

Supplements in Bone and Joint Health

Alireza Hayatshahi, PharmD, BCPS
American Board Certified Pharmacotherapy Specialist
Faculty of Pharmacotherapy, TUMS

Calcium Supplements

- Most abundant mineral in the body
- 1% to 2% of the body weight
- 99% stored in bones
- The majority of adult bone mass forms by age **18** in girls and **20** in boys
- Needs with different ages
 - **9-18 yo 1300 mg**
 - **19-50 yo 1000 mg**
 - **51+ yo 1200 mg**
(elemental calcium)

Calcium Supplements

- Foods rich in oxalic acid interfere with calcium absorption
 - **Spinach**
 - **Beans**
- Need to consume variety of calcium rich foods throughout the day
- Most efficient absorption when take 500 mg elemental calcium
- Divide higher doses in 2 to 3 times/day
- Most individuals can easily get at least half of the calcium they need from food

Calcium Supplements

- Different salts of calcium
 - Calcium carbonate (Highest amount of elemental calcium)
 - Calcium phosphate
 - Calcium lactate
 - Calcium citrate
 - Calcium gluconate (lowest amount of elemental calcium)
- Older patients with lower gastric acidity or patients on antacids, PPIs or H₂ blockers have better absorption of **citrate** salt

Calcium Supplements

- Drug-drug interactions
 - Co-trimoxazole
 - Fluoroquinolones
 - Cipro
 - Moxi
 - Levo
 - Tetracycline family
 - Levothyroxine
 - Digoxin
 - Phenytoin
 - Iron

Calcium Supplements

- May cause
 - Gas
 - Bloating
 - Constipation
- Spread out the supplemental doses reduces these adverse effects
- Drink plenty of water and other liquids
- Some Ca supplements also contain Boron since some small studies showed cartilage repairing effects of this element

Vitamin D Supplements

- Two forms
 - Ergocalciferol (fungal and plant source) D₂
 - Cholecalciferol (made in the skin) D₃
- 1st conversion occurs in liver to calcidiol
- 2nd conversion occurs in kidney to calcitriol
 - 1,25 dihydroxy Vitamin D
 - 24,25 dihydroxy Vitamin D
- Vitamin D stores decreases with
 - Age
 - Winter season
 - Liver insufficiency
 - Renal insufficiency
 - Malabsorption

- No salt or yeast
- No artificial colours
- Osteocare® is not tested on animals

FOR BONE
HEALTH

Nutritional Information	Av. per 2 x 5ml	% RDA*
Calcium	300 mg	38
Magnesium	150 mg	50
Zinc	6 mg	40
Vitamin D (150 IU)	3.8 µg	76

*RDA - Recommended Daily Allowance
µg - microgram, mg - milligram, IU - International Units

روش و مقدار مصرف : برای کودکان ۲-۱ سال روزی ۲ بار
هر بار ۱ قاشق مربا خوری
برای کودکان ۱۲ - ۳ سال روزی ۳ - ۲ بار هر بار ۱ قاشق مربا خوری
برای بزرگسالان : روزی ۲ بار هر بار ۲ قاشق مربا خوری
در بارداری و شیر دهی روزی دو بار هر بار ۲ قاشق مربا خوری
احتیاط : بیش از مقدار تجویز مصرف نشود .
نام وارد کننده : **شرکت بهار قند گستر**
شماره ثبت : ۱۲۲۷۷۰۰۰۰۰۰۰۰
شرایط نگهداری : دور از نور مستقیم آفتاب و خشک و دور از دسترس اطفال نگهداری شود .

Vitamin D Supplements

- Measuring serum levels
 - 25-hydroxyvitamin D (25OHD)
 - 30-40 ng/ml (70-99 nmol/l)
- Vitamin D insufficiency
 - 25OHD 20-30 ng/ml (50-75 nmol/l)
- Vitamin D deficiency
 - 25OHD less than 20 ng/ml (50 nmol/l)
- Patients with Vitamin D insufficiency
 - Relative hypocalcaemia
 - High serum PTH

Vitamin D Supplements

- Vitamin D insufficiency
 - Reduced intestinal absorption of calcium
 - Increased PTH levels
 - Increased bone resorption

Vitamin D Supplements

- Each 40 units of Vitamin D elevates the 25OHD levels by about 0.4 ng/ml (1 nmol/l)
- Cumulative dose
 - 1500 units/day
 - 10500 units/week
 - 45000 units/month
- Result the same rise in 25OHD levels after the same period of consumption

