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Demethoxycurcumin and Bis-demethoxycurcumin From Turmeric

The culinary spice turmeric (*Curcuma longa*) is a well-recognized and highly-recommended herb in the Ayurvedic system of medicine. Many recent studies support the use of turmeric extracts, and its active component, curcumin, for its anti-inflammatory activity, inhibitory effect on tumor prorogation and neuroprotective effect. **Turmeric extracts are usually standardized to 95% total curcuminoids.** Curcumin is the principal curcuminoid found in commercially-available turmeric extracts. However, the curcuminoid mixtures also include two minor demethylated curcuminoids which are coextracted with curcumin -- demethoxycurcumin and bisdemethoxycurcumin. The commonly observed ratio of curcumin:demethoxycurcumin:bisdemethoxycurcumin in commercially-available turmeric extracts is 66:23:11.ⁱ Animal studies report that coexisting curcuminoids improve the bioavailability of curcumin.ⁱⁱ

Like curcumin, these individual demethylated curcuminoids have demonstrated numerous biological properties such having antioxidant, anticarcinogenic, and hypocholesterolemic activities,ⁱⁱⁱ as well as shielding progressive neuronal degeneration from increased oxidative attack.^{iv} Curcuminoids also have a particular neuroprotective effect for Alzheimer's patients. Accumulation of amyloid-beta ($A\beta$) is one of the hallmarks of Alzheimer's disease (AD), and efficient clearance of $A\beta$ by cells by phagocytosis of peripheral blood mononuclear cells (PBMCs) may be an important mechanism for controlling or preventing disease onset. PBMCs of most AD patients are defective in the phagocytosis of soluble $A\beta$. Natural curcuminoids were shown to restore $A\beta$ phagocytosis by AD PBMCs and to up-regulate the expression of key genes.^v In fact, each component of the curcuminoid mixture distinctly affects apoptotic gene expression in AD animal models, thus highlighting the therapeutic potential of each individual curcuminoid in AD.^{vi}

In addition to studies on individual curcuminoids, research on novel mixtures of demethylated curcuminoids have shown to these compounds to be safe^{vii} and to exhibit higher neuroprotective and anti-inflammatory efficacy *in vitro* than standard 95% curcuminoid extracts of turmeric.^{viii}

In many cases, these minor constituents have been shown have higher potency compared to curcumin and unique activity. **Bisdemethoxycurcumin (BDC)** has been shown to:

- Have the **greatest potency for stimulating Alzheimer Disease peripheral blood mononuclear cells** compared to all other natural curcuminoids.^{1,5,ix}
- Have **higher antimetastasis potency** than curcumin.^x
- **Accelerate gastric ulcer healing** with potency equal to curcumin.^{xi}

- Act as an inhibitor to inactivate human pancreatic α -amylase, a therapeutic target for oral hypoglycemic agents in type-2 diabetes.^{xii}
- Have superior endothelial barrier protective activity than that of curcumin.^{xiii}
- Exhibit the strongest demethylation potency and therefore potential anti-cancer action compared to other curcuminoids.^{xiv}
- Exhibit a significant inhibition of MMP-3 expression in breast cancer cells, whereas curcumin had no effect.^{xv}

Demethoxycurcumin has been shown to:

- Have a higher antimetastasis potency than curcumin¹⁰
- Induce Phase II enzyme expression.³
- Have higher cytotoxic effects on prostate cancer PC3 cells compared with curcumin.^{xvi}
- Exhibit a significant inhibition of MMP-3 expression in breast cancer cells, whereas curcumin had no effect.¹⁴
- Have the highest effect on spatial memory in AD animal model compared to other curcuminoids.^{xvii}
- Exhibit the highest suppressive effect compared to other curcuminoids on anti-inflammatory markers,^{xviii} particularly nitric oxide,^{xix} TNF-alpha,¹⁹ (NF-kappaB)^{xx} and MAPKs²⁰ activation.
- Have significant protective potential (equal to curcumin) on the prevention of diabetic nephropathy *in vivo*.^{xxi}
- Have higher stability than curcumin and significantly inhibit proliferation, migration and invasion of cultured prostate cancer cells^{xxii} and breast cancer cells.^{xxiii}
- Have higher potency than curcumin in the ability to induce apoptosis.^{xxiv}

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