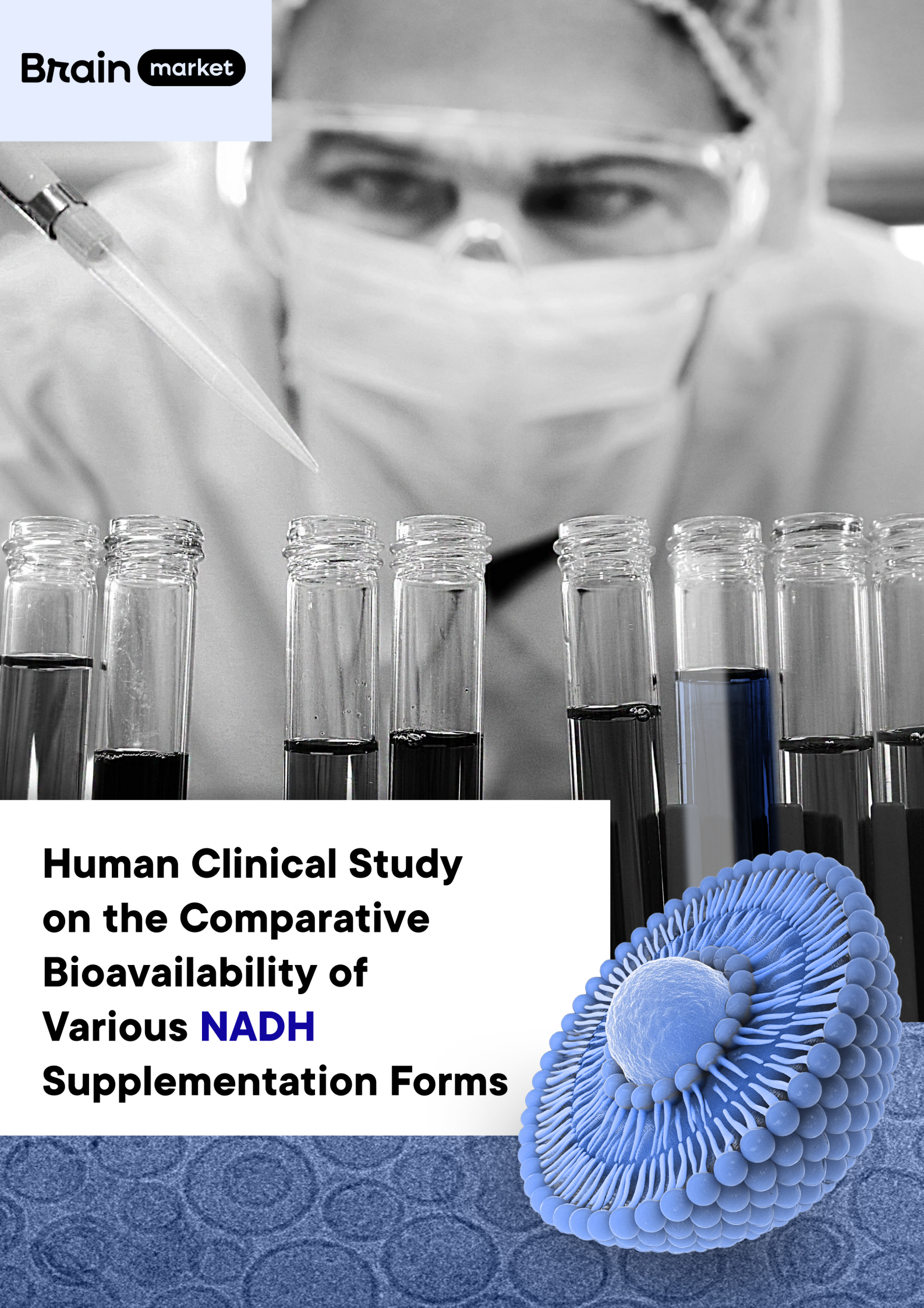
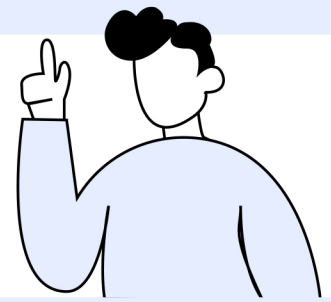




**Human Clinical Study
on the Comparative
Bioavailability of
Various **NADH**
Supplementation Forms**

Summary of the Study^[1]



Abstract

The purpose of this study was to compare the bioavailability of nicotinamide adenine dinucleotide in its protonated form, NADH, in liquid liposomal supplementation form provided by Brainmarket with other non-liposomal tablet form provided by competitor. Twenty metabolically healthy volunteers were enrolled in the study.

Overall, **the Brainmarket liposomal NADH supplement had the highest bioavailability, up to 22 times more**, compared to other non-liposomal NADH in tablet supplementation form tested.

