



Magtein®

Improves Sleep Quality, Mood, Energy and
Productivity in a Double-Blind, Placebo Controlled
Human Clinical Study

Jennifer Gu, PhD

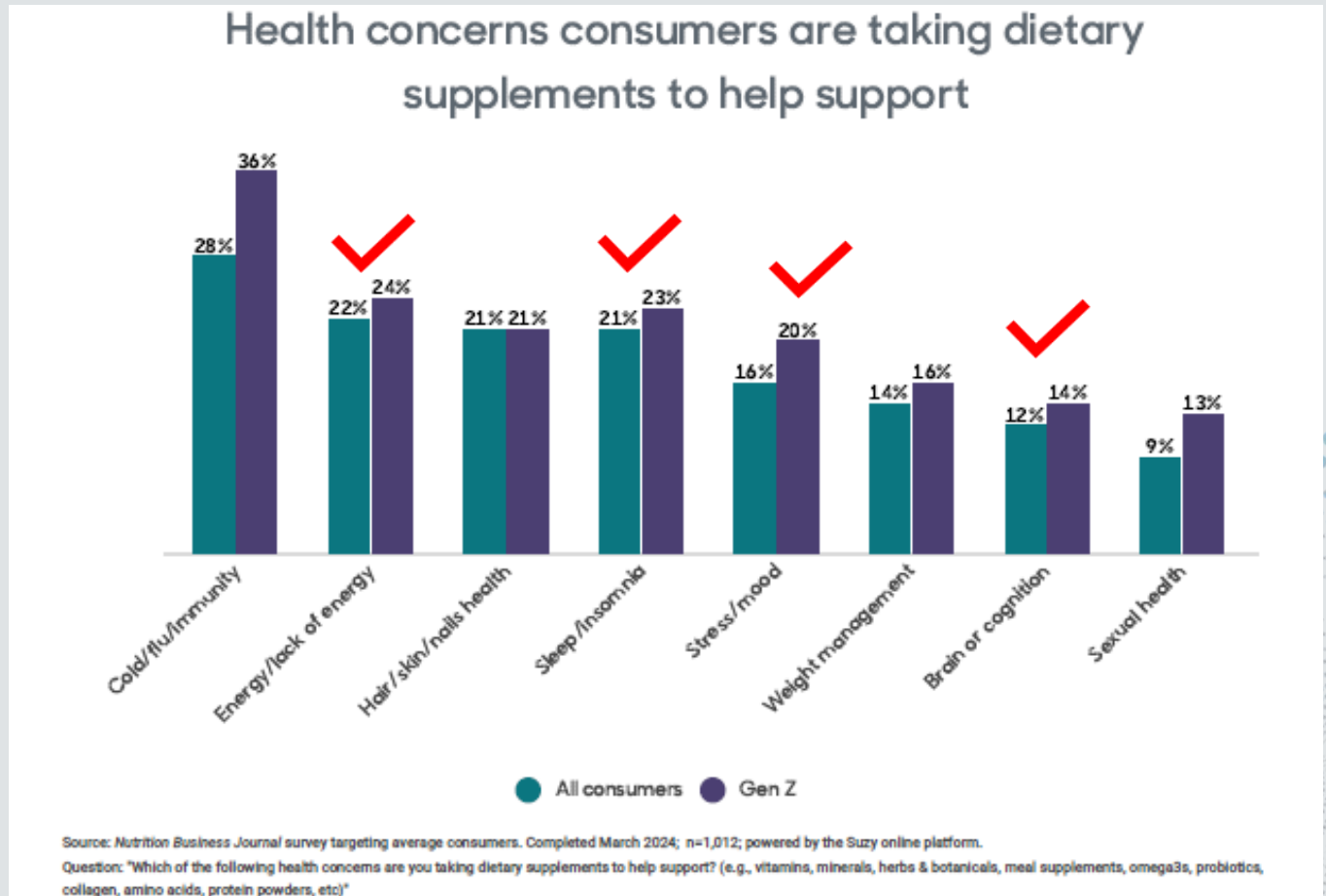
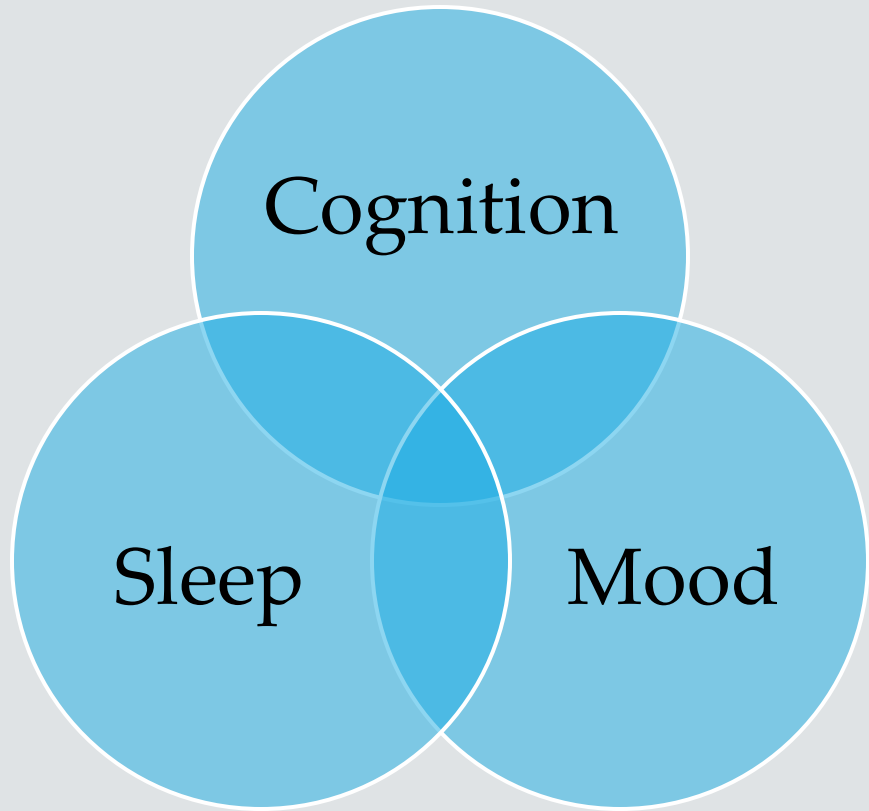
VP of R&D, AIDP, Inc

