



Calcium and calcium with Vitamin D supplementation protocol

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Approval Process

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Acronyms:

RDA	Recommended Daily Amount
EOD	Once Daily
TID	Three Times Daily
BID	Two Times Daily
IU	International Units



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1. Introduction

Calcium and Vitamin D are important nutrients needed to build and maintain strong bones and teeth throughout life. Heart, muscles and nerves also require calcium to function properly, as well as support muscle contraction, support of multiple stages in blood clotting, and as part of co-enzyme function and hormone release.

Some studies have also suggested that calcium and vitamin D may have benefits beyond bone health such as protection against cancer, diabetes and high blood pressure, but this evidence is not definitive.

Calcium is an important structural component for healthy bones and teeth, which serve as storage for calcium and will release calcium to help maintain blood calcium levels within a tightly regulated range. Signals within the body will act on bones, the intestines and kidneys to raise blood calcium levels when blood levels are low and are turned off automatically once the body senses it has enough.

Calcium requirements are highest during puberty, pregnancy and breastfeeding, followed by the elderly with particular emphasis on post-menopausal women.

Best sources of calcium with high bioavailability include dairy products and bony fish. Less absorbable calcium is also found in some green leafy vegetables, broccoli, soya, tofu, and fortified breakfast cereals. Age, vitamin D intake, and indirect consumption of oxalic acid (in certain vegetables and beans) and phytic acid (in wholegrains) can reduce calcium absorption.

2. Scope

This protocol is applicable to all of the physicians/specialists/consultants involved in prescribing calcium and vitamin D as per the cases required and per the dose deemed effective and safe

3. Purpose

The purpose of this protocol is to identify diseases that may benefit from supplementation of calcium and calcium with vitamin D (including the dosing), based on the evidence provided from medical research, randomized trials and systematic review, as well as clinical experience



that was discussed with the task force of consultants/specialists from different Ministry of Health hospitals.

4. Definitions

- 4.1 Calcium:** A mineral found mainly in the hard part of bones, where it is stored. **Calcium** is added to bone by cells called osteoblasts and removed from bone by cells called osteoclasts. **Calcium** is essential for healthy bones and is also important for muscle contraction, heart action, and normal blood clotting.
- 4.2 Vitamin D:** A steroid vitamin which promotes the intestinal absorption and metabolism of calcium and phosphorus. Under normal conditions of sunlight exposure, no dietary supplementation is necessary because sunlight promotes adequate vitamin D synthesis in the skin.
- 4.3 25.hydroxycholecalciferol:** A sterol $C_{27}H_{44}O_2$ that is a metabolite of cholecalciferol formed in the liver, is the circulating form of vitamin D, and has some activity in maintaining calcium homeostasis and preventing rickets.
- 4.4 Hypoparathyroidism:** Under function of the parathyroid glands with deficient production of the hormone parathormone which leads to low blood calcium (hypocalcemia).
- 4.5 Hyperparathyroidism:** Excessive parathyroid hormone resulting in abnormally high levels of calcium in the blood (hypercalcemia). This can cause bone resorption and osteoporosis, calcium deposits in the kidneys, muscular weakness, nausea, vomiting, abdominal pains, and drowsiness.
- 4.6 Familial hypophosphatemia:** A term that describes a group of rare inherited disorders characterized by impaired kidney conservation of phosphate and in some cases, altered vitamin D metabolism.
- 4.7 Osteomalacia:** Softening of bone, particularly in the sense of bone weakened by demineralization (the loss of mineral) and most notably by the depletion of calcium from bone.
- 4.8 Psoriasis:** A chronic, recurrent inflammatory skin disorder. The most common type, called plaque psoriasis (psoriasis vulgaris), is characterized by slightly elevated reddish patches or papules (solid elevations) covered with silvery white scales.



