scheme received 48 reports of adverse effects liable to be associated with the consumption of herbal supplements containing coumarin, between the scheme's establishment in 2009 and the month of April 2019.

ANSES was able to analyse the causality in 28 of these 48 reports (the others were not sufficiently documented to be appraised). It should be noted that more than half of the cases (57%) involved products containing essential oils. The adverse effects reported mainly concerned liver (hepatic cytolysis) and digestive (nausea, vomiting, abdominal pain, etc.) symptoms.

What is the maximum daily intake of coumarin that can be safely consumed?

According to data from the Third Individual and National Study on Food Consumption (INCA3), exposure of the French population to coumarin through food can account for as much as 20% of the TDI [6], without including additional consumption from food supplements. There is therefore a high risk of this TDI being exceeded in heavy consumers of food supplements containing plants rich in coumarin, such as Chinese cinnamon.

Manufacturers and distributors of food supplements recommend daily cinnamon intakes of between 1000 mg and 8000 mg/d.

Assuming an average coumarin content of 3000 mg/kg of Chinese cinnamon, the consumption of food supplements could correspond to intakes of 3 to 24 mg of coumarin per day (without taking into account other sources of exposure, via food or otherwise). With these intakes, the TDI of 0.1 mg/kg body weight per day, i.e. 6 mg/day for a 60-kg adult, could therefore be largely exceeded. In addition, consumption may be subchronic, as the duration of use recommended by man-

ufacturers can be as much as three months.

In view of the data on dietary exposure (excluding food supplements) and in order to comply with the TDI, ANSES recommends keeping coumarin intake through the consumption of food supplements below 4.8 mg of coumarin per day for a 60-kg person. This intake can be reached through consumption of food supplements containing around 1600 mg/d of cinnamon, which is quite common as shown above.

Important note

ANSES recommends taking special care with the use of cinnamon essential oils in products intended for food and food supplements, because these essential oils have been responsible for most of the adverse effects associated with coumarin recorded by nutriviigilance schemes. It recommends that coumarin consumption should not exceed the TDI.

The Agency also advises people with liver disease not to consume foods rich in cinnamon or food supplements containing coumarin.

**Youssef EL-OUADRHIRI et
Gwenn VO VAN REGNAULT (Anses)**

TO FIND OUT MORE :

[Opinion on the "assessment of the risk of hepatotoxicity associated with the coumarin content of certain plants that can be consumed in food supplements or in other foodstuffs"](#)

References

- [1] Regulation (EC) No 1334/2008 of the European Parliament and of the Council of 16 December 2008 on flavourings and certain food ingredients with flavouring properties for use in and on foods and amending Council Regulation (EEC) No 1601/91, Regulations (EC) No 2232/96 and (EC) No 110/2008 and Directive 2000/13/EC.
- [2] Lake, B.G. 1999. "Coumarin metabolism, toxicity and carcinogenicity: relevance for human risk assessment." *Food Chem Toxicol* 37 (4):423-453.
- [3] EFSA. 2004. "Opinion of the Scientific Panel on food additives, flavourings, processing aids and materials in contact with food (AFC) related to Coumarin." *EFSA Journal* 2 (12):104.
- [4] Abraham, K., M. Pfister, F. Wohrlin, and A. Lampen. 2011. "Relative bioavailability of coumarin from cinnamon and cinnamon-containing foods compared to isolated coumarin: a four-way crossover study in human volunteers." *Mol Nutr Food Res* 55 (4):644-53. doi: 10.1002/mnfr.201000394.