Vitamin D Supplements

- Initial treatment in vitamin D deficiency
 - 50,000 IU D2 or D3 weekly for 1-2 months
 - Then 800 to 1000 IU daily
 - Another option: 300,000 IU twice yearly
- In malabsorptive states
 - 10,000 to 50,000 IU daily may be necessary
- 25OHD to be monitored 3 months after the initiation of supplement intake

Vitamin D

- Patients with hepatic insufficiency
 - Calcidiol
- Patients with renal insufficiency
 - Calcitriol
- For most adults, 800- 1000 IU per day of D2 or D3
- Major signs of overdose:
 - Hypercalcaemia
 - Hypercalciuria
 - 25OHD above 88 ng/ml (220 nmol/l)

Vitamin D Supplements

- Each microgram of D₂ or D₃ is equivalent to 40 IU
- In healthy adults, overt intake of 1250 mcg/day (50,000 IU/day) may produce toxicity after several months
- There is a 12 to 24 hours time lag between vitamin D intake and onset of action due to the time needed for hepatic and renal metabolism to its most active form

Magnesium Supplements

- Approximately 50% of body Mg is found in bones.
- **Mitogenic effects on osteoblasts.**
- Mg depletion causes cellular growth inhibition.
- Ca maintain bone strength while Mg maintain its **elasticity** and prevention of injury
- Mg as a co-factor is involved in **Vit D synthesis** and **calcium metabolism**
- RDA for Mg
 - **Adult male : 420 mg/day**
 - **Adult female: 320 mg/day**
- Approximately 1/3 to 1/2 of Mg intake will be absorbed into the body.

Magnesium Supplements

- Certain medications results in low Mg levels
 - Lasix, Bumex
 - Hydrochlorothiazide
 - Cisplatin
 - Gentamicin
 - Amphotericin
- Mg supplements may be required in alcoholics

Magnesium Supplements

- Different salts of Mg in oral supplements:
 - Mg oxide (60%)
 - Mg carbonate (45%)
 - Mg hydroxide (42%)
 - Mg citrate (16%)
 - Mg lactate (12%)
 - Mg chloride (12%)
 - Mg sulfate (10%)



