9th International Congress on Nutrition & Health

Curcumin – a multifunctional compound from natural sources and current state of its research

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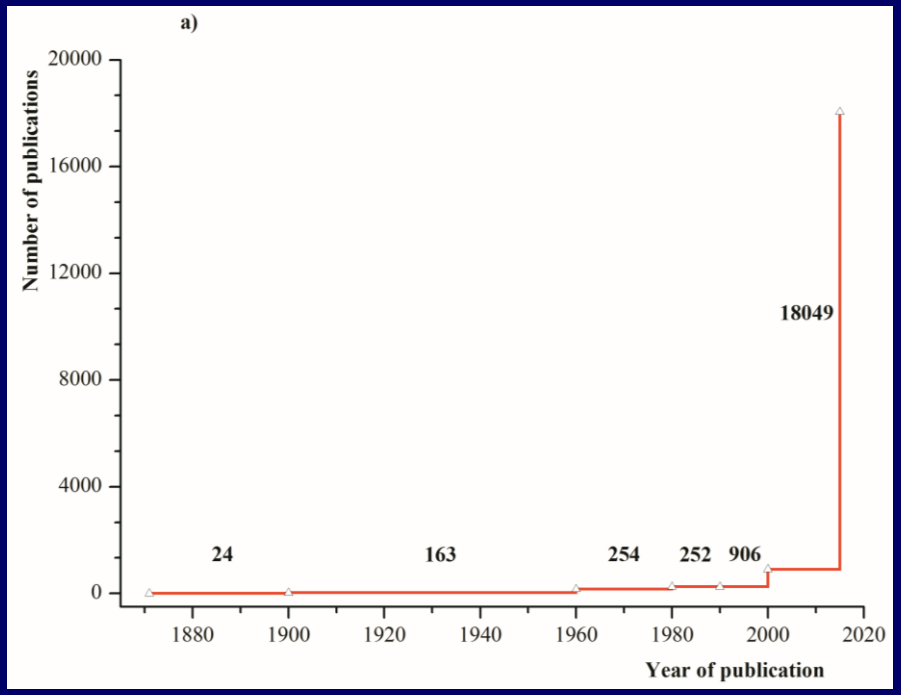
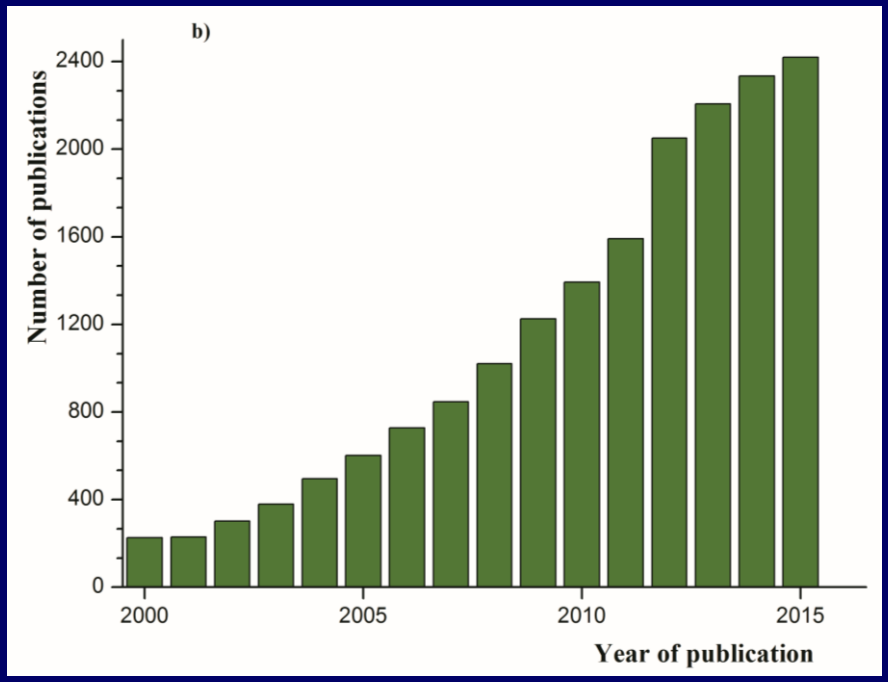
- When/how interest related to curcumin started :

