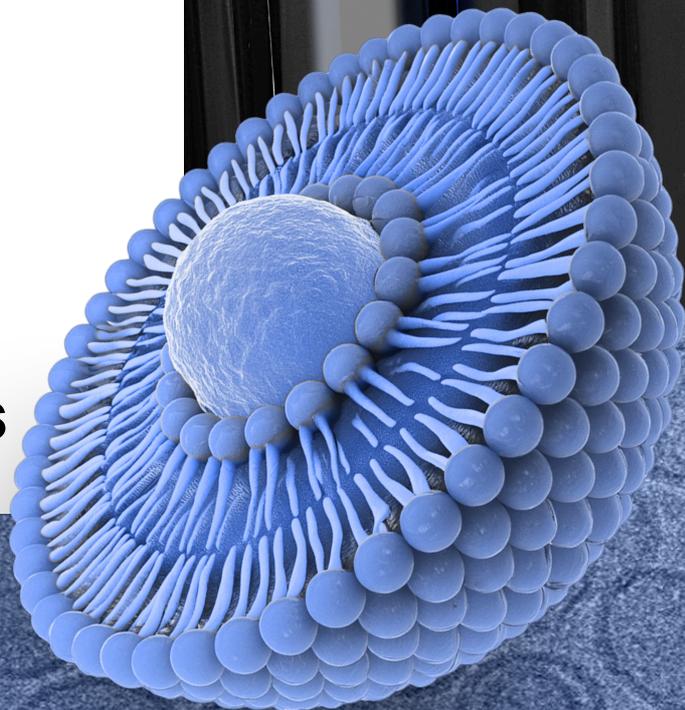


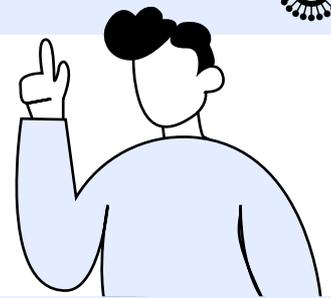


**Human Clinical Study
on the Comparative
Bioavailability
of Various **Magnesium**
Supplementation Forms**





Summary of the Study^[1]



Abstract

The purpose of this study was to compare the bioavailability of Magnesium in liquid liposomal supplementation form provided by PlantaCorp with other non-liposomal tablet form provided by competitor. Twenty metabolically healthy volunteers were enrolled in the study.

Overall, **the PlantaCorp liposomal Magnesium supplement had the highest bioavailability, up to 5.18 times more**, compared to other non-liposomal Magnesium in tablet supplementation form tested.

KEYWORDS: Magnesium, Liposomes, Bioavailability, Dietary Supplements, Biohacking.

Product Groups



Manufactured by PlantaCorp
in Hamburg, Germany

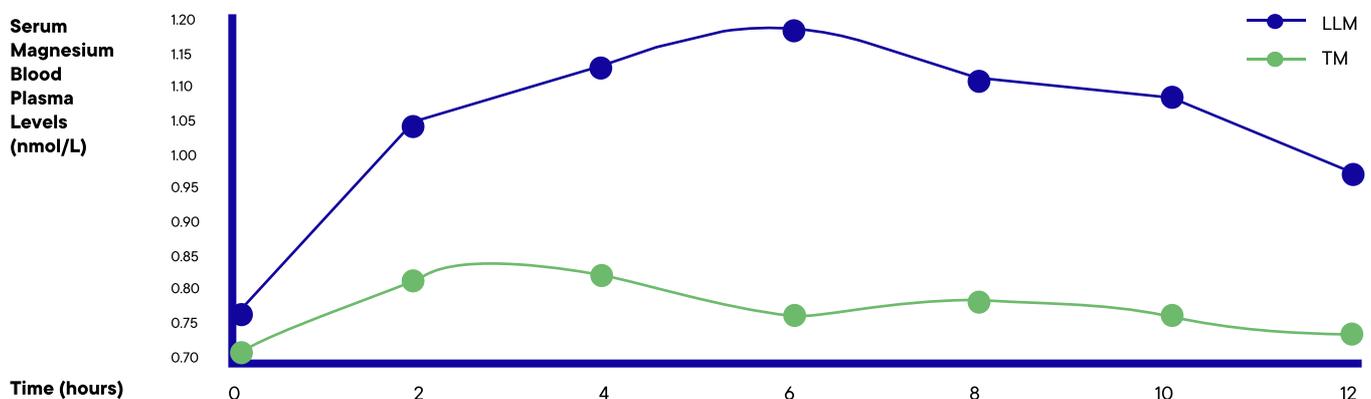


Manufactured by Competitor
in the United Kingdom

Results

During the study, Magnesium blood plasma levels were measured over time after the intake of Magnesium 400 mg in two supplementation forms, namely LLM, and TM.