- 4.9** Osteodystrophy: Defective ossification of bone usually associated with disturbed calcium and phosphorus metabolism
- 4.10** Fanconi Syndrome: Fanconi syndrome is a rare disorder of kidney tubule function that results in excess amounts of glucose, bicarbonate, phosphates (phosphorus salts), uric acid, potassium, and certain amino acids being excreted in the urine.
- 4.11** Rickets: a deficiency disease that affects the young during the period of skeletal growth, is characterized especially by soft and deformed bones, and is caused by failure to assimilate and use calcium and phosphorus normally due to inadequate sunlight or vitamin D

5. Food Sources of Calcium and Vitamin D

Food sources that are rich in calcium and vitamin D include the following:

- 5.1 Calcium-rich foods and drinks** include dairy products such as milk, yogurt, cheese, cottage cheese and ice cream. Other foods with lots of calcium include broccoli, kale, collard greens, certain nuts and certain breads as well as calcium-fortified foods like calcium-enriched orange juice, cereals and soy products. Calcium from dairy sources is easier for the body to absorb than calcium from vegetables.
- 5.2 Vitamin D rich foods and drinks** include salmon or mackerel, canned tuna fish, and egg yolks as well as vitamin D fortified foods like cereals, juice, milk and other dairy products.
- 5.3 For reference, 1 cup of milk contains approximately 300 mg of calcium and 100 units of vitamin D.**

For classifying vitamin D status, the status can be defined according to the level of serum/plasma 25-hydroxycholecalciferol (D3). The cut-offs that are followed for the classifications of vitamin D status in MOH Laboratories are those recommended by **Food and Nutrition Board (USA)** and by **The Association of Clinical Biochemistry (UK)**, which are as follows:



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Vitamin D status	Vitamin D level (25.hydroxyvit D) "nmol/L"	Vitamin D level (25.hydroxyvit D) "ng/ml"
Deficient	< 30	< 12
Insufficient	30 - 50	12 - 20
Sufficient	> 50	> 20
Toxic	> 375	> 150

Vit. D in SI unit (nmol/L) is followed in MOH Laboratories in Oman.

5.3.1 Vitamin D toxicity is usually caused by mega dose of vitamin D supplements – not by diet or sun exposure. It can lead to a buildup of calcium in the blood. This hypervitaminosis D when associated with hypercalcemia can lead to a poor appetite, nausea, vomiting, weakness, and frequent urination and kidney problems.

For estimating how much Calcium and Vitamin D is needed; the following table can be referred to for age-based need assessment:

Life Stage	Calcium Recommended daily amount (RDA)
Toddlers (1-3 years)	700 mg
Children (4-8 years)	1000 mg
Teens (9-18 years)	1300 mg
Adults (19-50 years)	1000 mg
Older Adults (51+ years)	1200 mg
Pregnant	1000 mg
Breast-feeding	1000 mg

Life Stage	Vitamin D Recommended daily amount (RDA)
Infants (Birth to 12 months)	400 International Units (IU)
Children (1-13 years)	600 IU
Teens (14-18 years)	600 IU
Adults& older adults (19-70 years)	600 IU



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Elderly Adults (71+ years)	800 IU
Pregnant	600 IU
Breastfeeding	400 IU

Physician and health providers may recommend or prescribe additional supplementation based on the clinical needs and/or blood levels.

6 Main indication for calcium and calcium with Vitamin D

	Indication	Dose	Adult/Ped.
1	Low calcium level due to Hypoparathyroidism	Calcium Carbonate/Citrate 1 gm TID (three times per day) + Calcitriol 0.25 mcg – 1 mcg BID (twice per day)	Adult
2	Low levels of phosphate in the blood due to an inherited disorder called familial hypophosphatemia	Calcium supplementation is not needed as this can lead to Hypercalciuria	Adult
3	Softening of the bones (osteomalacia)	Calcium 500 – 1000 mg/day (if dietary intake is less than 750 mg/day) If there is a lack of vitamin D: Vitamin D 800- 2000 IU/Day	Adult
4	Psoriasis (if patient on oral and high dose of corticosteroids)	35,000 IU per day Vitamin D Dietary calcium should be limited	Adult
5	A bone disorder called renal osteodystrophy, which occurs in people with kidney failure	1,25 OH Vit D3 0.25 mcg EOD (once per day) then adjust accordingly + Calcium Carbonate 500 mg per day (If no hypercalcemia) OR 0.43- 1 mcg /Day Calcium Carbonate (If no hypercalcemia)	Adult
6	Vitamin D deficiency	Oral ergocalciferol (vitamin D2) 50,000 IU per week for 6-12 weeks to be used as a replacement then maintenance dosages of cholecalciferol (vitamin D3) at 800 to 1,000 IU per day from dietary and	