A patented compound of Magnesium (Magnesium L-Threonate) **Magtein®** has been shown to *effectively cross the blood-brain barrier*, increasing brain magnesium to improve synaptic density and restore neuronal cells.

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- Rapid response time
 - Unique mode of action
 - Clinically proven for cognition, sleep and mood
 - High consumer acceptance & reorder rate
 - FDA GRAS & Non-GMO
 - Health Canada Product License with cognition claims
 - EFSA Approval
 - Use and manufacturing patent protection
 - Water soluble and suitable for multiple delivery systems
 - Odorless & colorless
 - Exclusive distributor
 - 1.5-2 g dose



Magtein®'s benefits are on trend with consumer needs



Magtein® Summary of Completed Animal Research

Study	Major Findings	Application/ Outcomes
Slutsky, et al. Neuron 2010 ⁶	Magtein® intake enhances learning abilities, working memory, short- and long-term memory.	Learning Working Memory Short-Term Memory Long-Term Memory
Bush. Neuron 2010 ¹⁰	Magtein® delivers magnesium to the brain and improves cognition in young and old rats.	Bioavailability Cognition
Abumaria, et al. J Neuroscience 2011 ¹¹	Magtein® intake leads to reduced fear, stress and anxiety-like behavior.	Stress Anxiety
Li, et al. J Neuroscience 2013 ¹²	Magtein® intake effectively prevented/reversed learning and memory deterioration in Alzheimer's mouse model.	Memory
Mickley, et al. Pharmacol Biochem Behav 2013 ¹³	Magtein® intake speeds extinction of a conditioned taste aversion.	Fear
Wang, et al. Pain Phys 2013 ¹⁴	Magtein® intake restores short-term memory dysfunction induced by nerve injury.	Short-Term Memory

Magtein® Summary of Completed Animal Research

Study	Major Findings	Application/ Outcomes
Abumaria, et al. Behav Pharmacol 2013 ¹⁵	Magtein® enhances spatial-context discrimination and pattern separation while preventing overgeneralization of fear.	Learning Fear
Yu, et al. FASEB 2015 ¹⁶	Magtein® significantly reduces amyloid plaques in hippocampus and frontal cortex of transgenic Alzheimer's mice.	Cognitive Decline Alzheimer's Disease
Jia, et al. J Cell Physiol 2016 ¹⁷	Magtein® increases number of neural stem cells in hippocampus.	Brain Health Bioavailability
Sun, et al. Neuropharmacol 2016 ¹⁸	Magtein® crosses the blood-brain barrier and promotes cognitive abilities by improving synaptic density of neurons.	Bioavailability Cognition
Wang, et al. Cell Mol Immunol 2017 ¹⁹	Magtein® inhibits neuroinflammation in transgenic AD mice.	Brain Health Anti-inflammation

