

RESEARCH MONOGRAPH . COMPOUND PROFILE

Curcumin

The principal yellow polyphenol of turmeric (Curcuma longa) with broad anti-inflammatory and antioxidant activity but very poor oral bioavailability without enhancement.

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ABSTRACT

Curcumin (CAS 458-37-7; molecular formula C₂₁H₂₀O₆; molecular weight 368.38) is the principal yellow polyphenol pigment of turmeric (*Curcuma longa*) rhizome. The compound has broad anti-inflammatory activity (NF-κB inhibition, cyclooxygenase modulation, JAK/STAT modulation), antioxidant activity, and modulation of multiple cancer-related pathways. The principal limitation is poor oral bioavailability: free curcumin shows less than 1 percent oral bioavailability due to extensive first-pass metabolism. Bioavailability-enhanced formulations (Meriva, Theracurmin, Longvida, BCM-95) provide 7- to 30-fold higher plasma exposure and are required for meaningful systemic effects. Doses depend on formulation; standardized 95 percent curcuminoid powder at 1 to 3 grams per day is typical for non-enhanced; enhanced formulations use proportionally lower doses.

1. Compound Identification

Curcumin is described as turmeric polyphenol. The principal yellow polyphenol of turmeric (*Curcuma longa*) with broad anti-inflammatory and antioxidant activity but very poor oral bioavailability without enhancement.

1.1 Class summary

Turmeric polyphenol

1.2 Subtitle

The principal yellow polyphenol of turmeric (*Curcuma longa*) with broad anti-inflammatory and antioxidant activity but very poor oral bioavailability without enhancement.

2. Abstract

Curcumin (CAS 458-37-7; molecular formula C₂₁H₂₀O₆; molecular weight 368.38) is the principal yellow polyphenol pigment of turmeric (*Curcuma longa*) rhizome. The compound has broad anti-inflammatory activity (NF-κB inhibition, cyclooxygenase modulation, JAK/STAT modulation), antioxidant activity, and modulation of multiple cancer-related pathways. The principal limitation is poor oral bioavailability: free curcumin shows less than 1 percent oral bioavailability due to extensive first-pass metabolism. Bioavailability-enhanced formulations (Meriva, Theracurmin, Longvida, BCM-95) provide 7- to 30-fold higher plasma exposure and are required for meaningful systemic effects. Doses depend on formulation; standardized 95 percent curcuminoid powder at 1 to 3 grams per day is typical for non-enhanced; enhanced formulations use proportionally lower doses.

3. Mechanism of Action

Broad anti-inflammatory: NF-kB, COX, JAK/STAT inhibition. Antioxidant. Bioavailability is the principal limitation.

The mechanistic profile described above represents the consensus position from peer-reviewed literature where available; for compounds with sparse formal characterization, this section reflects vendor-grade reports and structurally-related class pharmacology and should be interpreted with appropriate caution.

4. Pharmacokinetics and Routes of Administration

Pharmacokinetic data are summarized within the abstract for compounds with formal Phase 1 records. Compounds without published human pharmacokinetic studies are noted as such; investigators should treat the absence of data as a research limitation.

5. Reported Research Dose Ranges

1 to 3 g per day non-enhanced; lower for bioavailability-enhanced formulations.

Doses are scaled from clinical use where the compound is approved as a medicine, from Phase 2/3 trials where development advanced, or from rodent dose-response data scaled by allometric assumptions where the compound has no human clinical record. Investigators should treat dose ranges from research-chemical-grade vendors as starting points for their own pharmacokinetic and tolerability characterization rather than validated dosing recommendations.

6. Sourcing and Quality Verification

Investigators should obtain analytical confirmation of identity (mass spectrometry; for peptides, additionally amino acid analysis or N-terminal sequencing) and purity (HPLC area-percent, ideally greater than 95 percent) on every lot. Vendor certificates of analysis vary in quality; third-party analytical confirmation through independent laboratories (e.g., Janoshik Analytical, Anabolic Lab) is the gold standard for research-grade peptides and small molecules.

For compounds with established pharmaceutical-grade marketing in any jurisdiction, sourcing from the marketed product (where legal and accessible) provides the highest quality assurance.

7. Reconstitution and Handling

Peptides should be reconstituted in bacteriostatic water or sterile water for injection in the volume appropriate to the desired concentration; lyophilized peptides should be allowed to come to room temperature before reconstitution to minimize precipitation. Reconstituted peptides should be stored refrigerated and used within the timeframe specified by the manufacturer (typically 14 to 30 days for bacteriostatic water reconstitutions, shorter for sterile water).

Small molecules: storage conditions vary by compound; consult the certificate of analysis for the specific product. Most are stable at room temperature in dry, dark conditions; oxidation-sensitive compounds (e.g., catecholamine precursors) require cool storage and protection from light.

8. Stack Interaction Considerations

Investigators combining this compound with other research substances should consider receptor-level interactions (additive effects at shared targets), enzyme-level interactions (CYP-mediated drug-drug interactions where applicable), and pharmacodynamic interactions (additive sedation, additive serotonergic activity, additive hemodynamic effects).

The stack interaction section in published monographs of well-characterized compounds is necessarily incomplete for any specific combination; investigators should treat novel combinations with elevated caution and titrate gradually.

9. References

1. Aggarwal BB, et al. Curcumin: the Indian solid gold. Adv Exp Med Biol 2007.
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