  - Human
  - Scientific community
  - My research group





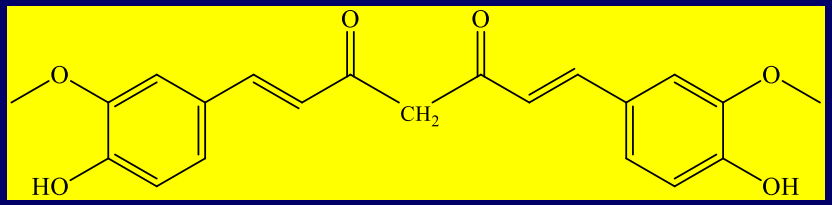
Evolution of the number of publications related to curcumin

a) **1871** – 2015

b) 2000 – 2015

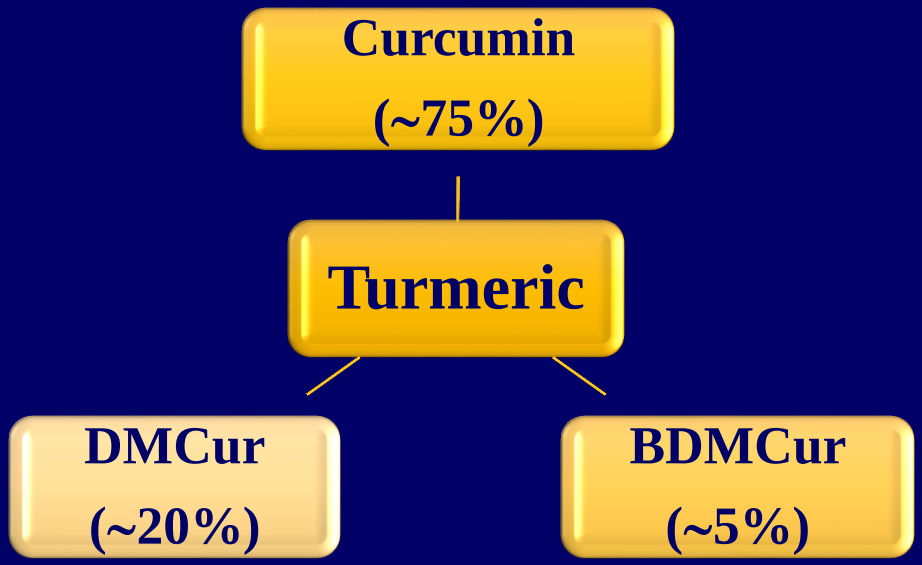
(source: SciFinder Scholar)

