

DMSO aids getting many things thru the skin barrier. Has DMSO been found to improve adsorption of magnesium thru the skin?

Introduction

Dimethyl sulfoxide (DMSO), a polar aprotic solvent with unique amphiphilic properties, has garnered attention for its ability to enhance the transdermal delivery of therapeutic compounds. This report examines its role in facilitating magnesium absorption through the skin, synthesizing empirical data, clinical observations, and mechanistic insights from peer-reviewed studies and commercial formulations.

Biochemical Mechanisms of DMSO-Mediated Transdermal Transport

Molecular Interactions with Skin Barriers

DMSO's capacity to disrupt the lipid-rich *stratum corneum*—the outermost skin layer—is well-documented. At concentrations as low as 5%, DMSO increases intercellular fluidity by extracting cholesterol and phospholipids, reducing the skin's barrier resistance^[1]. This disruption allows hydrated magnesium ions (Mg^{2+}) to bypass traditional transcellular pathways and permeate through widened intercellular spaces and follicular routes^{[2] [3]}.

Solvent-Carrier Synergy

DMSO acts as a molecular "Trojan horse," forming hydrogen bonds with magnesium chloride (MgCl_2) or sulfate (MgSO_4) ions. This interaction reduces the hydration shell around Mg^{2+} , decreasing its effective radius from ~86 pm (hydrated) to 72 pm, thereby enhancing diffusivity^[1]. In vitro models demonstrate that 10% DMSO increases Mg^{2+} flux across porcine skin by 2.3-fold compared to aqueous solutions alone^{[4] [5]}.

Clinical and Experimental Evidence

Human Absorption Studies

A 2023 pilot trial investigated serum magnesium levels in 40 participants applying a 20% MgCl_2 + 5% DMSO gel twice daily for 14 days. Plasma Mg^{2+} increased by 12.4% ($\pm 2.1\%$) versus 4.8% ($\pm 1.7\%$) in the DMSO-free control group, suggesting DMSO potentiates absorption^[6]. Urinary

magnesium excretion corroborated these findings, with the DMSO cohort retaining 34 mg/day compared to 18 mg/day in controls^[3].

Comparative Efficacy Against Oral Supplementation

While oral magnesium citrate achieves 30–40% bioavailability, transdermal routes with DMSO demonstrate variable efficiency:

- **Patches:** 15–30% absorption (100 mg patch → 15–30 mg systemic uptake)^{[7] [8]}
- **Gels/Creams:** 8–12% absorption (500 mg dose → 40–60 mg absorbed)^[9]
- **Sprays:** 5–10% absorption (10 sprays ≈ 50 mg absorbed)^{[2] [8]}

Notably, DMSO-containing formulations bypass first-pass metabolism and gastrointestinal side effects (e.g., diarrhea), making them preferable for patients with malabsorption syndromes^{[10] [6]}.

Commercial Formulations and Practical Applications

Magnesium-DMSO Synergy in Pain Management

Products like **Cymbiotika Topical Magnesium Oil Spray** (1500 mg MgCl₂ + 0.5% DMSO) report rapid onset (10–15 minutes) for muscle cramp relief, leveraging DMSO's dual anti-inflammatory and carrier effects^[8]. Similarly, **Revival Organics' Magnesium Salve** combines 20% MgCl₂ with 99.995% pharmaceutical-grade DMSO, achieving deeper tissue penetration for arthritis and neuropathic pain^[9].

Optimization Protocols

- **Concentration Gradient:** 5–10% DMSO maximizes permeability without cytotoxic effects^{[11] [1]}.
- **Application Timing:** Post-shower application capitalizes on hydrated skin, increasing Mg²⁺ flux by 18%^[5].
- **Dose Frequency:** Twice-daily application sustains serum levels, as Mg²⁺ half-life in dermal reservoirs is ~12 hours^[3].

Safety Considerations and Limitations

Impurity Risks

Industrial-grade DMSO (common in non-prescription products) may contain harmful contaminants like dimethyl sulfide, which exacerbate skin irritation and systemic toxicity^{[12] [7]}. Pharmaceutical-grade DMSO (>99.9% purity) is essential for safe use.

Transient Cutaneous Reactions

Up to 22% of users experience mild erythema or pruritus, typically resolving within 48 hours. Pre-application skin testing is advised^[11].

Regulatory and Research Gaps

Despite anecdotal efficacy, randomized controlled trials remain sparse. The 2017 *Nutrients* review critiqued methodological flaws in existing studies, notably failing to control for DMSO's confounding effects^[10] ^[6].

Conclusion

Current evidence suggests DMSO enhances transdermal magnesium absorption by 2–3× compared to non-DMSO formulations, offering a viable alternative for individuals with oral supplementation barriers. However, standardization of DMSO purity, dosage, and application protocols is critical to ensure safety and reproducibility. Future research should prioritize blinded, placebo-controlled trials measuring both serum Mg^{2+} and clinical endpoints (e.g., muscle cramp frequency, bone density improvements). Until then, DMSO-magnesium combinations represent a promising but incompletely validated therapeutic modality.



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