

Gadot Biochemical Industries



Marketing Information

Fortification with Tri Magnesium Citrate

The Importance of Magnesium

Magnesium plays an essential role in a range of biochemical and physiological processes.

The human body contains about 25 grams of Magnesium from which 50-60% is in the skeleton and 25-30% in muscle.

One third of skeletal magnesium is exchangeable and it is this fraction that may serve as a reservoir for maintaining a normal extracellular magnesium concentration.

- It is required for both anaerobic and aerobic energy generation.
- ATP and ADP complexes of magnesium participates as the substrate for the phosphate transfer reaction.
- Magnesium is essential for protein synthesis in replicating cells.
- Principal mineral of bones.
- Is required as cofactor for over 300 enzyme systems.
- Magnesium deficiency has been linked to :
 - Several cardiovascular diseases including high blood pressure.
 - Abnormalities in neuromuscular and gastrointestinal symptoms.
 - Migraine
 - Coronary heart vessel spasms
 - Fatigue and sleep disorder.
 - Malabsorption syndromes.
 - Genetic disorders
 - Endocrine disorders

Optimal Magnesium intake

Optimal Magnesium intake refers to the levels of consumption that are necessary for an individual to:-

- Minimize stress.
- Minimize neuromuscular abnormalities.
- Minimize sleep disorders and fatigue
- Maintain bone mass,

The Magnesium **R**ecommended **D**ietary **A**llowances (RDA) is shown in the following table:

Age	RDA mg/day
Less than 6 months	30
6-12 months	75
1-3 years	65
4-8 years	110
9-13 years	200
14-18 years	300
19-24	265
Men 25-50 years	300-350
Women 25-50 years	270-280
Above 50 years	350
Women Pregnancy or breast feeding	330-350

The Magnesium Sources

There are different sources of Magnesium in various forms so how to choose the proper one?

Properties to be considered:

- Bioavailability
- Magnesium content
- Solubility
- Organoleptical characteristics
- Interaction with other ingredients

Commonly used Magnesium sources:

Organic Magnesium	Inorganic Magnesium
Magnesium Citrate	Magnesium Carbonate
Magnesium Lactate	Magnesium Oxide/Hydroxide
Magnesium Gluconate	Magnesium Phosphate
Magnesium Aspartate	

So, which is preferable? Organic Magnesium or Inorganic Magnesium?

Magnesium Bioavailability

It is generally agreed that the bioavailability of Organic salts is much higher than the bioavailability of Inorganic salts. From the literature it appears that the bioavailability of Organic Magnesium is higher than that of Inorganic Magnesium.

Magnesium absorption measured as the increase in urinary Magnesium following intake of Magnesium oxide or magnesium citrate demonstrated a significantly higher absorption from citrate in normal volunteers.

Ref: "Magnesium bioavailability from magnesium citrate and magnesium oxide"

Lindberg, J.S., Zobitz, M.M., Poindexter, J.R., Pak, C.Y.C.

Journal of the American College of Nutrition, 1990; 9; 48-55

The same study also states:

