

Contaminants that might be found in cocoa and their potential effects on mammals

Chemical compound	Effect on health	Comments
Mycotoxins		
Ochratoxin A (OTA)	Damages DNA (mutagen)	Mycotoxin of most concern commonly occurring in cocoa
Aflatoxins (Aflatoxin B1 is considered the most toxic)	Children are especially affected: leads to stunted growth and delayed development. Chronic exposure also leads to a high risk of developing liver cancer.	At least 14 different types of aflatoxin are produced in nature by the very common <i>Aspergillus</i> spp.
Zearalenone	Infertility, abortion or other breeding problems	
Trichothecenes: large group chemically related compounds	Powerful inhibitors of protein synthesis	Considered for use in biological warfare
Heavy metals		
Cadmium (Cd)	Highly toxic and carcinogenic; softening and reduction of bone density especially in children and the elderly. Can cause damage to kidneys and lungs. In males can reduce virility and cause genital deformity.	Regulatory limit = 5 parts per billion (ppb) – EPA, FDA, OSHA
Lead (Pb)	Carcinogen can cause miscarriages and infertility, in males. Can affect every organ and system in the body.	Regulatory limit = 15 ppb – EPA
Mercury (Hg)	Damages nervous system, can cause permanent damage to brains and kidneys of developing fetuses	Regulatory limit = 2 ppb-EPA
Cr(VI) (hexavalent chromium)	Toxin and Carcinogen. Damage to kidney, liver, circulatory and nerve tissues.	Skin contact can cause ulcers and allergic reactions. EPA Regulatory limit = 0.1 ppm
(Copper)	(See below)	

Pesticides (more toxic groups: as residues)

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Cyclodienes (includes endosulfan), HCH	Acute neurotoxins; suspected carcinogens and endocrine disruption	Now mostly withdrawn
OP insecticides	Acute neurotoxins; suspected endocrine disruption	But no agreed definition of an “endocrine disruptor”, as yet; many have been withdrawn.
Carbamates	Acute neurotoxins; some suspected carcinogens and endocrine disruption	Ditto
Pyrethroids, Neo-nicotinoids	Some may have moderately high oral toxicity	Common insecticides now: extensive testing in order to obtain registration
Bipyridylum herbicides	Highly toxic by all routes of exposure, but especially oral (and inhalation).	ADI: 0.002 mg/kg (paraquat dichloride)
Fungicides: Copper compounds	Acute toxicity relates primarily to copper sulphate.	Virtually no reported cases; one of 26 essential trace elements occurring naturally in plants and animals.
Rodenticides	Very high mammalian toxicity	Toxic to be functional!

Other Potential Contaminants

Dioxins	Acute toxins; carcinogens and endocrine disruption	Was found in 2,4,5-T - a now banned herbicide
PAHs (Polycyclic Aromatic Hydrocarbons)	Carcinogens. (also cause “off flavours”)	Only 17 of the 100+ PAHs are of concern in cocoa
FFA (Free/trans Fatty Acid)	Diabetes	Also indicator of poor cocoa quality