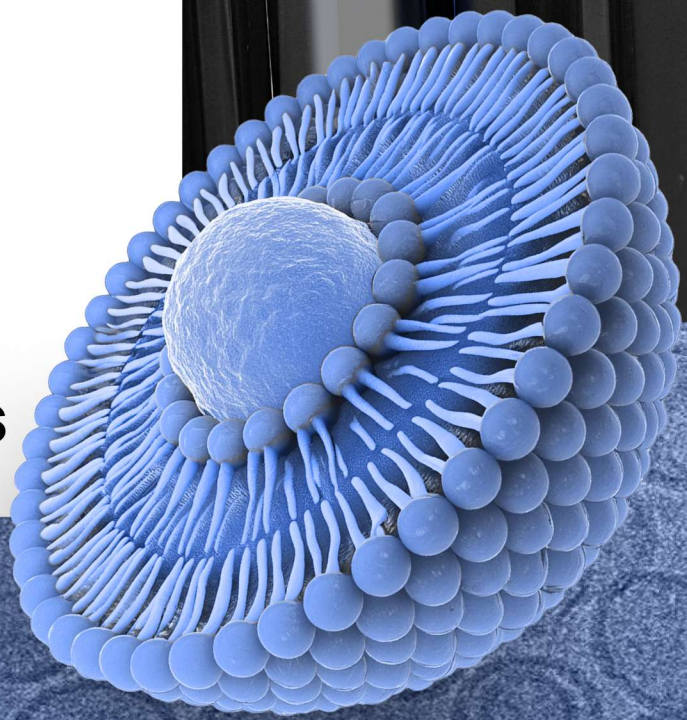
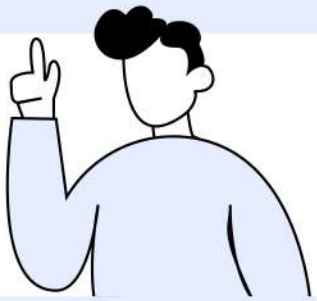
Brain market

Human Clinical Study on the Comparative Bioavailability of Various Zinc Supplementation Forms



Summary of the Study[1]



Abstract

The purpose of this study was to compare the bioavailability of liposomal Zinc provided for BrainMarket with other non-liposomal Zinc provided by competitors. Forty metabolically healthy volunteers were enrolled in the study.

Overall,**the BrainMax supplements with liposomal zinc had the highest bioavailability, up to 3.82 times more,** compared to other Zinc supplementation forms tested.

KEYWORDS: Zinc, Mineral, Liposomes, Bioavailability, Dietary Supplements, Biohacking.

Product Groups

LLZA
Liquid Liposomal Zinc Ascorbate 25 mg

Manufactured for BrainMarket

LLZG
Liquid Liposomal Zinc Gluconate 25 mg

Manufactured for BrainMarket

PZA
Zinc Ascorbate In Powder Form 25 mg

Manufactured by Competitor in Germany

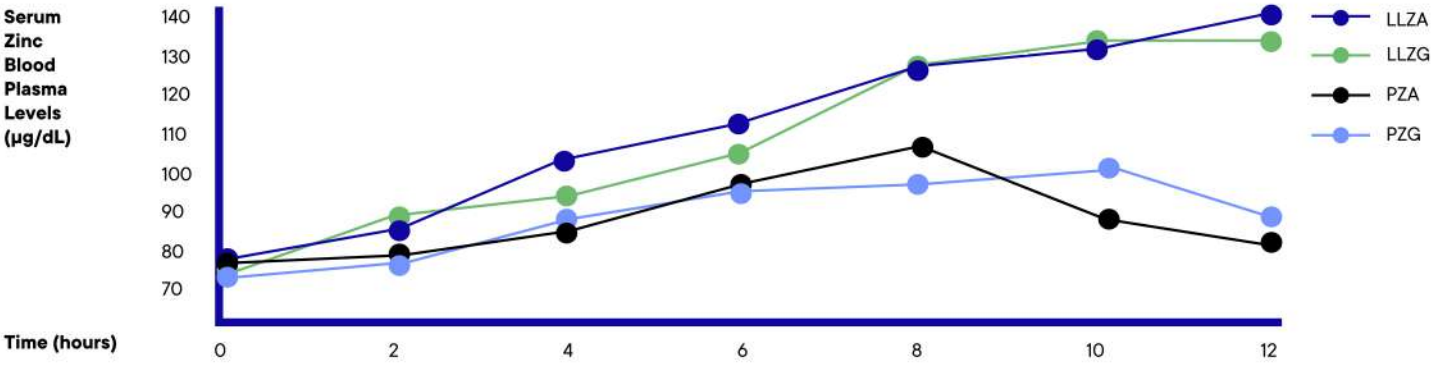
PZG
Zinc Gluconate In Powder Form 25 mg

Manufactured by Competitor in the Netherlands

Results

During the study, Zinc blood plasma levels were measured over time after the intake of Zinc 25 mg in four supplementation forms, namely LLZA, LLZG, PZA, and PZG.