Content of elemental Mg

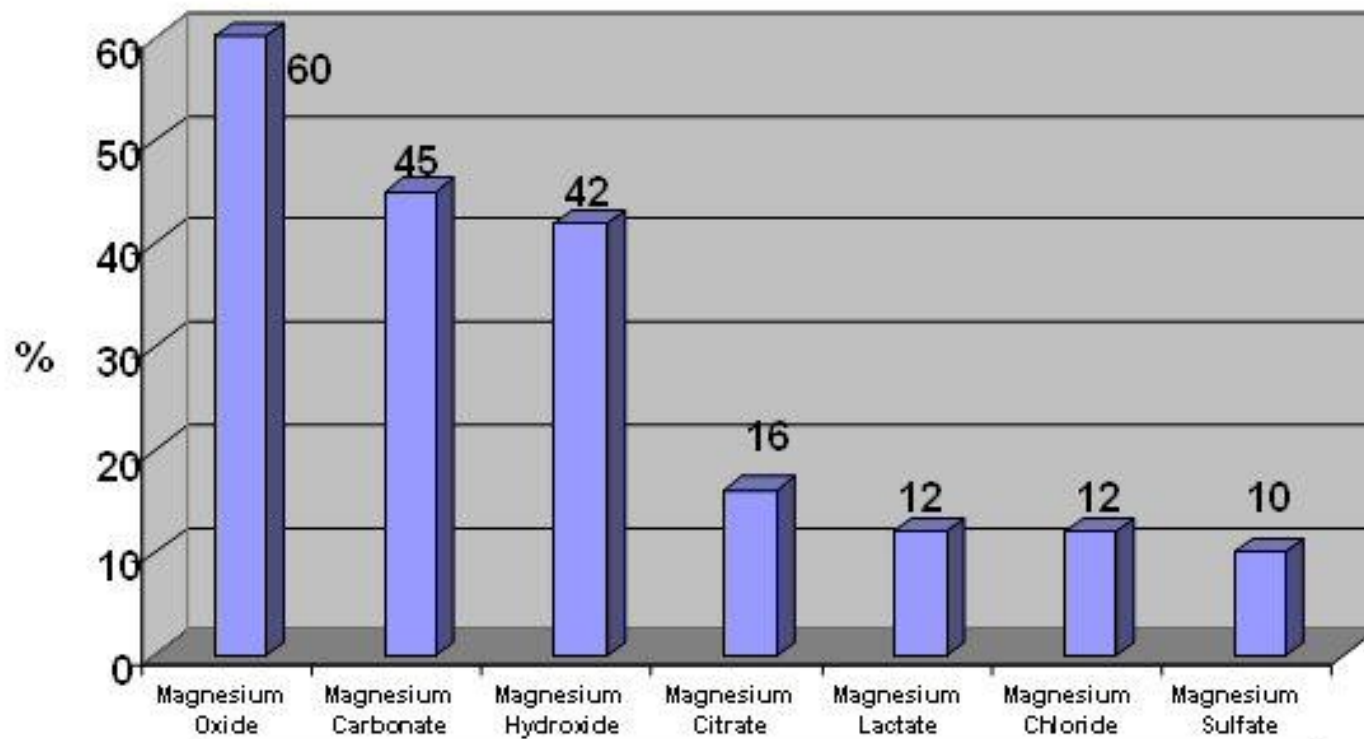


Figure 1: ■ Percent Magnesium content of oral supplements

Magnesium Supplements

- Elemental Mg
 - Mg oxide has the highest amount of elemental Mg
- Bioavailability
 - Bioavailability of Mg oxide is lower than Mg chloride and Mg lactate
- Major adverse effect
 - Diarrhea

Nutritional Information
Nährstoffangaben

	Avg. 2 x 5 ml	% of U.S. RDA
Calcium	500 mg	50
Magnesium	150 mg	38
Zinc	4 mg	27
Vitamin D	400 IU	100

RDA = Recommended Daily Allowance

IU = International Units mg = Milligram

محلول خوراکی کلسیجر (مکمل غذایی - ۲۰۰ میلی لیتر)

**Nutritional Information/
Nährstoffangaben**

	Av. per 2 tablets	% of U.S. RDA
Calcium	800 mg	80
Magnesium	200 mg	50
Zinc	8 mg	53
Vitamin D3	400 IU	100

RDA = Recommended Daily Allowance
IU = International Units mg = Milligram

**Inactive Ingre
Zusätzliche Inha**

Starch, Microcrys
Cellulose, Dibasic
Phosphate, Polyv
Pyrrolidone, Mag
Stearate, Purified
Sodium Starch G
(Type A), Tabcoat

Calcicare

قرص کلسیکر - ۳۰ عددی

(کلسیم + منیزیم + زینک + ویتامین D3)

Ingredients

Nutrition Facts Yes Serving Size : 1 Tablet

Amount Per Serving % Daily value* Vitamin D 200.0I.U.

Calcium 333.0mg Magnesium 133.0mg Zinc 5.0mg



کلسیم بنی
 مکمل رژیم
 ۱۹۹ IRC
 وزارت بهداشت
 روزانه
 احتیاط
 با مشورت
 این فرآورده جهت
 و یا پیشگیری از
 در جای خشک و خنک
 دسترس کودکان
 نگهداری

also aid in nerve, muscle and metabolic functions. Zinc
 processes. Vitamin D improves calcium absorption.
No Artificial Flavors • No Preservatives • No Yeast or
SUGGESTED USE: Take one tablet up to three times daily
 Store in a cool, dry place, out of reach of children.

Supplement Facts	
Serving Size 1 tablet	
Amount Per Tablet	% Daily Value
Vitamin D 200 I.U.	50%
Calcium 333 mg	33%
Magnesium 133 mg	33%
Zinc 5 mg	33%

Do not use if
 or missing
 INGREDIENTS
 Oxide, Meta
 Hydroxypro
 Silicon Diox
 (artificial color
 Glycol, Tri
 Starch, Vita

Distributed by: **Nature Made Nutritional Products**
 Mission Hills, CA 91346-9606, U.S.A.
 1-800-276-2878 • www.NatureMade.com
 Vitamin D Tablets