Magtein® Summary of Completed Animal Research

Study	Major Findings	Application/ Outcomes
Sadir, et al. Pharm Sci, 2019 ²⁴	Magtein® significantly improved memory and decreased depressive symptoms.	Bioavailability Memory Mood
Zhou, et al. Neurosci Bull. 2021 ²⁵	Magtein® reduces medication induced memory and emotional deficits.	Memory Mood
Xu, et al. Anesthesiology. 2017 ²⁶	Magtein® reduces neuropathic pain induced by medications.	Pain Bioavailability
Shen, et al. Neuropsychiatr Dis Treat. 2019 ²⁷	Magtein® reduces motor deficits caused by Parkinson's disease.	Bioavailability Parkinson's disease
Liu, et al. Brain Res Bull. 2021 ²⁸	Magtein® relieved inflammation in gut-brain axis, reshaped gut microbiota, and enhanced amino acid metabolism.	Memory Systemic Inflammation Digestive protection

Magtein® Summary of Completed Animal Research

Study	Major Findings	Application/ Outcomes
Bislimi et al. J Vet Res, 2021 ²⁹	Magtein® and vitamin C increased learning and memory in lead poisoned rats.	Learning Memory
Chen, et al. J Neuroinflammation , 2021 ³⁰	Magtein® alleviated pain and depression or memory deficits in bladder pain syndrome rats.	Pain Depression Memory
Zhang et al. J Inflamm Res. 2021 ³¹	Magtein® reduced pain hypersensitivity, memory and depressive symptoms in post menopausal rats.	Pain Memory Mood
Huang, et al. CNS Neurosci Ther. 2018 ³²	Magtein® rescued learning and memory function in AD rats.	Recognition Spatial memory
Yu, et al. Front Mol Neurosci. 2018 ³³	Magtein® increased brain magnesium and decreased TNF- α in AD rats.	Cognitive Impairment Bioavailability

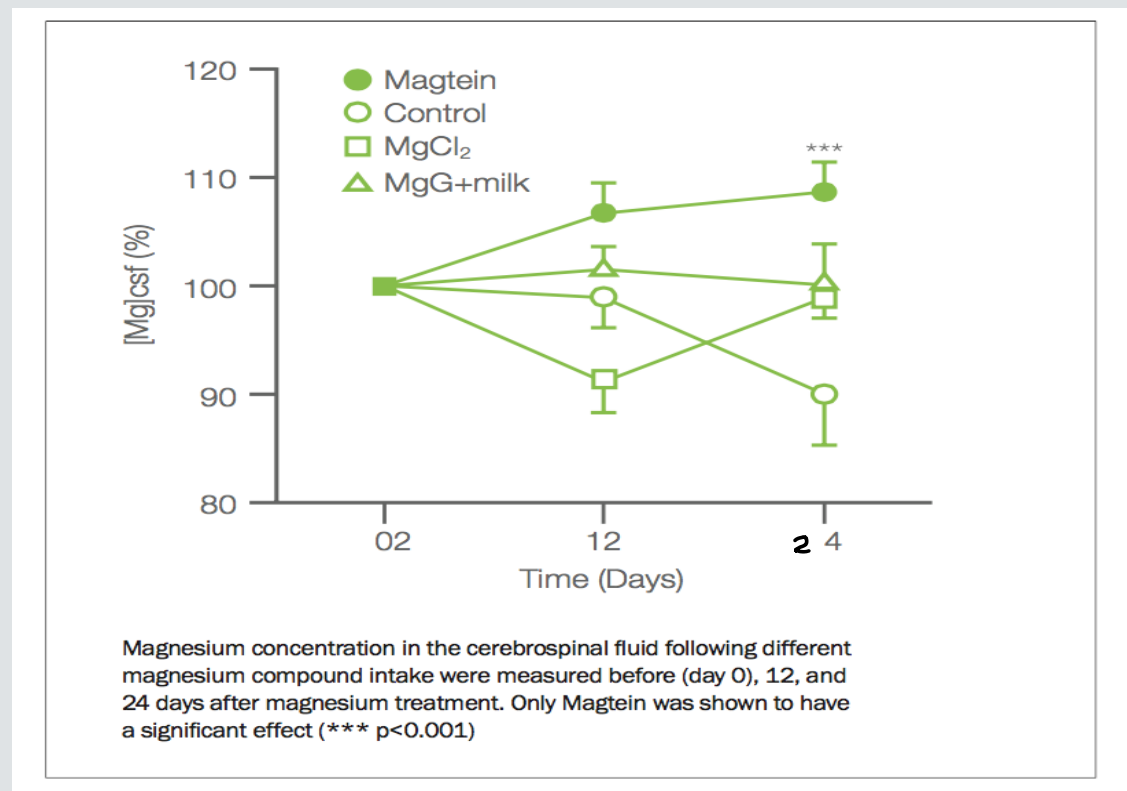
Magtein® Elevates Brain Magnesium

Magtein® (Magnesium L-Threonate) is the magnesium compound shown to effectively increase magnesium levels in the brain

1. Magtein® was evaluated in-vivo against the most bioavailable forms of magnesium.
2. After 24 days of supplementation, Magtein® was the only compound to significantly raise magnesium levels in the brain.

