

Enhancement of Vitamin D₂ Content in *Lentinula edodes* Through Solar Drying and Ultraviolet Irradiation

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Research question

Can solar drying and artificial UV-B exposure increase vitamin D₂ content in shiitake mushrooms?

INTRODUCTION

Global health issue: Vitamin D deficiency affects >1 billion people; linked to rickets, osteoporosis, cardiovascular disease, cancers, infections, depression, and more [1,2].

Limited sources: Humans mainly obtain vitamin D₃ from sunlight, but exposure is limited by indoor lifestyle, latitude, or clothing [3,4]. Food sources are scarce and mostly animal-based (e.g., fatty fish, liver, egg yolks) [5].

Alternative: Mushrooms exposed to UV light (even post-harvest), convert ergosterol into vitamin D₂ (ergocalciferol), a bioavailable and effective alternative to D₃ [6,7].

Shiitake (*Lentinula edodes*): Popular for taste, nutritional value, and numerous health-promoting bioactive compounds.

Vitamin D enrichment: typically by UV or sun irradiation; since sun drying is ineffective and unsafe, this study investigated solar drying as an alternative.

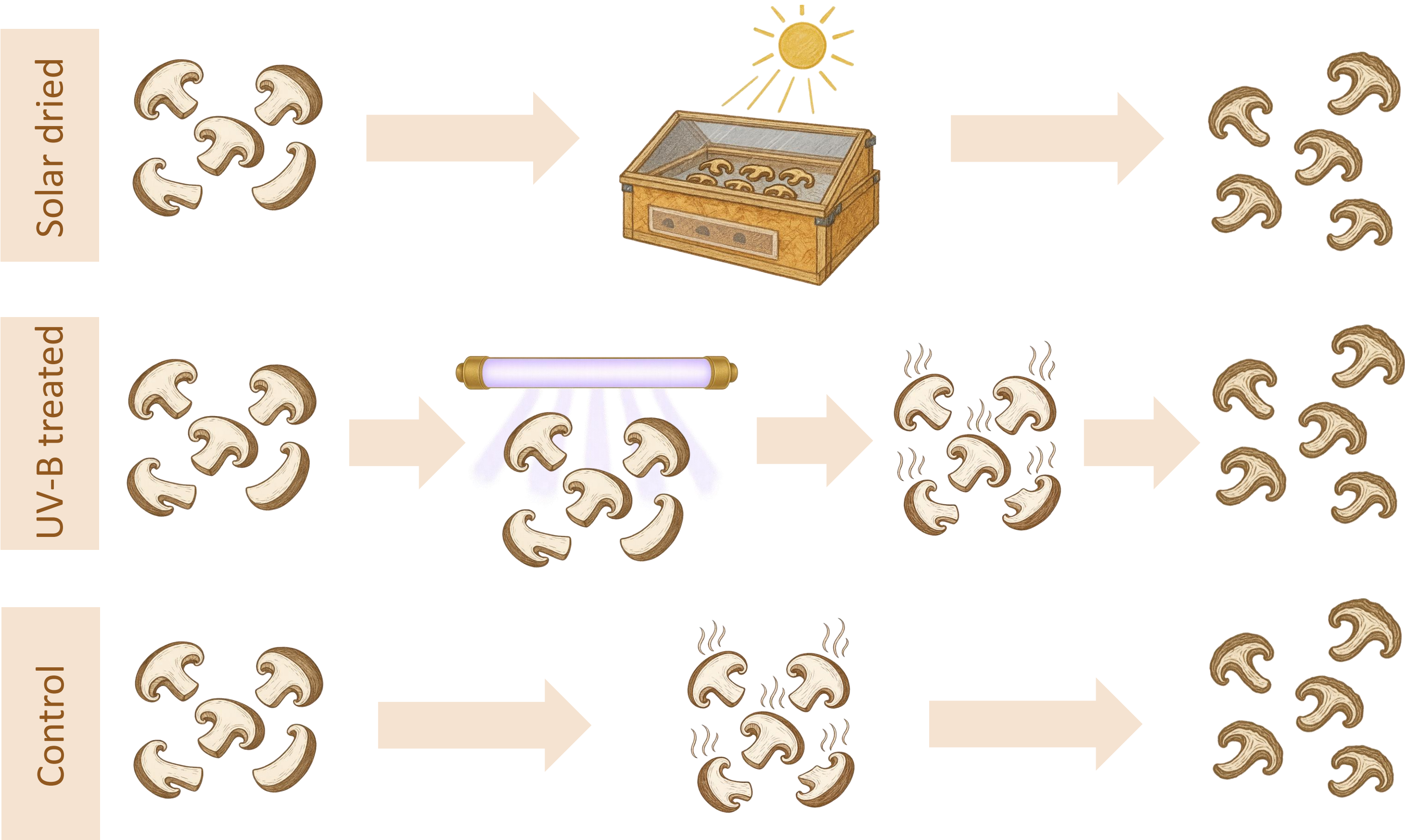
METHODOLOGY

Material: Shiitake mushrooms grown on logs in Czechia

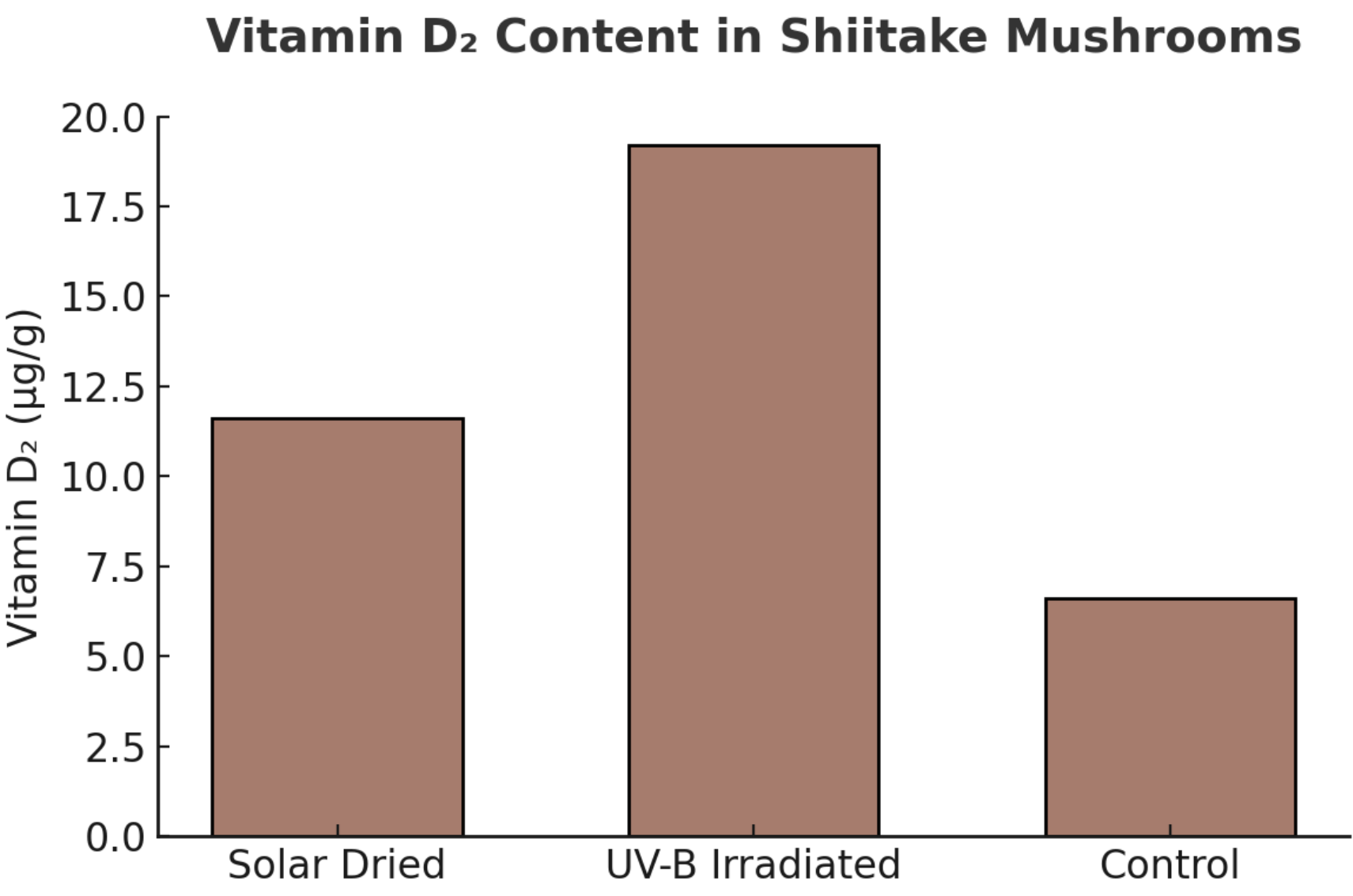
Processing: Sliced and divided into groups: 1) Solar drying (7 h, Prague, July); 2) UV-B irradiation (1 h, 10 cm from a 25 W lamp) + hot-air drying (55 °C, 5 h); 3) Control hot-air drying (55 °C, 5 h)

