

Curcumin

The fat-soluble polyphenol curcumin has an anti-inflammatory, antioxidant, antiseptic and analgesic properties. It is gaining importance in Western medicine and has been included, for example, in the S3 guideline ulcerative colitis of the German Society of Gastroenterology.

Three different ingredients, so-called "Curcuminoids" in curcuma root extract:

- Curcumin (isolated active ingredient: diferuloylmethane)
- Demethoxycurcumin (DMC)
- Bisdemethoxycurcumin (BDMC)

Biochemical properties

1. antioxidant

2. anti-inflammatory: inhibition of the proinflammatory transcription factor NF- κ B, reduces lipoxygenase (LOX) and cyclooxygenase-2 (COX-2) and thus reduced prostaglandin synthesis. Also it decrease expression of proinflammatory cytokines such as interleukins and TNF α

3. anticarcinogenic: Curcumin inhibits NF- κ B thus decreases angiogenesis and metastasis, induced apoptosis. Triggering of autophagy (cellular recycling system) and inhibition of VEGF (vascular-epithelial-growth factor; VEGF is essential for the blood supply of the tumor). Curcumin is also has a synergistic effect in combination with different chemotherapeutics.

4. Neuroprotective: Curcumin inhibits the aggregation of β -amyloid. It also Inhibits β -secretase and acetylcholinesterase in nerve cells

5. Cartilage protection in OA: Due to reduced prostaglandin synthesis, inhibition of elastase, collagenase and other cartilage-destructive cytokines.

6. As an antidepressant: Curcumin modulates the release of dopamine and serotonin, leads to an increase in the concentration of the growth factor BDNF (Brain-derived neurotrophic factor)

7. As an anticoagulant: Curcumin leads to a partial inhibition of platelet aggregation.

Uses:

The main area of application of curcumin is complementary cancer therapy and in inflammatory processes. However, it was recognized that the active ingredient also achieves a positive effect in the following diseases and is a useful addition to existing forms of therapy:

- Rheumatoid arthritis
- Chronic inflammatory bowel diseases (ulcerative colitis / Crohn's)
- Neurodegenerative diseases (M. Alzheimer's, M. Parkinson's)
- Cardiovascular diseases
- Psoriasis
- Allergies
- Diabetes Mellitus type I and II

Curcumin in cancer therapy: Curcumin is highly interesting for cancer therapy because of its numerous effects on cell growth and cell development. Polyphenol has the potential to support conventional tumor therapy and at the same time reduce the side effects that occur. Meanwhile, many studies also prove the positive benefits of curcumin in complementary cancer therapy.

a) Curcumin for breast cancer: The transcription factor NF- κ B plays a key role in the proliferation of tumor cells in breast cancer. It ensures the activation of proinflammatory processes and the development of tumors. Curcumin can downregulate the activity of NF- κ B and thus inhibit the proliferation and invasion of cancer cells. Many other targets are potential targets of curcumin in breast cancer therapy, such as the growth factor receptors HER-2 and EGFR. Studies also looked at the benefits of curcumin in complementary breast cancer therapy with standard chemotherapy. A protective effect against the cytotoxic side effect on healthy cells has been observed with 5-fluorouracil therapy. Another study confirms the benefits of co-therapy with doxorubicin and doxorubicin-resistant cancer cells. Here, an improvement in the chemo sensitivity of the resistant cells was achieved and the effectiveness of doxorubicin was thus improved.

Study situation on curcumin as a synergistic therapy component (in vitro):

polyphenol	Chemotherapy	Type of cancer	Source
Curcumin	5-fluorouracil	Chest	[15]
Curcumin	Doxorubicin	Chest	[16]

b) Curcumin in lung cancer: Curcumin exerts an effect on lung cancer cells through the attack of various molecular targets and important signaling pathways of the cancer cell. For example, it was discovered that inhibition of phosphorylation of the STAT3 protein is a factor in the antiproliferative effect of curcumin on tumor cells. STAT3 acts as a transcription factor in information transmission in the cell and can lead to uncontrolled growth and persistent angiogenesis in the event of misregulation in cancer cells. Other points of attack of curcumin in lung cancer are the Epidermal Growth Factor Receptor (EGFR), as well as the COX-2.