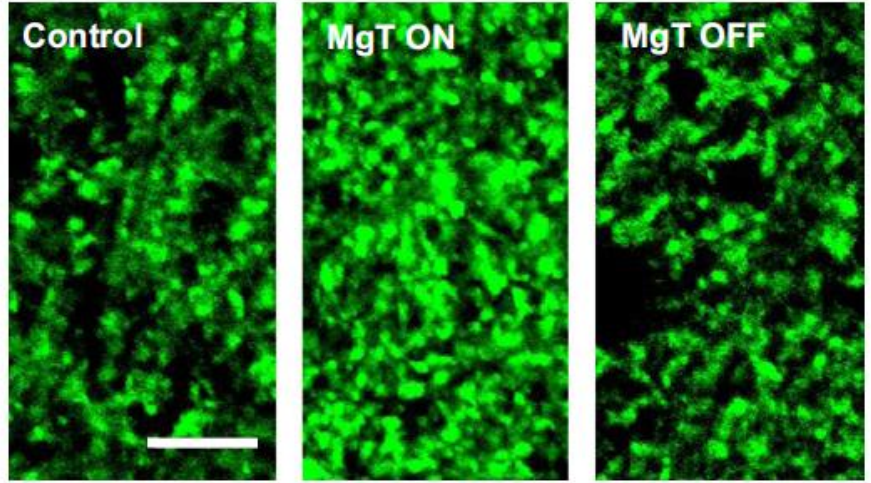
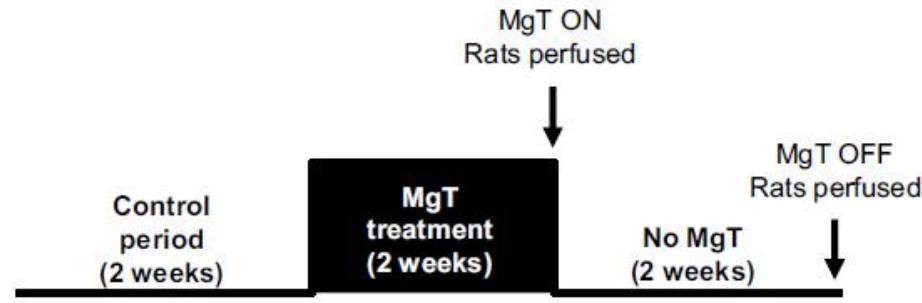


The chemical structure of Magtein® allows it to cross the blood-brain barrier.

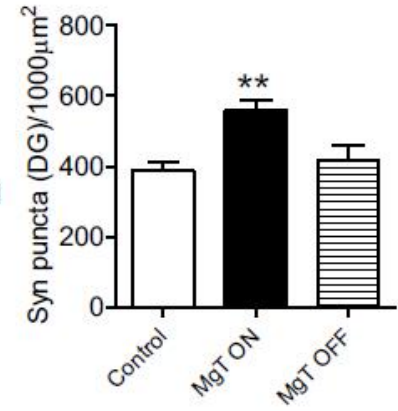


Correlation among MgT Treatment, Synaptic Bouton Density and Memory

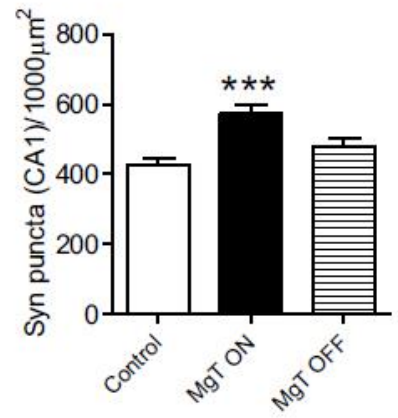
A



B



C



Source: 6.Slutsky, et al. *Neuron*. 2010;65:165-177.



Magtein[®] benefits demonstrated by animal studies

- Shown to enhance overall cognitive function
- Shown to be the only magnesium form shown to effectively increase the brain's magnesium levels
- Shown to increase brain synaptic density
- Shown to restore the prefrontal cortex synaptic density of the brain, which controls complex cognitive behavior and emotional response; executive reasoning; planning; decision making
- Shown to increase synaptic plasticity and density in both hippocampus and prefrontal cortex regions of the brain
- Helps to improve short- and long-term memory
- Helps to improve working memory
- Helps to control response to stressful events
- Helps to restore aging brain

Source: 6.Slutsky, et al. Neuron. 2010;65:165-177.