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		supplemental sources OR dietary and lifestyle	
7	Malabsorption	Calcium: 1000 mg for adults up to age 50 years old 1200 mg for women above 50 and men above 70	Adult
8	Chronic inflammatory bowel disease	Calcium: 1000 mg for adults up to age 50 years old 1200 mg for women above 50 and men above 70	Adult
9	For Hypophosphatemia/Fanconi Syndrome	- 20-40 mcg/kg/day Calcitriol + Phosphate supplementation 20-40 mg/kg/day - No need for calcium supplementation in case of hypophosphatemia rickets	Pediatrics
10	Chronic cases of Hypocalcemia	- Oral calcium 100 mg per kg per day BID or TID (as an elemental calcium as calcium gluconate or if not available then calcium carbonate can be used. - Monitor calcium level after a week and if calcium level > 2.2 nmol/l, then calcium dose can be reduced gradually till reach 50 mg per kg per day. NB: Calcium continuation depends on the cause of hypocalcemia. - Vitamin D level should be measured and if it is LOW, then Vitamin D can be given after starting calcium or together with calcium. NB: Vitamin D supplement in case of deficiency (less than 30 nmol/l), 2000 IU daily for 6 weeks, then maintenance dose for 6 months. • In neonate and toddler; 400 IU daily. • In children > 10 year; 800 IU daily	Pediatrics



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11	For preventing osteoporosis/For preventing bone loss due to use of corticosteroids	Calcium 600 mg per day + Vitamin D3: 400 IU/Day 1 tablet BID (twice per day) 30 minutes pre meal OR 4 hours post meal	Adult
12	For heart failure	800 IU/day of vitamin D in a form known as cholecalciferol taken alone or along with 1000 mg/day calcium for 3 years	Adult
13	For Liver Failure	1,25 OH Vit D3 0.43-1 mcg/day + Calcium Carbonate 500 mg per day (If no hypercalcemia)	Adult
14	For bone loss caused by having too high parathyroid hormone (hyperparathyroidism)	- Calcium: 1000 mg	Adult
15	For women particularly pregnant and lactating women	Women should be assessed for their risk of vitamin D deficiency at their booking appointment. 'At risk' groups for vitamin D deficiency or insufficiency should be started on 1000 IU cholecalciferol daily. Women at moderate or high risk of vitamin D deficiency should be tested with their booking blood tests and should have their Vitamin D replaced according to the vitamin D level to ensure it is adequately replaced by the third trimester, if pregnant. (Refer to page for calcium and vitamin D Requirements) –	Adult
16	Nutritional Rickets in Healthy Children	Vitamin D3 (cholecalciferol) – 1000 IU daily orally – for 6 weeks OR 10000 IU weekly – for 6 weeks Followed by Maintenance Dose for 6 months Level of Vitamin D Should be Checked: Infant and Toddler 400 IU OD for 6 months Older Children over 10 years old – 800 IU for 6 months	Pediatrics



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		<p>Calcium is needed only in the first two weeks to prevent hungry bone syndrome</p> <p>Calcium as oral 50 mg per kilogram per day in divided doses</p>	
17	Hypoparathyroidism	<ul style="list-style-type: none"> - alfacacidol – 0.01 mcg /1 kg per day. - No need for calcium unless calcium dropped to less than 2 then low dose required for a short time - 50 mg/kg/day till calcium levels normalize then stop it 	Pediatrics
18	Chronic Liver Disease and Rickets	<ul style="list-style-type: none"> - prefer to use alfacalcidol 0.01 mcg per kg per day - <i>-No need for calcium supplementation</i> 	Pediatrics
19	In case of Chronic Renal Disease and Rickets	<ul style="list-style-type: none"> - prefer to use calcitriol (active form of vitamin D3) - a-age less than 1 year with a 25 (OH)D serum level of less than 75 nmol/l, to be provided with vitamin D of 600 IU/day - b-age more than 1 year with a 25 (OH)D serum level of less than 12 nmol/l, to be provided with vitamin D of 8000 IU/day - c-age more than 1 year with a 25 (OH)D serum level of between 12-50 nmol/l, to be provided with vitamin D of 4000 IU/day - d-age more than 1 year with a 25 (OH)D serum level of between 50-75 nmol/l, to be provided with vitamin D of 2000 IU/day 	Pediatrics