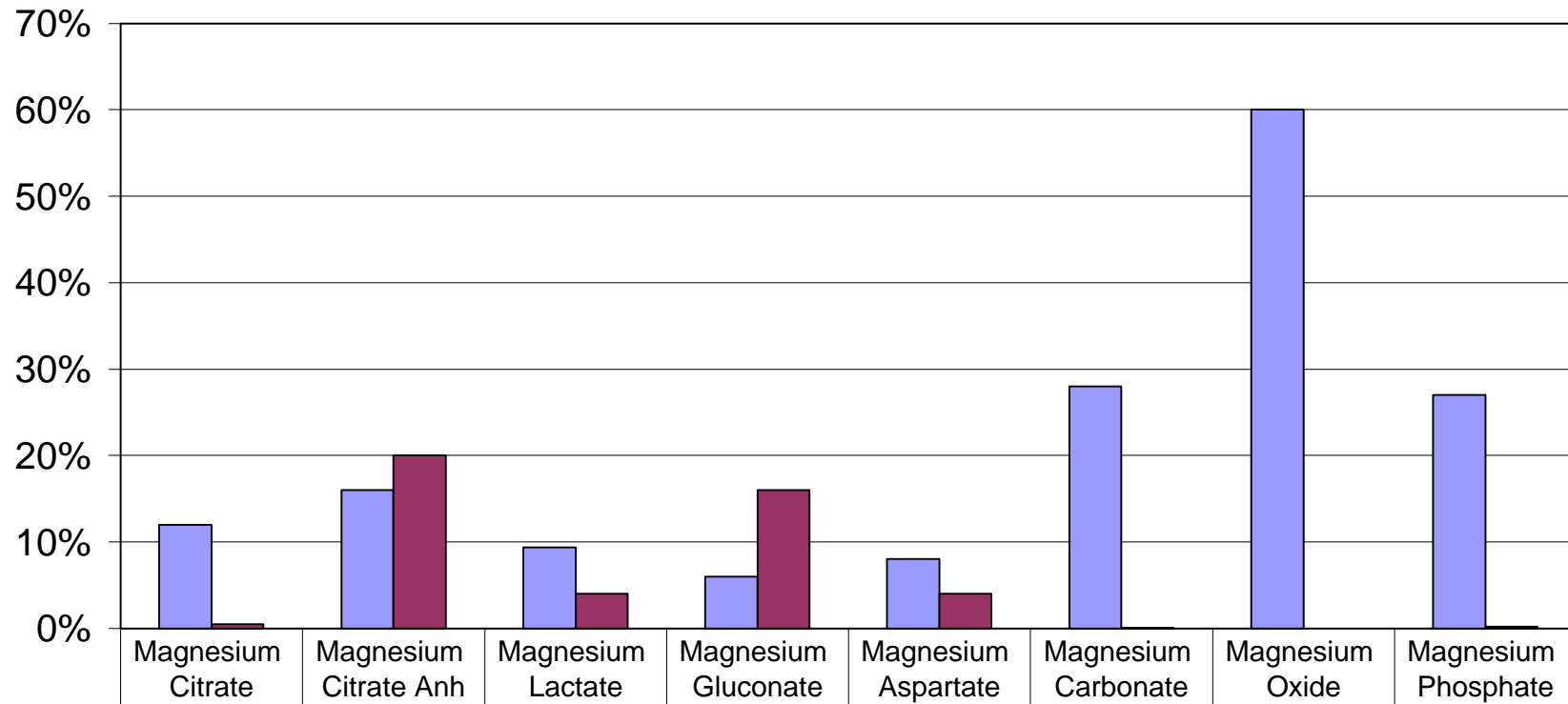
In vitro solubility showed that Magnesium oxide was only 43% soluble in simulated peak gastric acid secretion, while magnesium citrate was 86% soluble under these conditions.

On the other hand, the various organic Magnesium shows more or less the same bioavailability with slight advantage to Magnesium Citrate.

Magnesium Content and Solubility

Organic Magnesium	Magnesium	Solubility
Magnesium Citrate	12%	0.5%
Magnesium Citrate Anh.	16%	20%
Magnesium Lactate	9.4%	4%
Magnesium Gluconate	6%	16%
Magnesium Aspartate	8%	4%
Inorganic Magnesium		
Magnesium Carbonate	25.5%	0.04%
Magnesium Oxide	60%	0.0006%
Magnesium Phosphate	27%	0.2%

Magnesium content and Solubility Organic vs Inorganic sources



■ Mg-content	12%	16%	9%	6%	8%	28%	60%	27%
■ Solubility	0.5%	20.0%	4.0%	16.0%	4.0%	0.040%	0.0006%	0.200%

Mouth-feel & Taste of the various Magnesium sources

Organic Magnesium

Magnesium Citrate	Neutral
Magnesium Lactate	Bitter
Magnesium Gluconate	Bland
Magnesium Aspartate	Bitter

Inorganic Magnesium

Magnesium Carbonate	Sandy
Magnesium Oxide/Hydroxide	Sandy, Soapy
Magnesium Phosphate	Sandy