The results have shown that the PlantaCorp liquid liposomal Magnesium supplement (LLM) has **5.18 times** higher bioavailability than the competitor's non-liposomal tablet Magnesium (TM). Liposomal Magnesium also **maintained elevated plasma levels throughout the entire study period**, proving sustained highest concentrations during daily supplementation.



^[1] See the full study from page 2.



Introduction

Magnesium is an essential mineral involved in numerous physiological processes, including energy production, nerve function, and muscle health. It is commonly found in various foods and salt forms.^[1] Magnesium supplementation is particularly beneficial for elderly individuals facing absorption challenges and children experiencing hyperactivity or difficulty falling asleep.^[2] Despite its critical role, Magnesium exhibits low bioavailability, which significantly limits its effectiveness and underscores the need for enhanced delivery technologies.^[3] **Liposomal encapsulation is an enhanced drug delivery system that effectively overcomes the absorption challenges associated with magnesium supplementation.** The current study confirms that **PlantaCorp's unique advanced liposomal technology, LipoSone™**, maximizes Magnesium bioavailability, outperforming conventional supplementation forms such as tablets.

Method

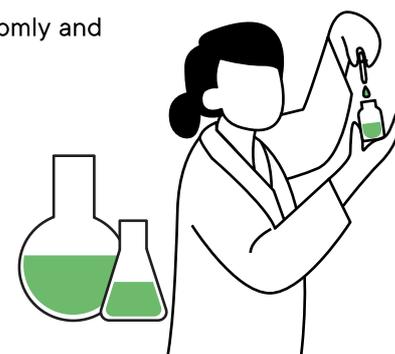
The current study was a randomized, controlled, two-group trial investigating the effect of Magnesium 400 mg in two different formulations: liquid liposomal Magnesium provided by PlantaCorp (LLM) and non-liposomal Magnesium in tablet form provided by competitor (TM).

Participants

Twenty (20) metabolically healthy volunteers were enrolled in the study. They were randomly and evenly assigned to one of the two supplementation groups.

Exclusion criteria for participants were:

- ✗ <20 and >50 years of age
- ✗ Any diagnosis of chronic condition(s)
- ✗ BMI outside of the normal category range (18.5–24.9kg/m²)
- ✗ Presence of acute illness
- ✗ Use of drugs or dietary supplements on a frequent and/ or mandatory basis



Measurements	LLM*	TM*
Age (years)	27 ± 6	27 ± 5
Females (%)	50	40
BMI (kg/m ²)	20 ± 2	21 ± 2
Systolic BP (mmHg)	117 ± 14	119 ± 13
Diastolic BP (mmHg)	78 ± 9	78 ± 9

Table 1. Participant Anthropometric Data

* Mean standard deviation n=10

Active Substances & Supplementation Groups

a. Liquid liposomal Magnesium (LLM): PlantaCorp's Magnesium 400 mg (20 ml) in liposomal liquid form, manufactured in Hamburg, Germany.

b. Non-liposomal tablet Magnesium (TM): Competitor's Magnesium 400 mg in tablet form, manufactured in the United Kingdom.



Dosage and Blood Collection

Participants in the designated supplement groups, while in a fasted state, received a **400 mg oral dose of Magnesium**. Blood samples were taken initially before the supplement was consumed (baseline) and then at intervals of 2, 4, 6, 8, 10 and 12 hours following the intake. These samples were microcentrifuged for 6 minutes at 15,000 g, cooled to 4°C, and analysed as a cofactor to isocitrate dehydrogenase to quantify Magnesium content.

Data

All participants successfully completed the study. They were predominately in their late twenties, with an equal distribution of males and females. All were characterized by healthy Body Mass Index (BMI) and blood pressure levels, detailed by both systolic and diastolic measurements. Participant anthropometric data is provided in **Table 1**.

Each group's average blood plasma Magnesium levels over time are graphically represented in **Figure 1**. Pharmacokinetic parameters, such as the peak plasma concentration of Magnesium (C_{max}) and the time to reach this peak (T_{max}), are documented in **Table 2**.

The area under the concentration-time curve (AUC_{0-t}) was calculated from dosing to the last measurable concentration using the trapezoidal rule, indicating the total exposure to the active ingredient over time. The incremental area under the curve (iAUC) adjusts the AUC for baseline variations. The Oral Bioavailability Value (OBV) was determined by comparing the liposomal and non-liposomal $iAUC_{0-t}$ values.

Results

A temporal analysis of Magnesium serum plasma levels reveals that:

After 2 hours, the LLM group demonstrates significantly higher Magnesium serum levels compared to the TM group, which remains below the reference range for normal Magnesium intake.

After 4 hours, the LLM group achieves values above the reference range, while the TM group experiences a slight decline in serum levels and remains unable to reach the reference range.

After 6 and 10 hours, both groups maintain stable Magnesium serum levels; however, the LLM group remains above the reference range, whereas the TM group stays below it.

After 12 hours, Magnesium serum levels begin to decline in both groups. The LLM group remains within the middle of the reference range, whereas the TM group reaches baseline levels.

