# DIETARY SUPPLEMENTATION IN CHILDREN AND ADOLESCENTS

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# INTRODUCTION

- Dietary supplements: **food products added to the normal diet constituting a source of nutritional substances, like vitamins and minerals, or substances with a physiological or nutritional effect, like amino acids, essential fatty acids, fiber or vegetable extracts in pre-dosed forms**

- Inadequate information may lead to the risk of attributing beneficial properties and overlooking the side effects of these supplements, leading to their over-use in the pediatric field

Martini L, et al. Journal of nutritional science. 2020;9.

# INTRODUCTION (CONT')

- Continuous research in this field is very important in order to **properly use these products in children**.
- The use of vitamin supplements **should be based on evidence-based medicine**, with the awareness that the **best source of vitamins is indeed a balanced diet, associated with a healthy lifestyle, particularly during growth**
- The **lack of guidelines in these fields** may lead pediatricians to an improper use of vitamins, both in terms of excessive use or inadequate use.
- This is due to the fact that vitamin supplementation is often intended as a therapy of support rather than an essential therapeutic tool able to modify disease prognosis.

Martini L, et al. Journal of nutritional science. 2020;9.

# INTRODUCTION (CONT')

- **Routine supplementation** is not necessary for healthy growing children who consume a varied diet as many processed foods that are commonly consumed (eg, ready-to-eat cereals, grain, and milk products) are fortified with additional nutrients.

- Foods that are fortified supply additional nutrients for which children may be at risk (eg, folate, other B vitamins, and calcium) and the **majority of children who consume fortified products meet the reference standards for nutrient intakes.**

- For children and adolescents **who cannot or will not consume adequate amounts of micronutrients** from any dietary sources, the use of supplements should be considered.

# CHILDREN WHO MAY BENEFIT FROM SUPPLEMENTATION

## Those at nutritional risk:

- **1.** With anorexia or an inadequate appetite or who have extremely selective diets;
- **2.** With chronic disease (eg, cystic fibrosis, inflammatory bowel disease, or hepatic disease);
- **3.** From food-deprived families or who suffer neglect or abuse;
- **4.** Who participate in a dietary/bariatric surgery program for managing obesity;
- **5.** Who consume a vegetarian diet without adequately consuming products with bioavailable minerals for bone deposition and maintenance;
- **6.** With growth faltering (failure to thrive);
- **7.** With developmental disabilities
- **8.** From families with limited resources.

- **Evaluation of dietary intake** should be included in any assessment of the need for supplementation.

- If parents wish to give their children supplements, a standard pediatric vitamin-mineral product containing nutrients in amounts no larger than the DRI (EAR or RDA) poses little risk.

- Levels higher than the DRI should be discouraged and counseling provided about the potential adverse effects, **especially of fat-soluble vitamins** and **synthetic folate.**

# VITAMINS AND/OR MINERALS SUPPLEMENTATION

# VITAMIN A DEFICIENCY

- Routine supplementation with vitamin A during early childhood ↓ visual complications of malnutrition and measles

- The role of supplementation in infectious diseases other than measles is less clear.

- In several studies and a Cochrane review, vitamin A supplementation made no difference in clinical symptoms in infections other than measles (pneumonia, respiratory syncytial virus infection, infectious diarrhea) and, in several instances, worsened clinical symptoms

# VITAMIN A DEFICIENCY

## Vitamin A Supplementation programs

**In 2018**, more than 80 countries were implementing **universal vitamin A supplementation programs (VASP)** specially targeted for **children aged 6–59 months** by semi-annual national campaigns

The two national population-based surveys conducted in 2001 and 2012 revealed the **increasing prevalence of vitamin A deficiency** (from 2.1 to 18.3%) in children aged 15 to 23 months in Iran

Supplementation is the most common policy for VA-deficient children in Iran. **It is free for children up to 6 months as they take vitamins A + D, then multivitamins**

Rajaeieh G, et al. BMC Public Health. 2021 Dec;21(1):1-2.

# CALCIUM SUPPLEMENTATION

- Numerous controlled trials have found an increase in the bone mineral content in children in this age group who have received calcium supplementation

- The available data suggest that if calcium intake is augmented only for relatively short periods (ie, 1 to 2 years), there may be minimal or no long-term benefits to establishing and maintaining maximum peak bone mass.

- Even longer-term increased intake of calcium may only lead to relatively small benefits in bone mass, although calcium supplementation may be more beneficial in some subgroups of children, such as those with early puberty or those of greater height.

- The implications of such findings for dietary guidance are unclear. In general, the available data emphasize the importance of a well-balanced diet in achieving adequate calcium intake and in establishing dietary patterns with a calcium intake at or near recommended levels throughout childhood and adolescence.

# CALCIUM SUPPLEMENTATION

- **Dietary sources of calcium, including fortified foods, are preferred to calcium supplementation** via pill or similar non dietary supplements
  - ✓ wide range of nutrients
  - ✓ establishment of good dietary habits
  - ✓ ↓ nutrient interactions
  - ✓ ↑ tolerance for minerals provided from food sources.