Turmeric, *Curcuma longa L.*

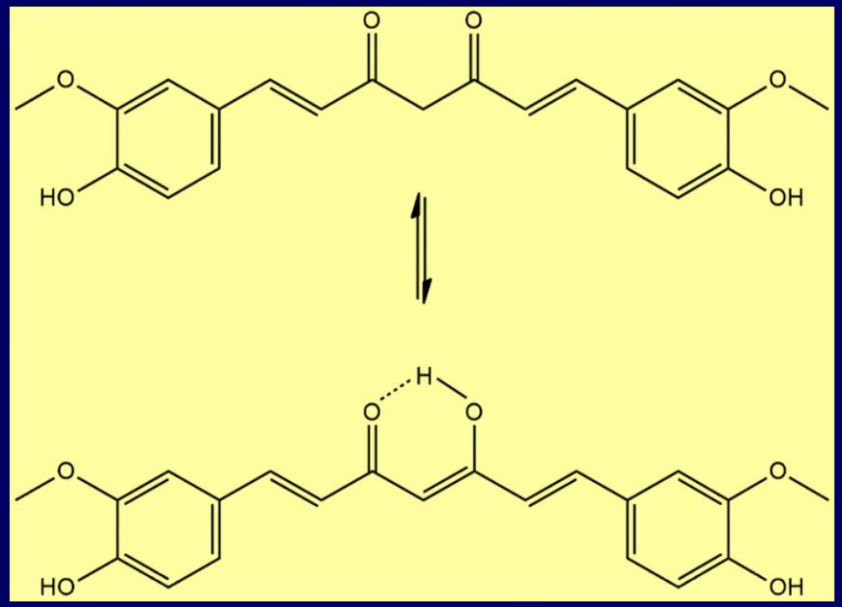


CURCUMIN
1,7-bis(4-hydroxy-3-methoxy-phenyl)hepta-1,6-diene-3,5-dione

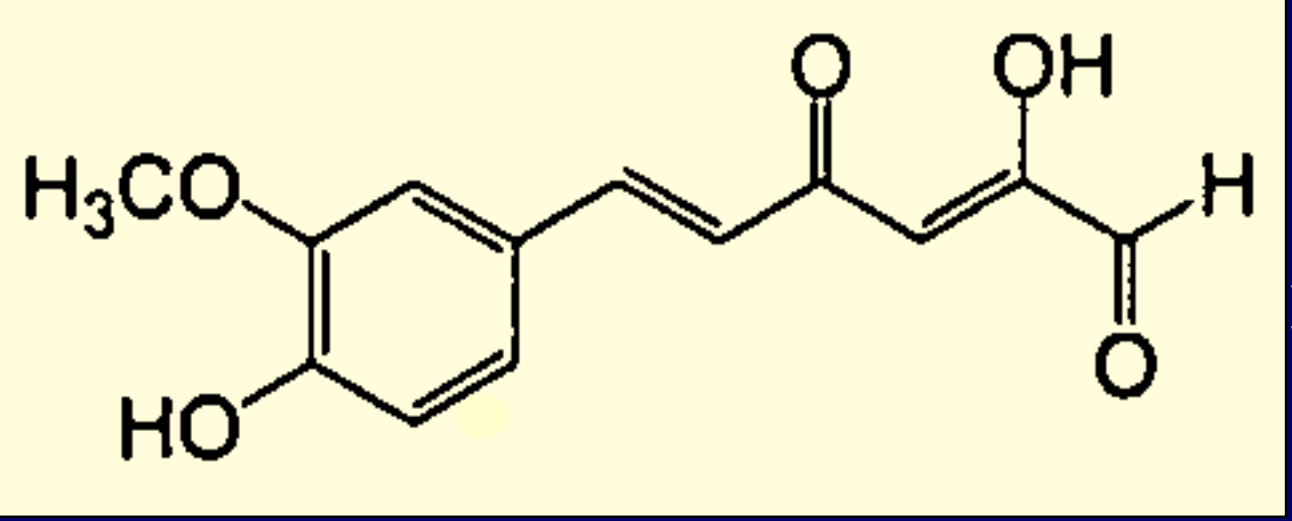
Basics of the chemical and biochemical properties of curcumin