The results have shown that the BrainMax supplements with liquid liposomal Zinc ascorbate (LLZA) has **3.82 times** higher bioavailability than the competitor's Zinc ascorbate in powder form (PZA), and BrainMax supplements with liquid liposomal Zinc gluconate supplement (LLZG) has **2.73 times** higher bioavailability than the competitor's Zinc gluconate in powder form (PZG).



[1]See the full study from page 2.

Introduction

Zinc is a vital mineral that plays a crucial role in numerous bodily functions, making adequate intake essential to prevent deficiencies.[1] A key challenge of the dietary supplement industry has been improving Zinc absorption and bioavailability.[2] While traditional Zinc supplementation methods have low absorption rates,[3] liposomal technology can be an excellent alternative to encapsulate Zinc and increase its bioavailability. The current study confirmed **that the unique advanced liposomal technology LipoSone™, used in BrainMax supplements, effectively enhances** Zinc bioavailability, outperforming other supplementation forms tested, such as non-liposomal powder Zinc.

Method

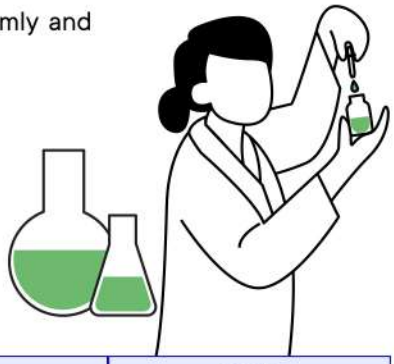
The current study was a randomized, controlled, four-group trial on the effect of Zinc 25 mg in four different formulations: BrainMax liquid liposomal Zinc ascorbate (LLZA), BrainMax liquid liposomal Zinc gluconate (LLZG), non-liposomal Zinc ascorbate in powder form by competitor (PZA), and a non-liposomal Zinc gluconate in powder form by competitor (PZG).

Participants

Forty (40) metabolically healthy volunteers were enrolled in the study. They were randomly and evenly assigned to one of the four 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	LLZA*	LLZG*	PZA*	PZG*
Age (years)	28 ± 5	27 ± 4	28 ± 7	29 ± 7
Females (%)	50	40	60	40
BMI (kg/m2)	20 ± 2	20 ± 1	20 ± 1	20 ± 2
Systolic BP (mmHg)	119 ± 11	120 ± 9	119 ± 13	119 ± 13
Diastolic BP (mmHg)	78 ± 7	78 ± 7	80 ± 5	78 ± 7

Table 1. Participant Anthropometric Data

** Mean standard deviation n=10*

Active Substances & Supplementation Groups

a. Liquid liposomal Zinc ascorbate (LLZA): BrainMax supplement with Zinc ascorbate 25 mg in liposomal liquid form.

b. Liquid liposomal Zinc gluconate (LLZG): BrainMax supplement with Zinc gluconate 25 mg in liposomal liquid form.

c. Powdered Zinc ascorbate (PZA): Competitor's Zinc ascorbate 25 mg in powder form, manufactured in Germany.

d. Non-liposomal product (PZG): Competitor's Zinc gluconate 25 mg in powder form, manufactured in the Netherlands.

Dosage and Blood Collection

Participants in the designated supplement groups, while in a fasted state, received a **25 mg oral dose of Zinc**. 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 of Zinc. These samples were promptly microcentrifuged for 12 minutes, cooled to 2°C, and subjected to plasma Zinc level quantification by spectrophotometry.

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 Zinc levels over time are graphically represented in **Figure 1**. Pharmacokinetic parameters, such as the peak plasma concentration of Zinc (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 Zinc plasma levels reveals that:

At baseline, all supplementation groups exhibit similar plasma Zinc levels.

After 4 hours, a nearly linear increase in plasma Zinc levels is observed across all groups.

After 6 hours, the liposomal groups show a more pronounced rise in plasma Zinc levels compared to the non-liposomal groups.

After 8 hours, plasma Zinc levels in the liposomal groups appear to plateau, with a significant gap emerging between the liposomal and powder groups.

After 10 hours, the liposomal groups maintain high and stable plasma Zinc levels, whereas the powder groups begin to decline.

After 12 hours, the liposomal groups continue to sustain elevated and steady plasma Zinc levels, while the non-liposomal groups' levels decrease further, approaching baseline values.

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

Liposomal Zinc ascorbate has an OBV **3.82 times** higher than non-liposomal powder Zinc ascorbate. Liposomal Zinc gluconate has an OBV **2.73 times** higher than non-liposomal powder Zinc gluconate.

