ENHANCED ABSORPTION OF FUNCTIONAL INGREDIENTS IN A CARBOHYDRATE-ELECTROLYTE SOLUTION: A PHARMACOKINETIC ANALYSIS

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ABSTRAC

PURPOSE: The study examined the individual pharmacokinetics (PK) of functional ingredients for 1) Sleep: melatonin & L-theanine & 2) Energy: caffeine & L-theanine. Primary outcomes included the relative PK of each functional ingredient: time of maximum observed concentration (Tmax), maximum observed concentration (Cmax), cumulative Area Under the Curve (AUC). **METHODS:** 25 subjects (ages 23-55) were randomized to one of two arms; (Arm 1: melatonin & L-theanine or Arm 2: caffeine & L-theanine, with or without carbohydrate and electrolytes (CHO-E) and completed a crossover design separated by 7 days. Serial blood draws took place pre and post treatment over the course of 4hrs. **RESULTS:** Analysis showed all analytes in both arms had a significantly lower test article Tmax than the control demonstrating faster absorption. Data from Arm 1 showed that melatonin & L-theanine absorption were 37% (p=0.01) & 25% (p=0.05) faster. Arm 2 showed that caffeine & L-theanine absorption were 44% (p<0.01) & 42% (p=0.01) faster (Figure 1). **CONCLUSION:** The optimized CHO-E hydration solution enabled significantly faster rate of intestinal absorption of caffeine, L-theanine & melatonin. These findings suggest a potential faster onset of sleep and energy benefits.

INTRODUC

There is a rapid consumer adoption of fast-acting, dual-benefit hydration products that address hydration along with other benefits: sleep and energy. However, there is a paucity of data on the effects of such CHO-E hydration solutions on absorption of functional ingredients: melatonin, L-theanine & caffeine. PK studies of such functional ingredients can help elucidate structure function relationships and expand the understanding of mechanisms. Rate of intestinal absorption of functional ingredients can be further enhanced using an optimized CHO-E solution by triggering the active GI transport mechanisms.

METHO

Table 1. Mean (±SD) subject physical characteristics

	Arm 1 (Sleep)	Arm 2 (Energy)
N	13	12
Age	45.08 ± 6.41	33 ± 6.13
Gender	11F / 2M	10 F / 2M
Height (cm)	165.88 ± 7.73	167.13 ± 6.77
Body Mass (kg)	74.59 ± 11.20	75.11 ± 17.05

- Participants completed a 7d washout period prior to their study visits
- No alcohol, exercise, or consumption of melatonin, caffeine, or l-theanine 24hrs prior to study visit
- Baseline blood draws were completed at 0-min
- Immediately afterwards, participants consumed the supplement drink containing equal amounts of either melatonin & L-theanine or caffeine & L-theanine w/ and w/o the inclusion of CHO-E within 15min of start
- Product was administered in 4 equal volumes every 3.75min
- Blood draws were completed at 15-, 30-, 45-, 60-, 90-, 120-, 180-, and 240-min post consumption

RESUL

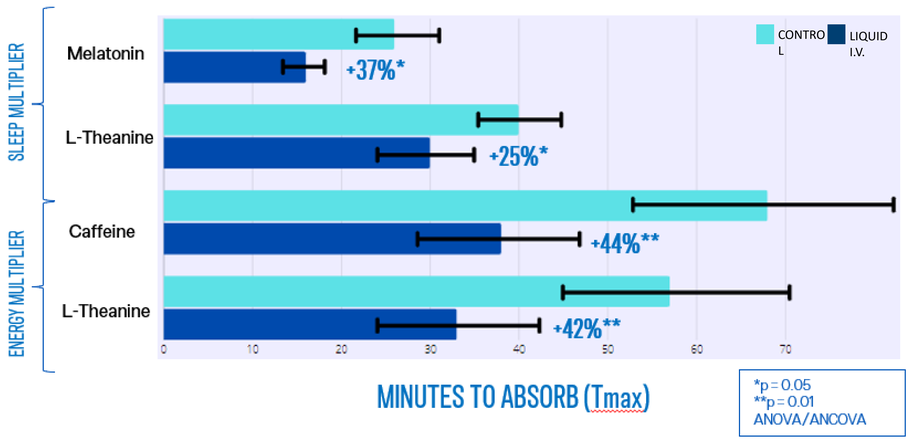
No significant difference in total absorption of functional ingredients (AUC) over 240min or maximum value of absorption (Cmax)

AUC (mg/mL)	Melatonin	L-theanine	Caffeine	L-Theanine
Control	8.149×10^{-4}	0.230	0.333	0.806
Liquid I.V.	8.767×10^{-4}	0.200	0.330	0.853
Cmax (mg/mL)	**Melatonin**	**L-Theanine**	**Caffeine**	**L-Theanine**
Control	1.056×10^{-5}	0.001	0.196	0.006
Liquid I.V.	1.312×10^{-5}	0.001	0.190	0.008

↑ **Table 2.** Mean (±SD) concentration maximum (Cmax) and area under the curve (AUC) over 240min

RESULTS

Significantly faster absorption of functional ingredients via time to maximum absorption (Tmax)



↑ **Figure 1**. Mean (±SD) time to maximum absorption (Tmax)

CONCLUS

This study demonstrates significantly faster absorption of functional ingredients, such as caffeine, melatonin and L-theanine, when combined with a CHO-E solution. Additionally, the CHO-E showed modest improvements in area under the curve over 240min of both melatonin and L-theanine when compared to the control (but did not reach statistical significance). The CHO-E solution also showed modest improvements in the maximum concentration of both melatonin and l-theanine when compared to control. Although the AUC and Cmax data did not demonstrate significant improvements, these findings were expected given these were healthy adults with no impaired absorptive functionality. These findings indicate that CHO-E solutions provide a means to enhance the initial absorptive phase and thus, the onset of specific benefits associated with melatonin, L-theanine, and caffeine.

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