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Study Design	Participants	Intervention	Outcomes
Randomized, double-blind, placebo-controlled, parallel arm study [21].	51 healthy participants 50-70 years old. Self-reported complaints of memory problems, anxiety and poor sleep, USA	Magtein [®] 1.5 – 2 g/day (if >70 kg bodyweight). 12 weeks.	Magtein [®] significantly raised body magnesium status. Magtein [®] significantly improved memory and cognition vs placebo. Magtein [®] reduced brain age by 9 years.
Randomized, double-blind, placebo-controlled, parallel arm study [22].	102 healthy participants. 18-65 years old. China.	Magtein [®] formula: Formula: MgT+PS+C+D (delivered BID). 30 days.	Magtein [®] significantly improved results over placebo and baseline for the Clinical Memory Test, a standard cognition test that assesses: <ul style="list-style-type: none"> • Memory • Associational Learning • Figure Recognition • Recall • Character-Face Association
Randomized, double-blind, placebo-controlled, parallel arm study [23].	50 healthy participants 50-70 years old. Self-reported complaints of stress and anxiety. USA.	Magtein [®] 1.5 – 2 g/day (if >70 kg bodyweight). 12 weeks.	Magtein [®] significantly reduced Hamilton Anxiety Rating Scale-A (HADS-A) Fear score compared to placebo.
Randomized, double-blind, placebo-controlled, parallel arm study [24].	80 healthy participants 35-55 years old. Self-reported complaints of poor sleep and non-clinical anxiety USA.	Magtein [®] 1 g/day (delivered BID). 3 weeks.	Magtein [®] significantly improved results over placebo for: Objectively measured (Oura ring): deep sleep score, activity score and activity daily movement score. Leeds Sleep Questionnaire (LSEQ) subcategory behavior following awakening; Restorative Sleep Questionnaire (RSQ) subcategories grouchy, in a good mood, and mental alertness.

Table 1. Magtein human clinical studies in healthy people.



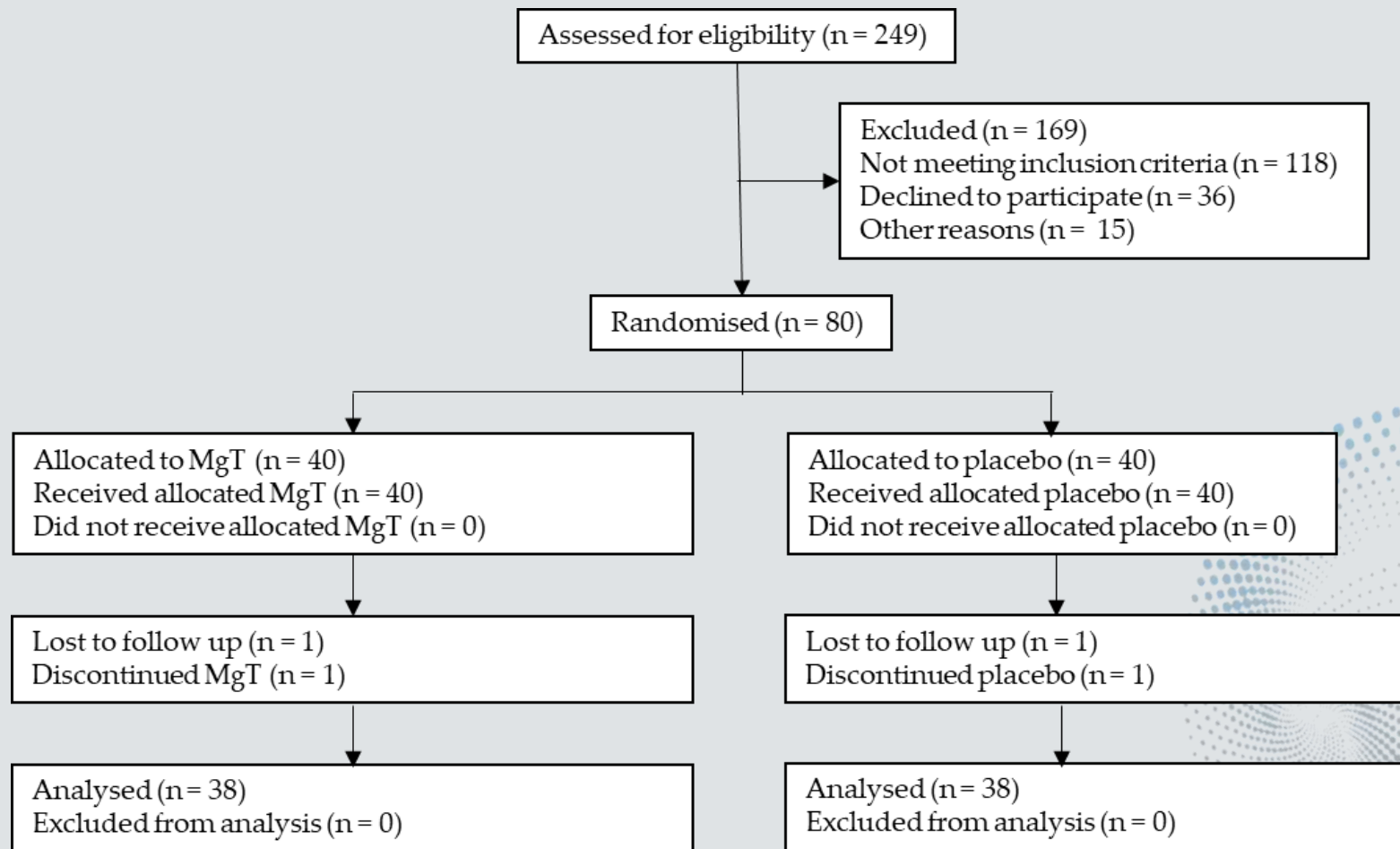
Magnesium-L-threonate improves sleep quality, mood, energy and mental clarity in a randomized, placebo-controlled clinical trial.