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

Product Groups

LLN

Liquid Liposomal
NADH
50 mg

Manufactured by Brainmarket
in Hamburg, Germany

TN

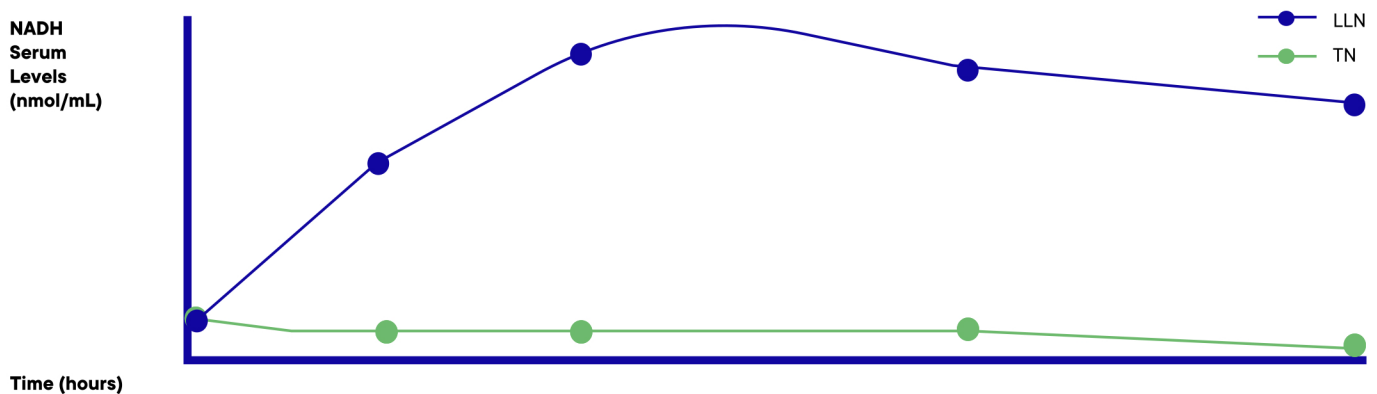
Non-liposomal tablet
NADH
50 mg

Manufactured by Competitor
in the Netherlands

Results

During the study, NADH serum levels were measured over time after the intake of NADH 50 mg in two supplementation forms, namely LLN, and TN.

The results have shown that the Brainmarket liquid liposomal NADH supplement (LLN) has **22 times** higher bioavailability than the competitor's non-liposomal tablet NADH (TN). Liposomal NADH also **maintained elevated serum levels throughout the entire study period**, proving sustained highest concentrations during daily supplementation.



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

Introduction

The supplement **NADH** (nicotinamide adenine dinucleotide) is widely studied for its role in energy-related functions, including alleviating physical fatigue, supporting metabolic processes, and reducing cellular oxidative stress.^[1] However, scientific research highlights the bioavailability challenges posed by NADH's instability in aqueous environments, often necessitating the use of intravenous forms for effective delivery.^[2] Addressing these limitations, Brainmarket has developed **liquid liposomal NADH** to unlock the full therapeutic potential of this supplement. The current study confirms that **Brainmarket's unique advanced liposomal technology, LipoSone™**, maximizes NADH bioavailability, outperforming conventional supplementation forms such as tablets.

Method

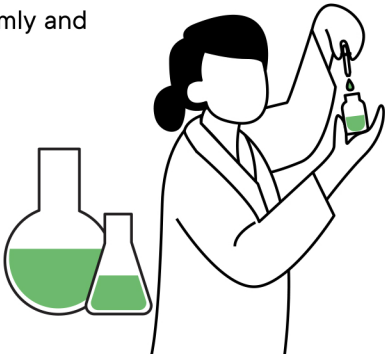
The current study was a randomized, controlled, two-group trial investigating the effect of NADH 50 mg in two different formulations: liquid liposomal NADH provided by Brainmarket (LLN) and non-liposomal NADH in tablet form provided by competitor (TN).

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	LLN*	TN*
Age (years)	27 ± 4	28 ± 5
Females (%)	40	50
BMI (kg/m2)	22 ± 2	21 ± 2
Systolic BP (mmHg)	119 ± 7	122 ± 11
Diastolic BP (mmHg)	79 ± 5	79 ± 6

Table 1. Participant Anthropometric Data

* Mean standard deviation n=10

Active Substances & Supplementation Groups

- a. **Liquid liposomal NADH (LLN):**Brainmarket's NADH 50 mg in liposomal liquid form, manufactured in Hamburg, Germany.
- b. **Non-liposomal tablet NADH (TN):** Competitor's NADH 50 mg in tablet form, manufactured in the Netherlands.

Dosage and Blood Collection

Participants in the designated supplement groups, while in a fasted state, received a **50 mg oral dose of NADH**. Blood samples were taken initially before the supplement was consumed (baseline) and then at intervals of 1, 2, 4, 8 and 12 hours following the intake. These samples were microcentrifuged, cooled to 2°C, and analysed for serum NADH levels via a NAD/ NADH colorimetric assay (450 nm).

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

At baseline, both the LLN and TN supplementation groups exhibit the same plasma levels.

After 1 hour, The LLN group exhibited a significant increase in NADH serum levels compared to baseline, while the TN group showed no change.