The LLZA and LLZG groups exhibit comparable AUC and iAUC values, indicating that the liquid liposomal delivery system effectively equalizes the bioavailability of minerals from different sources.

Measurements	LLZA	LLZG	PZA	PZG
C_{max} (mg/dL)	130.2	133.0	101.4	97.5
T_{max} (hours)	10	12	8	10
AUC_{0-t} (mg*hr/dL)*	1291.6	1315.9	1072.5	1084.9
$iAUC_{0-t}$ (mg*hr/dL)*	406.0	400.3	105.3	146.5
OBV	1	1	3.82	2.73

Table 2. Pharmacokinetic Parameters Data

** AUC_{0-t} and $iAUC_{0-t}$ calculated using trapezoidal rule*

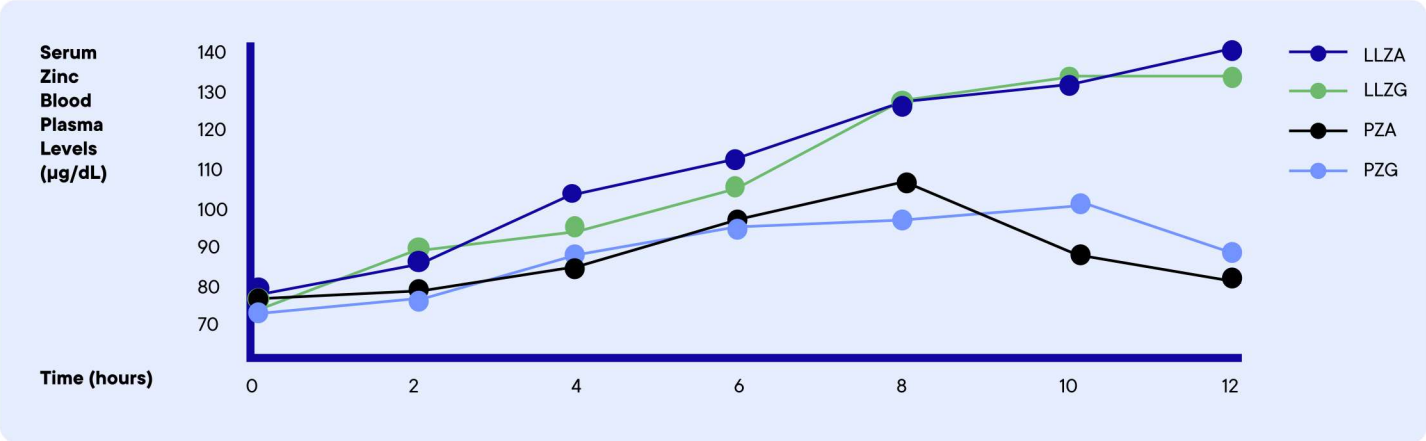


Figure 1. Zinc blood plasma levels measured over time after the intake of Zinc 25 mg in four supplementation forms, namely LLZA liquid liposomal Zinc ascorbate manufactured for BrainMarket, LLZG liquid liposomal Zinc gluconate manufactured for BrainMarket, PZA non-liposomal Zinc ascorbate in powder form manufactured by competitor, PZG non-liposomal Zinc gluconate in powder form manufactured by competitor.

Discussion and Conclusion

The study demonstrates that liposomal Zinc in BrainMax supplements (LLZA and LLZG) exhibits the **highest bioavailability** among the tested groups. Specifically, LLZA has **3.82 times** higher bioavailability than the competitor's powder non-liposomal Zinc ascorbate (PZA), and LLZG has **2.73 times** higher bioavailability than the competitor's powder non-liposomal Zinc gluconate (PZG).

After 8 hours, Zinc plasma levels of the liposomal groups were substantially higher than that of the non-liposomal powder groups. Additionally, LLZA and LLZG **maintained elevated plasma Zinc levels** for the **entire 12-hour** duration of the study. In contrast, the non-liposomal powder groups plasma levels started to decrease after 10 hours. Furthermore, the LLZA and LLZG groups exhibit comparable bioavailability values, suggesting that the liquid liposomal delivery system successfully bridges the gap in mineral bioavailability across different sources.

These findings underscore the substantial impact of liquid liposomes on Zinc bioavailability and highlight **the superior performance of BrainMax formulations**.

The advanced liposomal technology LipoSone™, powering BrainMax Liposomal products, is the most effective way to deliver Zinc to the bloodstream while maintaining the highest blood plasma levels for up to 12 hours.

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Acknowledgement

Study conducted in collaboration with: Surya Research Clinics
D1002, Purva Venezia apartments. Yelahanka Newtown Bengaluru. KA 560065, India