

AI-Driven Phytochemical Formulation for Fibromyalgia Management

Seshat AI for Targeted Supplement Medicine

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1 Introduction

Fibromyalgia is a chronic pain disorder characterized by widespread musculoskeletal pain, fatigue, cognitive dysfunction (fibro fog), sleep disturbances, and neuroinflammation. This AI-driven phytochemical formulation targets multiple pathways to relieve pain, reduce neuroinflammation, support mitochondrial function, and enhance cognitive clarity.

2 Key Phytochemicals and Mechanisms

2.1 Pain Modulation (Reducing Central Sensitization)

- **Capsaicin (50 mg):** Activates TRPV1 receptors, depleting substance P and reducing hyperalgesia (Basith et al., 2016).
- **Magnesium Glycinate (200 mg):** Blocks NMDA receptors, reducing central sensitization and muscle pain (Mauskop and Varughese, 2016).
- **Palmitoylethanolamide (PEA) (300 mg):** Activates CB2 cannabinoid receptors, reducing neuroinflammation and pain perception (Skaper et al., 2018).

2.2 Neuroinflammation Reduction

- **Curcumin (200 mg):** Inhibits NF- κ B, COX-2, and TNF-, reducing neuroinflammation and pain sensitivity (Gupta et al., 2013).
- **Boswellic Acid (200 mg):** Inhibits 5-LOX, reducing inflammatory pain and oxidative stress in nerves (Sengupta et al., 2011).
- **Quercetin (100 mg):** Modulates mast cell activity, reducing histamine-related pain and fatigue (?).

2.3 Mitochondrial Function & Fatigue Reduction

- **Alpha-Lipoic Acid (ALA) (300 mg):** Enhances ATP production and reduces oxidative stress in muscle and nerve cells (?).
- **N-acetylcysteine (NAC) (200 mg):** Boosts glutathione levels, reducing oxidative stress and muscle fatigue (?).

2.4 Neuromodulation & Cognitive Support ("Fibro Fog" Reduction)

- **Resveratrol (150 mg):** Activates SIRT1, improving mitochondrial function and reducing cognitive impairment (?).
- **Epigallocatechin Gallate (EGCG) (100 mg):** Modulates GABA and glutamate levels, improving cognitive function and reducing fibro fog (?).

2.5 Bioavailability & Synergy Enhancers

- **Piperine (10 mg):** Increases bioavailability of Curcumin, Boswellic Acid, and Resveratrol (Shoba et al., 1998).
- **Liposomal Encapsulation & Fermentation:** Improves gut absorption and systemic circulation of phytochemicals (Li et al., 2017).

3 Regulatory Considerations

This formulation aligns with:

- **FDA GRAS** (Generally Recognized as Safe) compliance for individual phytochemicals.
- **WHO & EFSA Guidelines** ensuring safe intake for chronic pain and neuroinflammatory conditions.
- **Clinical Trials Requirement:** Preclinical and randomized controlled trials (RCTs) are necessary for human validation.

4 Conclusion

This AI-driven phytochemical supplement integrates pain-modulating, neuro-protective, and anti-inflammatory compounds for fibromyalgia management. Future research must include rigorous clinical trials to validate safety and efficacy.

Disclaimer: This formulation is for research purposes only and has not been tested in humans. Clinical validation is required before any medical application.

References

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