DMCur – demethoxycurcumin
BDMCur - bisdemethoxycurcumin



Keto-enol tautomerism of curcumin



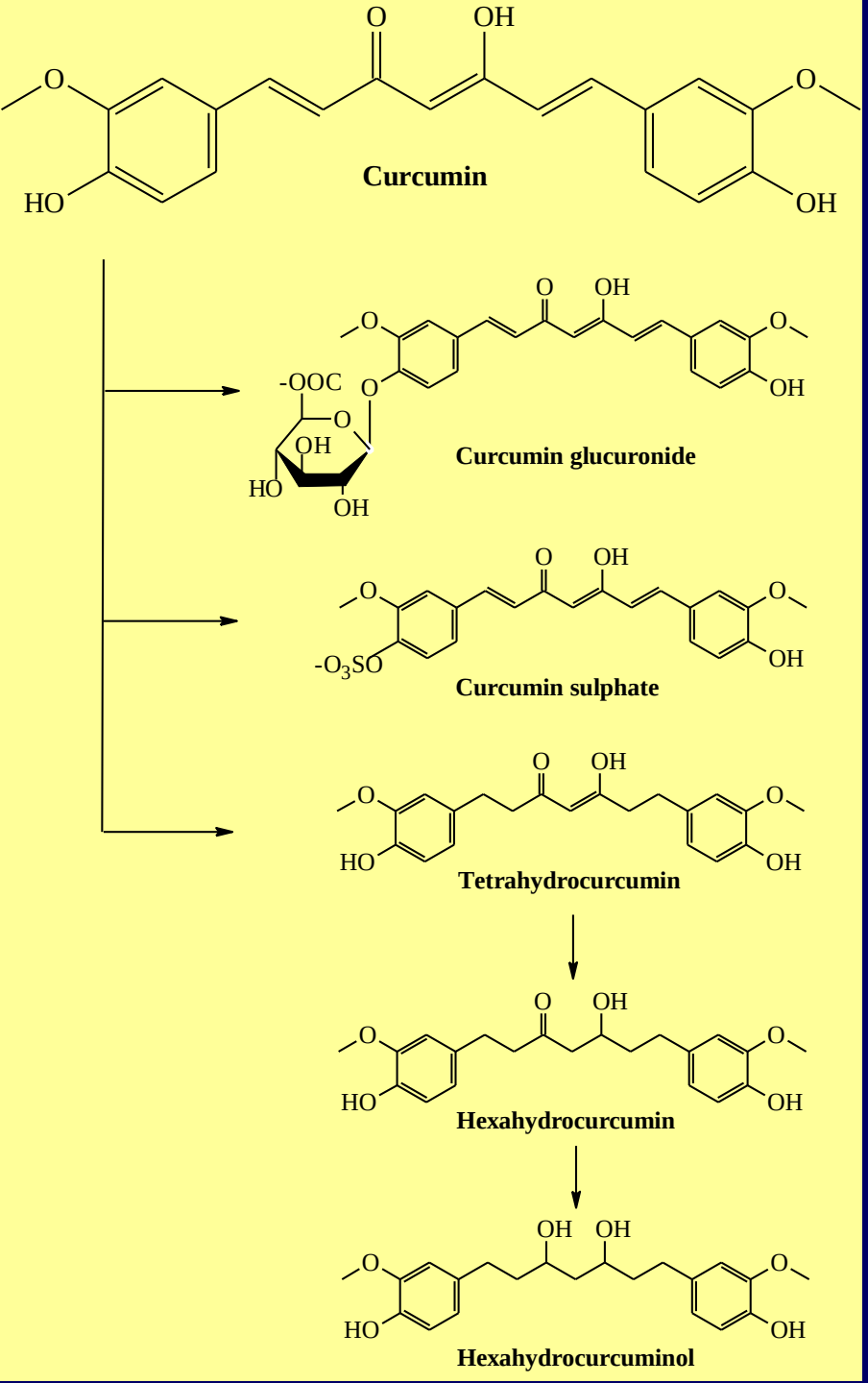
main degradation product at pH 3-10

trans-6-(4-hydroxy-3-methoxyphenyl)-2,4-dioxo-5-hexenal

$H_3Cur \rightarrow H_2Cur^- + H^+$, $pKa_1 = 8.38 \pm 0.04$
(acetylacetone group)

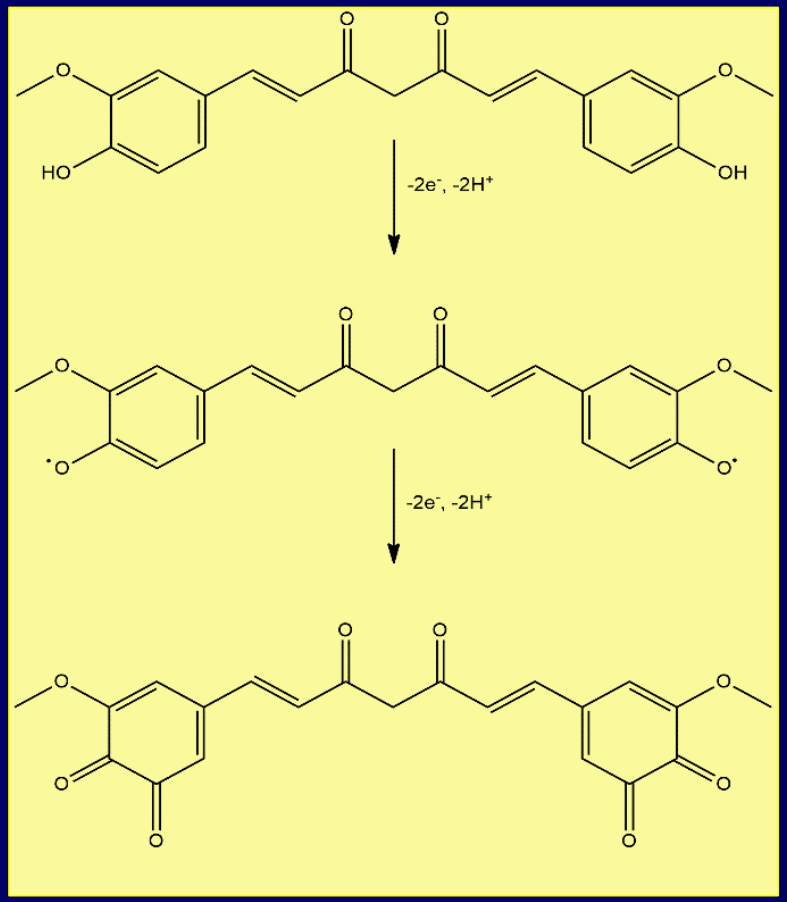
$H_2Cur^- \rightarrow HCur^{2-} + H^+$, $pKa_2 = 9.88 \pm 0.02$
(hydrogen from the phenol group)

$HCur^{2-} \rightarrow Cur^{3-} + H^+$, $pKa_3 = 10.51 \pm 0.01$
(hydrogen from the phenol group)