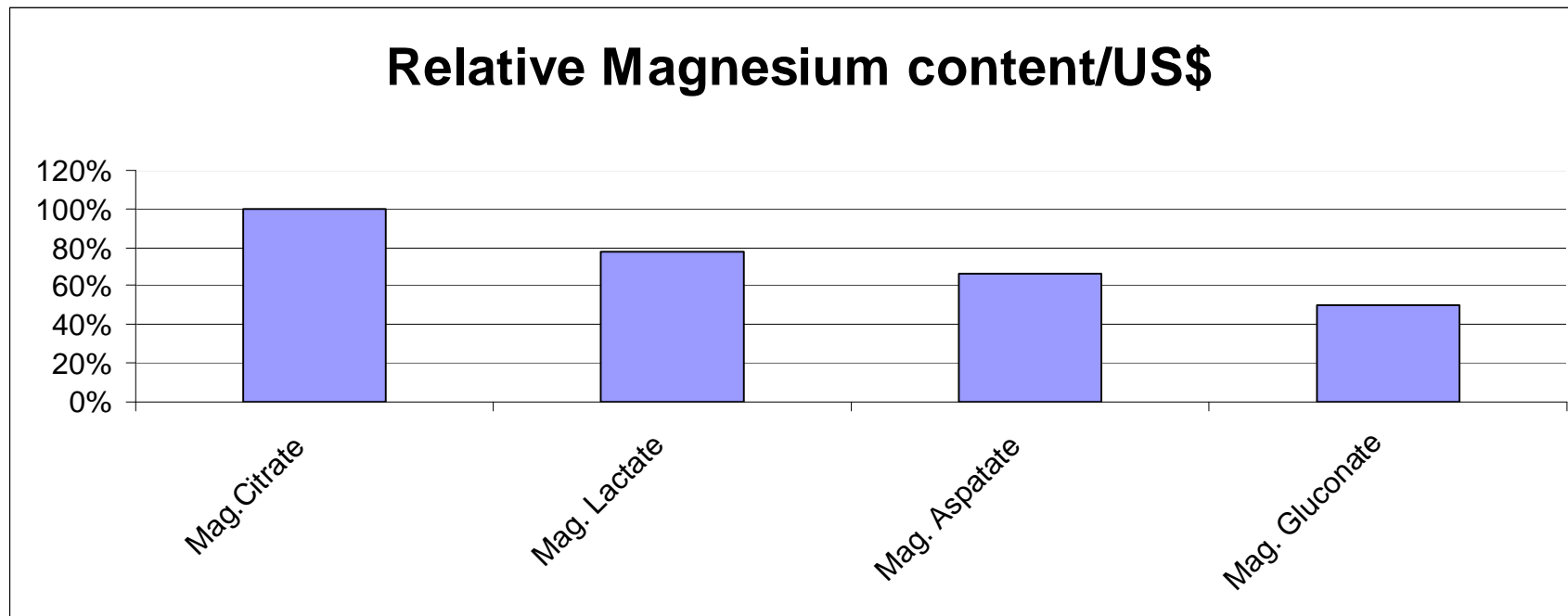
Conclusion: Organic Magnesium sources have a better bioavailability, solubility and organoleptical characteristics.

Which organic Magnesium is preferable?

Costs

For the same amount of money one will get 100% amount of Magnesium as Citrate or 50% of that amount of Magnesium as Gluconate or only 66% of that amount Magnesium as Aspartate.

Magnesium Citrate is by far a more cost effective source than any other Organic Magnesium source.



Solubility

Is the solubility, consist of a barrier for the use of Magnesium Citrate?

The solubility of Magnesium Citrate enables to introduce approx. 500 mg into 100ml of water which represents 120-165% of the RDI.

With this solubility a magnesium content level of 25-35% of the RDI is easily achieved.

Such level of RDI can be considered optimal.

In certain application (such as fortification of milk or soy beverages) the low solubility of Magnesium citrate is considered a major advantages

CONCLUSION: TRI MAGNESIUM CITRATE IN ITS HYDRATED FORM WILL BE THE MOST SUITABLE AND MOST COST EFFECTIVE AMONG ORGANIC MAGNESIUM SOURCES.

Other Benefits of Magnesium Citrate

Magnesium Citrate and stress

Magnesium plays a role in the response to stress. Both physiological and psychological kinds of stress stimulate the hormone adrenaline which increase urinary excretion of magnesium. Magnesium deficiency stimulates stress hormones, aggravates the stress response and results in depression and irritability.

Magnesium Citrate and Other Nutrients

Magnesium Citrate can be used in combination with other nutrients.

It was found (in practice) that magnesium citrate has good compatibility with:

Calcium
Vitamin D
Zinc
Iron
Protein

Benefits of Magnesium Citrate - Summary

- High bioavailability.
- High Magnesium content: Cost effective Magnesium source.
- Neutral flavor.
- Magnesium absorption is independent of gastric acid secretion. It does not cause stomach upset and can be taken on an empty stomach or with a meal.
- Low interference with other minerals.
- Good compatibility with other nutrients.