Heather A. Hausenblas, PhD¹; Tarah Lynch, MS¹; and Stephanie Hooper, MPH²;
Aahana Shrestha, PhD³; Doug Rosendale, PhD^{3*} and Jennifer Gu, PhD³.



Participants:

- N = 80 adults (35 to 55 years of age) with self reported poor sleep quality and nonclinical anxiety, determined by a score of between 8-21 on the insomnia severity index.
- Maintained current lifestyle behaviors
- IRB consent



- **Investigational Product:**

1 g/day of Magtein or placebo for 21 days.

Outcome Measures: measured at baseline, week 1, week 2 and week 3 of the study

Sleep

- Insomnia Severity Index
- Leeds Sleep Evaluation Questionnaire
- Restorative Sleep Questionnaire
- Oura Ring.

Mood

- Restorative Sleep Questionnaire

Energy and Productivity, Safety

- Daily Diary: Adherence, sleep quality, mood/anxiety levels, adverse events

Results: Effect of Magtein® on Sleep using Sleep Questionnaires

	MgT				Placebo				Condition	Time	Interaction (Condition x Time)
	Baseline	Day 7	Day 14	Day 21	Baseline	Day 7	Day 14	Day 21	P value	P value	P value*
Insomnia Severity Index	12.32 (4.25)	8.90 (3.09)	8.16 (4.49)	7.86 (4.79)	12.57 (3.63)	9.22 (4.15)	9.34 (4.43)	9.39 (4.04)	< 0.001	< 0.01	0.390
LSEQ Behavior following awakening	142.37 (58.43)	194.33 (47.02)	185.85 (54.07)	200.82 (46.83)	130.71 (46.76)	133.49 (49.21)	159.67 (54.1)	163.25 (57.58)	< 0.001	< 0.010	0.004
LSEQ Awake following sleep	94.42 (38.91)	124.11 (33.09)	121.94 (31.79)	124.75 (38.48)	83.57 (36.68)	105.56 (34.66)	105.62 (24.64)	100.91 (36.39)	< 0.001	< 0.001	0.650
LSEQ Quality of sleep	73.36 (40.65)	107.46 (28.21)	114.45 (27.75)	113.86 (34.77)	77.16 (33.21)	105.1 (27.70)	108.87 (39.89)	109.9 (32.98)	< 0.001	< 0.001	0.810
LSEQ Getting to sleep	159.11 (43.00)	172.86 (25.47)	164.87 (39.95)	183.46 (37.90)	144.38 (51.49)	177.36 (42.16)	173.46 (51.63)	176.62 (40.32)	< 0.001	< 0.001	0.250

- Both Magtein® and Placebo improved significantly over baseline, demonstrating a strong placebo effect that is often associated with subjective measures.
- It is interesting that most of the improvements observed in the placebo happened in the first week of product intake, and the effects plateaued afterwards, while in the MgT group, the effects continued to improve for the rest of the study.

