

# Nutraceutical gummies: head-to-head comparison of uncoated vs. encapsulated water-soluble vitamins

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## Introduction

- Gummies are prepared at **high temperature & low pH value**
  - This can degrade active ingredients
  - Huge overages are applied to ensure label content is met
- Encapsulated formulations** claim to reduce processing losses
- Objective:** head-to-head comparison of **four commercial Calpan (vitamin B<sub>5</sub>) products** in gummy manufacturing
- Key takeaway:** encapsulated B<sub>5</sub> formulations did not reduce processing losses → uncoated vitamin performs equally well!

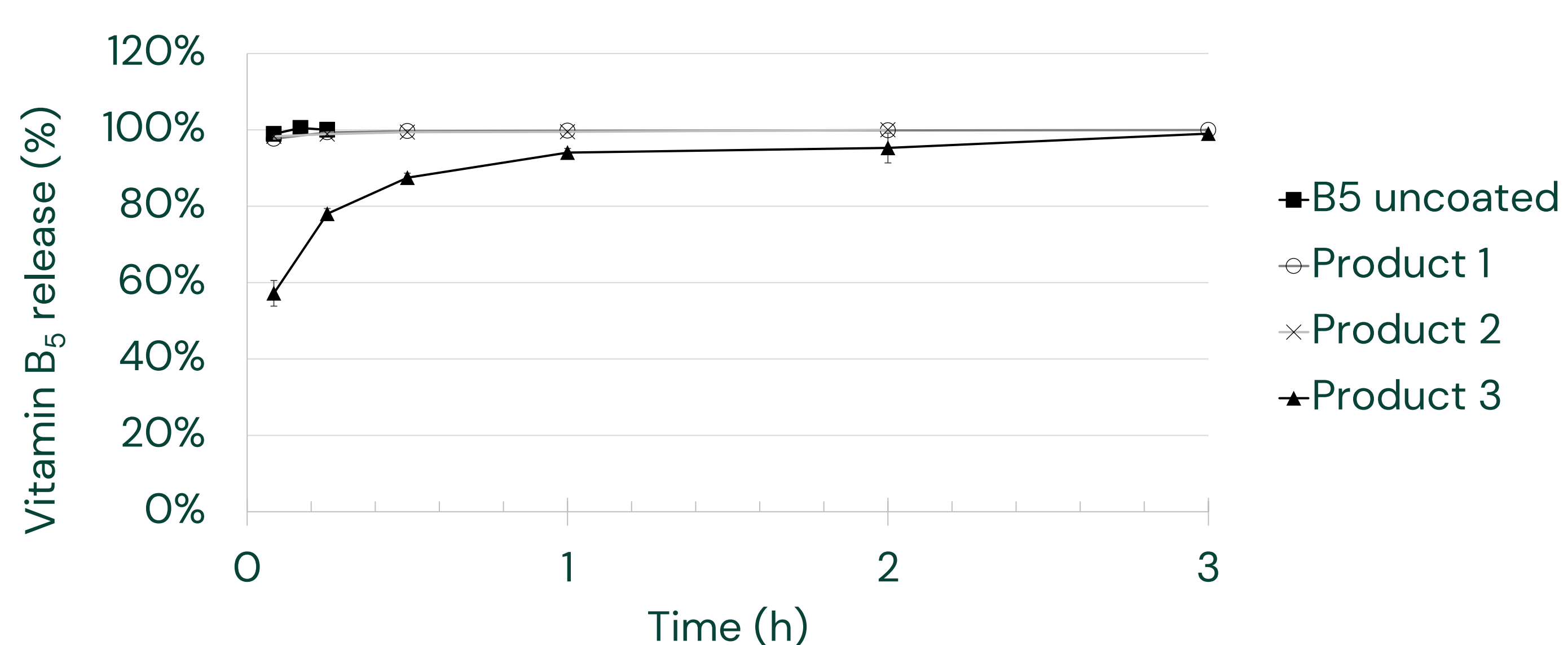
## Materials & methods

- Physico-chemical characterization**
  - Particle size distribution (laser diffraction)
  - Particle morphology & coating layer thickness (SEM)
  - B<sub>5</sub> content (HPLC)
  - Thermal transitions (DSC)
- Product performance**
  - B<sub>5</sub> bioavailability (USP-2 dissolution test, pH 3.3, 37°C)
  - Simultaneous B<sub>5</sub> release & degradation (stress test, pH 3.5, 100°C)
  - Lab-scale gummy manufacturing