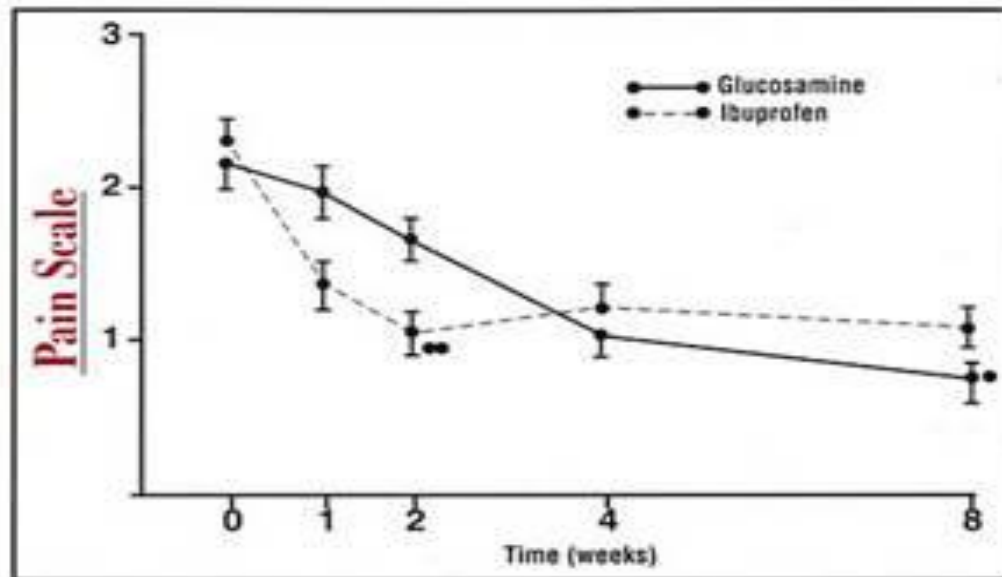
Glucosamine Supplements

- Endogenous precursor for the aminoglycans found in synovial fluid and ligaments
- Exogenous glucosamine is derived from marine exoskeletons
- Anti-inflammatory effects
- Glucosamine sulfate is preferred over glucosamine HCL

Glucosamine Supplements

- In trials comparing glucosamine sulfate with either acetaminophen or NSAIDs in reduction of osteoarthritis symptoms and pain, glucosamine had effective reduction in pain with fewer side effects compared to NSAIDs.
- Results from glucosamine HCL with or without chondroitin is conflicting.
- It is recommended to use glucosamine sulfate to reduce osteoarthritis symptoms and possibly slowing disease progression.

Changes in pain score during the trial period.



Supplement Facts

Serving Size 2 Tablets

Servings per Container 45

Amount Per Serving	% Daily Value
--------------------	---------------

Glucosamine Hydrochloride	1000 mg. †
---------------------------	------------

Methylsulfonylmethane (MSM)	1000 mg. †
-----------------------------	------------

† Daily Value not established

As a
take
preferably

MENTS:

Acid
Gum,
Searate

are
to become pregnant, breast feeding, taking
medication

Glucosamine Supplements

- Regarding concerns of having shellfish allergy
 - Most allergic people have reactions to the meat of shellfish not the exoskeleton
 - No report of reactions in persons with shellfish allergy who takes glucosamine
- No significant increase in A1C in patients with type 2 DM based on clinical studies
- Dose
 - 1500 mg PO once daily
 - 500 mg PO three times a day (less GI intolerance)

Chondroitin

- Endogenous glycosaminoglycan
- Often derived from bovine cartilage
- Inconsistent results from clinical studies
- Symptomatic benefit of chondroitin is minimal
- Routine use of this agent in practice is generally discouraged
- Dose
 - 200 mg to 400 mg PO two or three times a day
- Combination of glucosamine-chondroitin NO better than glucosamine alone

MethylSulfonylMethane (MSM)

- Clinical trials showed modest reduction in pain and swelling but no reduction in joint stiffness
- No significant adverse effect reported
- Overall not strongly recommended due to insufficient evidence
- Dose
 - 1500 mg to 3000 mg daily in divided doses
 - Usually in combination with glucosamine and chondroitin

S-adenosylmethionine (SAME)

- Clinical trials showed reduction in arthritis pain
 - Increases chondrocytes
 - Decreases inflammatory cytokines
- Potential interactions with serotonergic drugs
- There is a time lag of 6-8 weeks before seeing the results
- Increases serotonin, norepinephrine and dopamine levels
- Expensive
- Dose
 - 200 mg PO three times a day