Results: Magtein® significantly improved sleep quality as compared to the placebo using Subjective Oura Ring Measurement

Table 3: Oura Ring sleep results (mean and standard deviation, n=38 per group)

Sleep parameters	MgT				Placebo				Condition	Time	Interaction
	Baseline	Day 7	Day 14	Day 21	Baseline	Day 7	Day 14	Day 21	P value	P value	(Condition x Time) P value*
REM Sleep Score	84.65 (17.37)	87.43 (14.77)	86.42 (15.26)	84.82 (16.84)	88.31 (13.88)	85.96 (15.15)	84.55 (17.87)	85.61 (16.52)	< 0.001	0.190	0.020
Deep Sleep Score	93.84 (8.33)	92.65 (10.31)	93.58 (8.63)	94.2 (8.54)	93.58 (9.18)	94.05 (8.51)	88.03 (12.73)	90.7 (12.99)	< 0.001	< 0.001	< 0.001
Latency Sleep Score	78.92 (10.83)	79.65 (10.86)	81.46 (10.98)	79.6 (10.31)	80.18 (10.11)	80.81 (10.62)	79.73 (10.37)	80.49 (10.36)	< 0.001	0.540	0.100
Overall Sleep Score	82.33 (7.25)	83.4 (7.3)	82.62 (7.05)	82.44 (7.68)	84.6 (6.07)	84.19 (6.94)	82.96 (7.18)	83.13 (7.64)	< 0.001	0.070	0.130
Sleep Efficiency Score	89.41 (9.85)	90.04 (9.61)	89.07 (9.9)	86.2 (15.15)	92.14 (6.99)	91.07 (8.63)	90.54 (8.19)	89.4 (9.69)	< 0.001	< 0.001	0.210
Total Sleep Score	80.74 (12.43)	81.9 (12.83)	80.72 (12.58)	81.16 (12.76)	84.26 (12.87)	83.5 (12.59)	82.58 (13.12)	83.64 (13.6)	< 0.001	0.310	0.420
Activity and readiness parameters											
Activity Score	88.53 (8.38)	85.19 (11.34)	85.84 (10.58)	87.82 (9.02)	86.17 (11.16)	78.61 (16.18)	80.83 (15.67)	80.87 (16.77)	< 0.001	< 0.001	0.010
Activity Met Daily Movement Goals	81.33 (13.94)	81.90 (13.6)	81.89 (13.34)	81.97 (13.49)	84.69 (12.94)	84.74 (12.38)	84.44 (13.1)	84.93 (12.52)	< 0.001	0.880	0.810
Activity Daily Movement Score	79.72 (20.26)	79.59 (22.31)	80.71 (24.55)	79.81 (22.93)	76.52 (25.47)	65.62 (38.85)	64.74 (38.45)	64.6 (39.62)	< 0.001	0.010	< 0.001
Readiness Score	79.75 (7.56)	82.05 (6.36)	80.01 (6.41)	80.16 (7.24)	82.21 (6.69)	81.52 (6.97)	80.73 (6.27)	79.95 (7.02)	< 0.001	< 0.001	0.010
Readiness Activity Balance	82.69 (7.25)	81.84 (9.91)	82.85 (8.77)	84.75 (7.17)	83.69 (13.19)	85.39 (7.73)	85.54 (8.11)	84.9 (8.97)	< 0.001	0.007	0.003
Readiness Sleep Balance	78.53 (9.51)	81.97 (9.85)	80.17 (11.06)	78.25 (12.2)	83.24 (7.52)	80.85 (11.06)	81.09 (10.07)	82.74 (11.46)	< 0.001	0.710	< 0.001

* p < 0.05 indicates significance between groups

Results: Magtein[®] intake reduced grouchiness, led to improved mood and mental alertness.

Table 2: Restorative Sleep Questionnaire (RSQ) results (mean and standard deviation, N=38)

Sleep parameters	MgT				Placebo				Condition	Time	Interaction (Condition x Time)
	Baseline	Day 7	Day 14	Day 21	Baseline	Day 7	Day 14	Day 21	P value	P value	P value*
RSQ Total Score	24.16 (3.18)	25.16 (2.82)	26.13 (3.18)	25.68 (3.57)	22.23 (2.67)	23.41 (3.51)	23.25 (3.34)	23.45 (3.52)	<0.001	<0.010	0.134
RSQ Grouchy (R)	2.92 (0.59)	2.78 (0.62)	2.53 (0.72)	2.4 (0.85)	3.02 (0.72)	2.88 (0.65)	2.83 (0.75)	2.88 (0.76)	<0.001	<0.010	0.044
RSQ In a good mood	3.08 (0.59)	3.22 (0.62)	3.47 (0.72)	3.60 (0.85)	2.98 (0.72)	3.12 (0.65)	3.17 (0.75)	3.12 (0.76)	<0.001	<0.010	0.044
RSQ Mentally alert	2.87 (0.65)	3.11 (0.65)	3.45 (0.71)	3.58 (0.71)	2.64 (0.7)	2.97 (0.75)	2.79 (0.81)	3 (0.77)	<0.001	<0.010	0.003
RSQ Sleepy (R)	2.76 (0.79)	3.65 (0.94)	3.66 (0.87)	3.8 (0.86)	3.10 (0.95)	3.57 (0.86)	3.55 (0.89)	3.68 (0.90)	<0.001	<0.010	0.085
RSQ Tired (R)	2.49 (0.47)	3.10 (0.65)	3.36 (0.84)	3.49 (0.85)	2.62 (0.94)	3.24 (0.82)	3.19 (0.76)	3.41 (0.91)	<0.001	<0.010	0.238
RSQ Rested	2.11 (0.73)	2.71 (0.93)	2.95 (1.09)	3.02 (1.03)	1.99 (0.72)	2.46 (0.92)	2.47 (0.95)	2.5 (0.86)	<0.001	<0.010	0.144
RSQ Refreshed and restored	2.06 (0.77)	2.74 (0.92)	2.78 (0.96)	2.75 (0.82)	1.79 (0.78)	2.36 (0.94)	2.31 (0.84)	2.47 (0.95)	<0.001	<0.010	0.702
RSQ Ready to start the day	2.61 (0.89)	3.05 (1.14)	3.39 (0.78)	3.3 (0.95)	2.27 (0.89)	2.63 (1.05)	2.66 (0.99)	2.68 (0.99)	<0.001	<0.010	0.267
RSQ Energetic	2.58 (0.83)	3.04 (0.52)	3.14 (0.62)	3.18 (0.8)	2.04 (0.76)	2.39 (1.05)	2.43 (0.97)	2.5 (1.08)	<0.001	<0.010	0.829