Analysis: Dried samples ground, extracted, and analyzed for vitamin D₂ and ergosterol (HPLC)

Statistics: Triplicate measurements, evaluated by ANOVA with Tukey's HSD (p < 0.05)



RESULTS & DISCUSSION



Sample	Ergosterol ± SD (µg/g)	Vitamin D ₂ ± SD (µg/g)	% of AI (15 µg) per 1 g*	g needed to reach AI (15 µg)*
Solar dried	3 349.4 ± 31.4 ^a	11.6 ± 0.7 ^b	77.3%	1.29 g
UV-B treated	4 354.3 ± 102.9 ^b	19.2 ± 0.3 ^c	128%	0.78 g
Control	4 334.5 ± 193.8 ^b	6.6 ± 0.7 ^a	44%	2.27 g

Different superscript letters (a, b, c) denote significant differences at p < 0.05 (Tukey's HSD)

*AI: Adequate Intake of vitamin D per day for adults (15 µg)

- **Vitamin D₂:** Levels differed significantly—highest in UV-B treated, followed by solar-dried, lowest in control mushrooms.
- **Nutritional significance:** With an adequate intake (AI) = 15 µg/day, only 0.78 g UV-B, 1.29 g solar-dried, or 2.27 g control mushrooms meet daily needs.
- **Unexpected vitamin D₂ in control sample:** Despite usually negligible vitamin D₂ in industrially grown mushrooms, control mushrooms showed measurable levels, likely from sunlight exposure during cultivation in a partially open hall.
- **Solar drying limitations & potential:** The transparent cover of the solar dryer transmitted only 50 % of UV radiation; using more UV-transparent materials could enhance vitamin D₂ synthesis.
- **Ergosterol:** Comparable in UV-B and control, lower in solar-dried mushrooms, likely due to prolonged drying and heat degradation rather than conversion to vitamin D₂.

CONCLUSION

Vitamin D₂ enrichment: Both UV-B and solar drying increased vitamin D₂; UV-B was the most effective and controllable, while solar drying is a low-cost, sustainable option that could be improved with more UV-transparent covers.

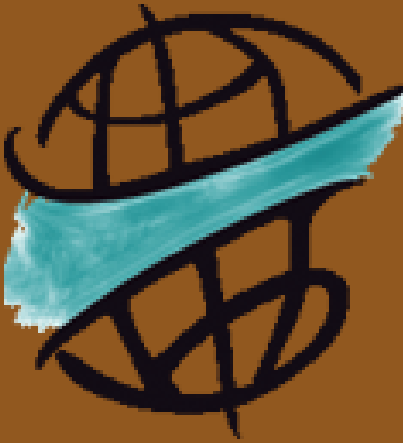
Nutritional value: Mushrooms are the **only natural non-animal food source of vitamin D**, (suitable also for vegetarians/ vegans); even small portions meet daily needs. Our irradiated shiitake contained far higher levels than eggs, dairy, fish (≤0.25 µg/g), or even cod liver oil (2.5 µg/g) (note: others on fresh weight, mushrooms on dry weight).

With their **nutritional richness, long shelf life, and sustainable production**, vitamin D₂-enriched mushrooms are a promising **functional food to combat global vitamin D deficiency**.

Research answer

Yes! Just about one gram of dried shiitake (solar-dried or UV-B treated) is enough to meet your daily vitamin D₂ needs.

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