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20	In Chronic Malabsorption and Rickets	<ul style="list-style-type: none">- Parental (intramuscular) Vitamin D3 – Sotos therapy as one single dose.- If Calcium is needed then oral 50 - 100 mg per kilogram per day in divided doses	Pediatrics
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7 Responsibilities

- 7.1 Pediatrician is responsible for: Prescribing Calcium or Calcium/Vitamin D to infants or children who are suspected of a deficiency and as per the condition being treated, using evidence-based guidelines. Refer to dietician if supplementation is not required initially, and the patient is able to meet requirements through dietary sources.
- 7.2 Orthopedic Doctor is responsible for: Prescribing Calcium or Calcium/Vitamin D to patients with skeletal deformities (disorders of the bones, joints, muscles, ligaments, tendons, nerves and skin), who are suspected of a deficiency and as per the condition being treated, using evidence-based guidelines. Refer to dietician if supplementation is not required initially, and the patient is able to meet requirements through dietary sources.
- 7.3 Obstetrician/Gynecologist Doctor is responsible for: Prescribing Calcium or Calcium/Vitamin D to women of child-bearing age, pregnancy at all stages, and post-pregnancy or breastfeeding, who are suspected of a deficiency and as per the condition being treated, using evidence-based guidelines. Refer to dietician if supplementation is not required initially, and the patient is able to meet requirements through dietary sources.
- 7.4 Gastroenterologist is responsible for: Prescribing Calcium or Calcium/Vitamin D to patients afflicted with any gastrointestinal disorder such as inflammatory bowel disease, suspected of having a calcium or vitamin D Deficiency, using evidence-based guidelines. Refer to dietician if supplementation is not required initially, and the patient is able to meet requirements through dietary sources.
- 7.5 Endocrinologist is responsible for: Prescribing Calcium or Calcium/Vitamin D to patients afflicted with any endocrinological disorder, such as diabetes, suspected of



having a calcium or vitamin D Deficiency, using evidence-based guidelines. Refer to dietician if supplementation is not required initially, and the patient is able to meet requirements through dietary sources.

- 7.6** Nephrologist is responsible for: Prescribing Calcium or Calcium/Vitamin D to patients afflicted with any kidney related disorders that warrant supplementation as per evidence-based guidelines. Refer to dietician if supplementation is not required initially, and the patient is able to meet requirements through dietary sources.
- 7.7** Pharmacist is responsible for: Dispensing calcium or calcium/vitamin D supplements as per the physician's prescription, and cross check with age appropriate dose to avoid toxicity. Check for drug-drug interaction, drug-nutrient interaction, or drug-food interaction and advise accordingly
- 7.8** Dietician is responsible for: Advising patients on food sources rich in calcium and vitamin D, using reliable scientific references and advice on local sources of these nutrients and how they can be incorporated into a balanced diet.



8. Document History and Version Control

Document History and Version Control			
Version	Description of Amendment	Author	Review Date
01	Initial Release		April 2023
02			
03			
04			
05			
Written by		Reviewed by	Approved by
Dr Mariam Abdullah Al Waili Mr Shabib Said Al Kalbani		Calcium and calcium with Vitamin D supplementation guideline task force	Dr. Kadhim Sulaiman

9. Related Documents:

There are no related documents for this Protocol



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10. References:

Title of book/ journal/ articles/ Website	Author	Year of publication	Page
Sperling Paediatric endocrinology 5 th Edition, Guidelines for clinical paediatric endocrinology			
American Academy of Pediatrics			
https://www.webmd.com/vitamins/ai/ingredientmono-929/vitamin-d			
https://ods.od.nih.gov/factsheets/VitaminD-HealthProfessional			
https://www.webmd.com/diet/guide/vitamin-d-deficiency#2			
https://www.health.harvard.edu/staying-healthy/vitamin-d-and-your-health-breaking-old-rules-raising-new-hopes			
https://ods.od.nih.gov/factsheets/Calcium-Consumer/			
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Am Fam Physician. 2009;80(8):841-846. 2009 American Academy of Family Physicians			
Institute of Medicine (IOM)			