(R): reverse scoring (lower number indicates improvement)

* p <0.05 indicates significance between groups

Results: Magtein® intake reduced grouchiness, led to improved mood and mental alertness.

Restorative Sleep Questionnaire

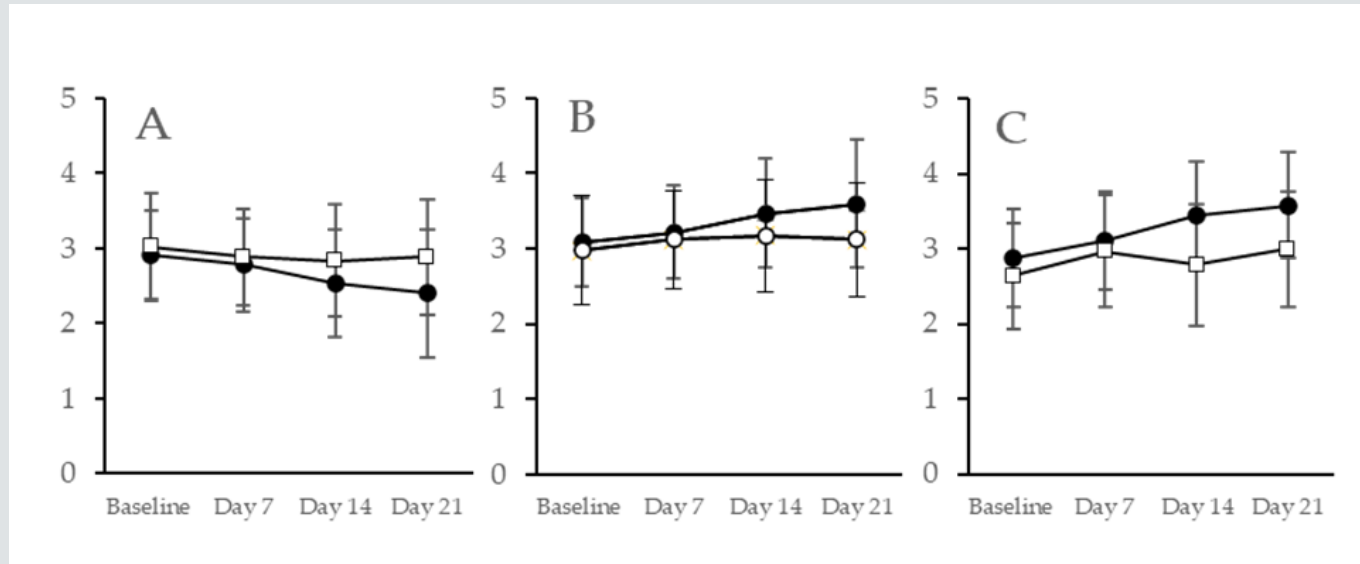


Figure 2. Magtein® (black) showed significant ($p < 0.05$) improvements over placebo (white) for

- (A) Grouchy
- (B) Good Mood
- (C) Mental Alertness

Data shown are mean \pm standard deviation.

Conclusions

This double-blind, placebo-controlled study demonstrated significantly improved benefits of Magtein[®] versus Placebo:

- Improved sleep quality, especially deep/REM sleep stages,
- Improved mood, reduced grouchiness,
- Improved energy, alertness and daily activity and productivity.
- Magtein[®] was safe and well tolerated.

These are consistent with how MgT works in neuron cells and in animal models, suggesting broader positive impacts on overall brain health.



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