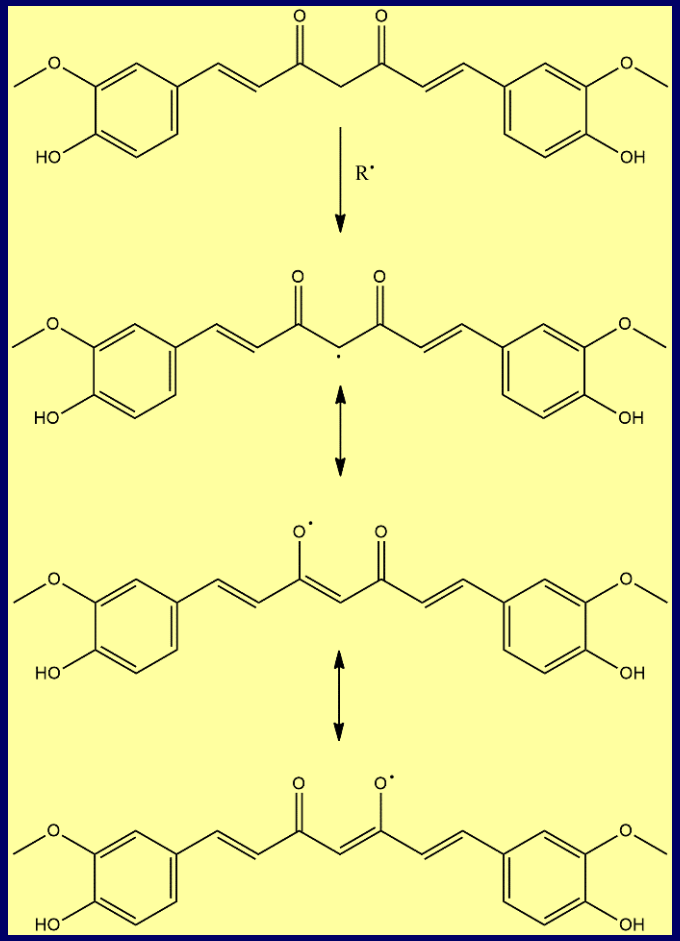


Chemical structures of the major metabolites of curcumin inside the body

Electrochemical properties of curcumin and its bioactivity



Mechanism of curcumin electrooxidation



Antioxidant mechanism of curcumin –carbon-centered radical scavenging activity

The most recent curcumin investigations and their contributions

Multiple biological activities of curcumin

The most recent curcumin investigations and their contributions

- solubility
- stability
- rapid metabolism

→

- poor absorption
- rapid elimination from the body

Solutions?

Enhancing the nutraceutical bioavailability of curcumin

How?

POSSIBLE SOLUTIONS

Formulations	*Effects*
Starch nanoparticle	Increases water solubility Increases stability Retains antioxidant activity
Mixed surfactant aggregate	Increases water solubility Increases stability Increases antioxidant activity
Chitosan-tripolyphosphate nanoparticle	Increases stability Prolonged release
Solid lipid nanoparticle	Increases water solubility Increases stability
Multilayer nanoemulsion	Increases stability
Lipid nanoemilsion	Increases stability
Chitosan hydrogel	Prolonged release
Chitosan-gumarabic nanoparticle	Increases stability Increases antioxidant activity Prolonged release
Polyacrylamide-grafted-xanthan gum nanoparticle	High gastric resistance Increases pH-dependent solubility
O-carboxymethyl chitosan/fucoidan nanoparticle	Increases cellular uptake
Low density lipoprotein/pectin nanogels	pH-depended controlled release
Nanoencapsulation by milk fat/sodium caseinate	Increases antioxidant activity
Mixed colloidal, protein and lipid nanoparticle	Increases stability Increases bioaccessibility
Zein colloidal particle	Increases stability Limits free radical induced oxidation
Corn oil-in-water emulsion	Increases oral bioavailability

- Additional activities of curcumin
  - *Nutrition supplement*
  - *Photo-inactivation of fungal spores*

- Curcumin helps in the analysis of different indispensable substances

Conclusion
Useful suggestions for nutrition and health

- "Turmeric belongs to the group of the healthiest beneficial spices on the planet."

- Turmeric and its primary polyphenol – curcumin provide more than 600 potential health benefits! (MEDLINE)

- **HOW TO INCREASE TURMERIC'S BIOAVAILABILITY?**
  - **Always mix with black pepper**
  - **Add a healthy fat to turmeric**
  - **Heat increases turmeric's bioavailability**

Thank you for your attention

“let food be thy medicine and medicine be thy food”

Hippocrates