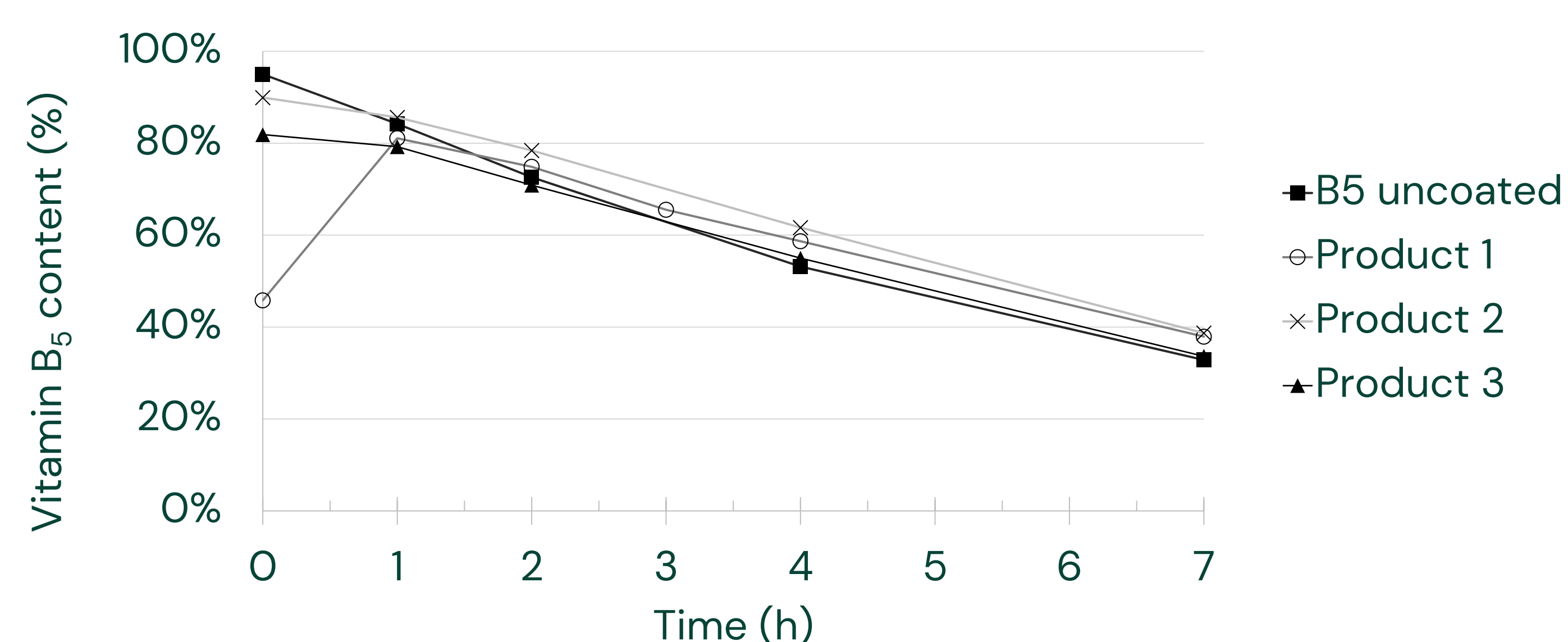
## Results & discussion

**Table 1** Overview of screened products: **Physico-chemical characterization** (target application, particle size distribution, scanning electron microscopy, coating layer thickness, vitamin B<sub>5</sub> content, and product composition) and **product performance** (USP-2 dissolution, stress test, vitamin B<sub>5</sub> recovery after gummy manufacturing).

Product	Designed for	Particle size			SEM image	Coating layer (µm)	Product composition		USP-2 dissolution	Stress test	B <sub>5</sub> recovery after gummy production (%)
		d <sub>10</sub> (µm)	d <sub>50</sub> (µm)	d <sub>90</sub> (µm)			Theoretical	Measured			
<b>Uncoated vitamin B<sub>5</sub></b>	B <sub>5</sub> uncoated	-	59	102	166	0	100% Calpan	100% Calpan	Immediate release	Immediate degradation	97
<b>Encapsulated (coated) vitamin B<sub>5</sub></b>	Product 1	Gummy applications	136	244	403	1-3	85% Calpan 15% coating	92% Calpan 8% Ethyl cellulose based coating	Immediate release	1 h protection	91
	Product 2	Powder applications	67	135	236	2-5	85% Calpan 15% coating	88% Calpan 12% Ethyl cellulose based coating	Immediate release	1 h protection	87
	Product 3	Gummy applications	106	262	611	15-20	60% Calpan 40% coating	66% Calpan 34% Ethyl cellulose-lipid based coating	1 h sustained release	Immediate degradation	95



**Fig. 1** Vitamin B<sub>5</sub> release from four commercial products (pH 3.3, 37°C). Data points and error bars represent average and standard deviation (n=3).



**Fig. 2** Concomitant vitamin B<sub>5</sub> release and degradation from four commercial products (pH 3.5, 100°C), n=1.

## Conclusions

- Vitamin B<sub>5</sub> **encapsulation** in commercially available formulations **did not translate** into superior stability
  - Uncoated vitamin → **comparable performance** to encapsulated alternatives
  - Processing stability** → losses during gummy manufacturing are negligible, also for uncoated vitamin. They do not explain the huge overages applied in industry.
- Ongoing activities
  - Assess **storage stability** → compare performance of encapsulated formulations in gummies during shelf-life

Contact information



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