A study shows the effectiveness of curcumin when co-administered with the chemotherapy gefitinib to increase the anticarcinogenic effect and reduce gastrointestinal side effects. In another study, the improvement in the effectiveness of cisplatin in the treatment of non-small cell lung cancer by curcumin could be observed.

Study situation on curcumin as a synergistic therapy component (in vitro and in vivo):

polyphenol	Chemotherapy	Type of cancer	Source
Curcumin	Gefitinib	Lungs	[17]
Curcumin	Cisplatin	Lungs	[18]

c) Curcumin in gastrointestinal carcinomas: The complementary use of curcumin in gastrointestinal carcinomas has been studied in several studies, such as the joint use with 5-fluorouracil in gastric carcinoma. Here, a synergistic effect in combination therapy and an improved cytotoxic effect compared to monotherapy could be observed. The COX-2 and NF- κ B signaling pathway is assumed as a possible point of attack. Several studies have also been able to prove the effectiveness of curcumin in complementary therapy in colon carcinomas. For example, the administration of curcumin with concomitant oxaliplatin therapy leads to synergistic effects with existing resistance and improved results in the treatment of metastatic colon cancer. Another study examined the co-administration of curcumin with 5-fluorouracil (5-FU) and oxaliplatin. Here, the authors of the study concluded that curcumin is an effective complementary treatment strategy to prevent the development of resistant colon cancer cells.

Study situation on curcumin as a synergistic therapy component (in vitro):

polyphenol	Chemotherapy	Type of cancer	Source
Curcumin	5-fluorouracil	Stomach	[19]
Curcumin	Oxaliplatin	Colon	[20]
Curcumin	5-fluorouracil + oxaliplatin	Colon	[21]

d) Curcumin for leukemia: Some studies proved the benefits of curcumin therapy in cancers of the blood or the hematopoietic system. Curcumin has thus been observed to affect many different signaling pathways that are responsible for the excessive proliferation of myeloid and lymphatic blood cells. For example, curcumin suppresses TNF- α -induced chromosome translocation, the binding of NF- κ B to DNA and the STAT3 signaling pathway in multiple myeloma.

An improvement in the cytotoxicity of carfilzomib compared to myeloma cells could be observed when curcumin is administered complementary with chemotherapy drugs. At the same time, synergistic antileuemic effects in the mouse model were observed in Philadelphia chromosome-positive (Ph+) acute lymphocytic leukemia (ALL) and imatinib therapy in combination with curcumin. Curcumin was also able to increase the cytotoxic effect on leukemia cells in one study when treated with valproic acid.

Study situation on curcumin as a synergistic therapy component (in vitro and in vivo):

polyphenol	Chemotherapy	Type of cancer	Source
Curcumin	Carfilzomib	Leukemia	[22]
Curcumin	Imatinib	Leukemia	[23]
Curcumin	Valproic acid	Leukemia	[23]

e) Curcumin in other cancers: There are also some studies on complementary curcumin therapy on other cancers. In the following table you will find a list of additional studies on curcumin in tumor therapy.

polyphenol	Chemotherapy	Type of cancer	Source
Curcumin	Cisplatin	head and neck	[25]
Curcumin	gemcitabine	Pancreas	[26]
Curcumin	Bevacizumab	Liver	[27]
Curcumin	Paclitaxel	Brain	[28]
Curcumin	Temozolomide	Glioblastoma	[29]
Curcumin	Docetaxel	Prostate	[30]
Curcumin	Cisplatin	Bubble	[31]

Interactions:

Intolerances to curcumin
 Kidney damage
 Liver diseases
 Interactions with antithrombotic drugs and antiplatelets because curcumin inhibits platelet aggregation

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