After 4 hours, NADH levels in the LLN group peaked, whereas the TN group remained at baseline levels.

After 8 hours, NADH levels in the LLN group began to decline, yet the TN group continued to exhibit baseline levels.

After 12 hours, the LLN group displayed a linear decrease in NADH levels, while the TN group remained unchanged at baseline values.

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

The liposomal group has an OBV **22 times** greater than the tablet group.

Measurements	LLN	TN
C_{max} (nmol/mL)	18.7	11.39
T_{max} (hours)	5	0
AUC_{0-t} (nmol*h/mL)	200	134
$iAUC_{0-t}$ (nmol*h/mL)	67	-3
OBV	22	

Table 2. Pharmacokinetic Parameters Data

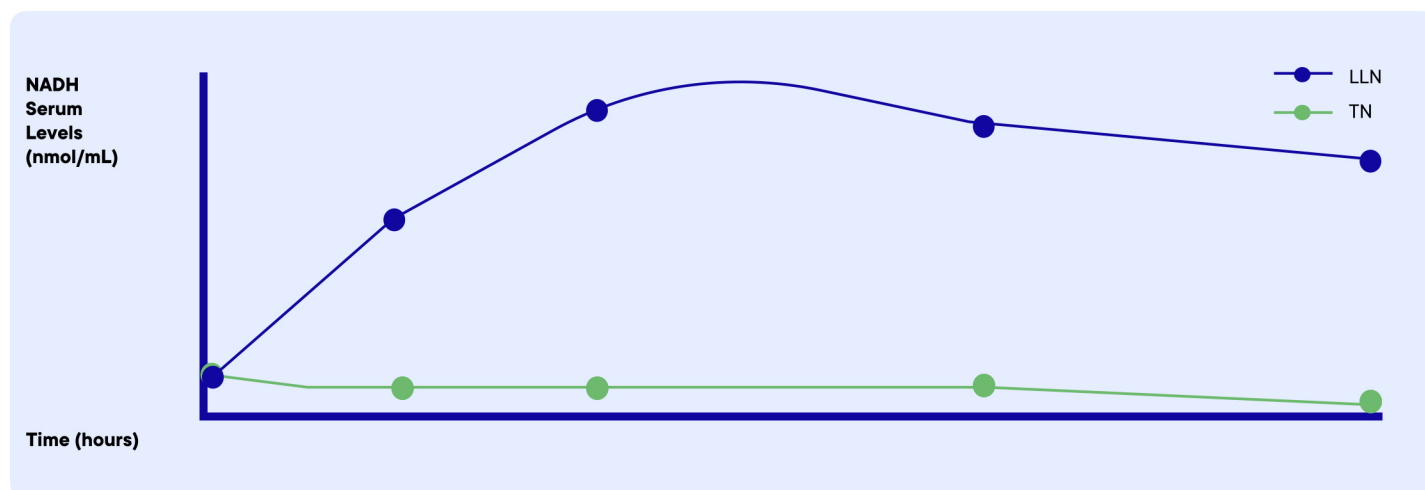


Figure 1. NADH blood serum levels collected over time in two supplementation groups, namely LLN liquid liposomal form manufactured by Brainmarket, and TN tablet product manufactured by competitor.

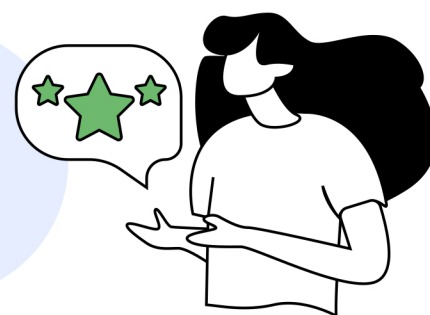
Discussion and Conclusion

The present study demonstrates that Brainmarket's liposomal NADH exhibits **the highest bioavailability** among the tested groups. Specifically, LLN has **22 times** higher bioavailability than the competitor's non-liposomal tablet form (TN). Furthermore, the LLN group **maintained elevated NADH serum levels** throughout the **entire 12-hour** duration of the study. In contrast, the TN group showed no increase from the baseline.

The results of this study are particularly significant given NADH's natural instability in water, which causes it to degrade rapidly. The evidence strongly indicates that NADH in tablet form provides minimal, if any, contribution to effective supplementation of the active ingredient.

These findings underscore the substantial impact of liquid liposomes on NADH bioavailability and highlight the superior performance of Brainmarket's liposomal formulations.

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



1. The Effect of Antioxidant Supplementation on Fatigue during Exercise: Potential Role for NAD⁺(H). by John Mach et al. *Nutrients* 2010, 2(3), 319–329; <https://doi.org/10.3390/nu2030319>
2. Current State of Science Review focusing on characterization, efficacy, safety, use and promising areas for oral NADH. C.Kelley. *Science Behind Supplements*, 2006

Acknowledgement

Study conducted in collaboration with: Surya Research Clinics C-6, Sujan Singh Park Cornwallis Road New Delhi, Delhi 110003 J62H+CF New Delhi, Delhi, India

Brainmarket GmbH, December 2021