Considering the **iAUC** values, the outcomes suggest:

The liposomal group has an OBV **5.18 times** greater than the tablet group.

Measurements	LLM	TM
C_{max} (nmol/L)	1.14	0.83
T_{max} (hours)	6	2
AUC_{0-t} (nmol*h/L)	6.41	4.73
$iAUC_{0-t}$ (nmol*h/L)	1.85	0.36
OBV	5.18	

Table 2. Pharmacokinetic Parameters Data

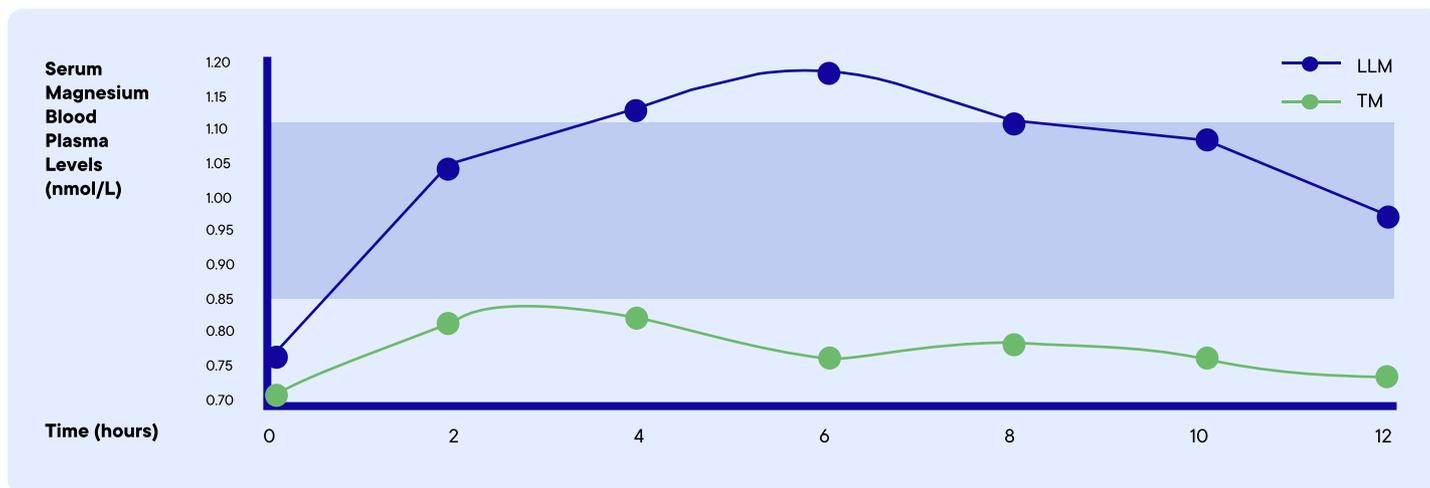


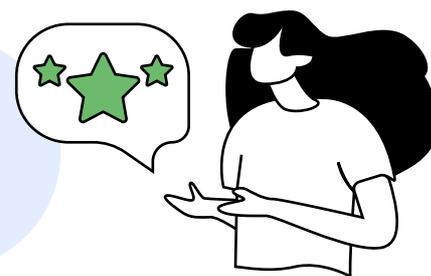
Figure 1. Serum Magnesium blood plasma levels collected over time in two supplementation groups, namely LLM liquid liposomal form manufactured by PlantaCorp, and TM tablet product manufactured by competitor. The highlighted area refers to the reference range for the normal Magnesium consumption of 0.85–1.10nmol/L.^[5]

Discussion and Conclusion

The European Food Safety Authority recommends a daily Magnesium intake of approximately 300 mg for women and 350 mg for men.^[4] Serum Magnesium levels, with a reference range of 0.85–1.10 nmol/L, are used to assess adequacy.^[5] This study used a 400 mg dose, slightly above the daily recommendation but typical for tablets at the time of the conducted study.

The present study demonstrates that PlantaCorp's liposomal Magnesium exhibits **the highest bioavailability** among the tested groups. Specifically, LLM has **5.18 times** higher bioavailability than the competitor's non-liposomal tablet form (TM). After just two hours, the liposomal group reached blood serum of Magnesium levels above the reference range, and **maintained elevated plasma levels** throughout the **entire 12-hour** duration of the study. On the other hand, the standard supplement in tablet form was unable to reach plasma levels within the reference range, indicating that conventional Magnesium dietary supplements are not efficient even at high dosages. These findings underscore the substantial impact of liquid liposomes on Magnesium bioavailability and highlight the superior performance of PlantaCorp's liposomal formulations.

Overall, PlantaCorp's unique advanced liposomal technology, LipoSone™, is the most effective way to deliver Magnesium to the bloodstream while maintaining the highest blood plasma levels for up to 12 hours.



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Plantacorp GmbH, September 2020