- If lactose-free diets are used for treatment of lactose intolerance, the diets should **include a good source of calcium and/or calcium supplementation to meet daily recommended intakes.**

# CALCIUM SUPPLEMENTATION

## Effects of calcium supplementation on bone density in healthy children: meta-analysis of randomised controlled trials

**Table 1** Characteristics of included studies

| Study | Supplement and Ca dose (mg/day) | Duration of supplement/ follow-up (years) | No* | Ethnicity/pubertal stage | Female (%) | Mean (range) age (years) | Baseline Ca† (mg/day) | Sites measured |
|---|---|---|---|---|---|---|---|---|
| Bonjour 1996 | Milk extract, 850 | 1/8 | 149 | White/prepubertal | 100 | 7.93 (5.6-9.4) | 752 | Radius, hip, LS |
| Cameron 2004 | $CaCO_3$, 1200 | 2/2 | 128 | NS/prepubertal | 100 | 10.3 (8-13) | 716 | Hip, forearm, LS, TB |
| Chevalley 2005 | Milk extract, 850 | 1/2 | 235 | White/prepubertal | 0 | 7.44 (5.5-8.5) | 752 | Radius, hip, LS, TB |
| Courteix 2005 | $CaPO_4$, 800 | 1/1 | 113 | White/prepubertal | 100 | 9.91 (8-13) | 994 | Radius, hip, LS, TB |
| Dibba 2000 | $CaCO_3$, 1000 mg 5 days/week | 1/3 | 160 | Gambian/mixed | 50 | 10.3 (8.3-11.9) | 338 | Radius |
| Iuliano-Burns 2003 | Foods fortified by milk minerals, 400 | 0.7/0.7 | 72 | Asian 15%, rest NS; 85%, 80% prepubertal | 100 | 8.86 (7-11) | 674 | TB, upper and lower limb, LS |
| Johnston 1992 | CaCM, 1000 | 3/6 | 140 | White/mixed | 61 | 10 (6-14) | 919 | Radius, hip, LS |
| Lee 1994 | $CaCO_3$, 300 | 1.5/2.5 | 163 | Chinese/prepubertal | 46 | 7.18 (NS) | 277 | Radius |
| Lee 1995 | $CaCO_3$, 300 | 1.5/3 | 109 | Chinese/precubertal | 43 | Age7 | 567 | Radius, hip, LS |
| Lloyd 1993 | CaCM, 500 | 2/2 | 112 | White/mixed | 100 | 11.9 (NS) | 976 | Pelvis, LS, TB |
| Malkovic 2004 | CaCM, 1000 | 7/7 | 354 | White/peripubertal | 100 | 10.8 (NS) | 837 | Radius, TB |
| Molgaard 2004 | $CaCO_3$, 300 | 1/2 | 113 | White/mixed | 100 | 13.2 (12-14) | 841 | TB |
| Nowson 1997 | $CaCO_3$/Ca lactate gluconate, 1000 | 1.5/1.5 | 110 | NS/mixed | 100 | 14 (10-17) | 734 | Forearm, hip, LS, TB |
| Prentice 2006 | $CaCO_3$, 1000 | 1/1 | 150 | White/postpubertal | 0 | 16.8 (16-18) | 1198 | Radius, hip, TB |
| Rozda 2004 | $CaCO_3$, 1200 | 1-4/4 | 93 | Chinese 43%, white 57%/NS | 100 | N.S. (10-12) | NS | TB, LS |
| Raven 2008 | $CaCO_3$, 1000 | 1/4.5 | 112 | Jewish 76%, Amb 24%/postpubertal | 100 | 14.85 (12-17) | 582 | Hip, LS, TB |
| Specker 2003 | $CaCO_3$, 1000 | 1/1 | 239 | White/prepubertal | 47 | 3.92 (3-5) | 946 | TB, arm, leg |
| Shear 2003 | $CaCO_3$, 1000 | 1.3/1.3 | 144 | NS/post pubertal | 100 | 17.3 (16-18) | 938 | Radius, hip, LS, TB |
| Wang 1996 | $CaCO_3$, 300 | 1.5/1.5 | 163 | Chinese/prepubertal | 46 | 7.2 (NS) | 277 | Radius |

$CaCO_3$=calcium carbonate; Ca=calcium; CaCM=calcium citrate malate; $CaPO_4$=calcium phosphate; LS=lumbar spine; TB=total body; NS=not stated.
*Number of subjects randomised.
†Mean baseline calcium intake.

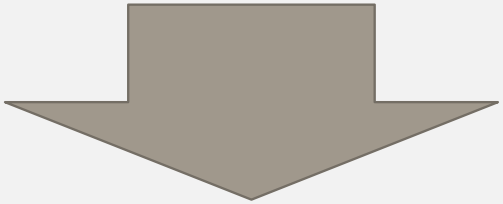
Winzenberg T, et al. Bmj. 2006 Oct 12;333(7572):775.

# CALCIUM SUPPLEMENTATION

19 studies involving 2859 children included

**no effect** on bone mineral density at the femoral neck or lumbar spine

small effect on total body bone mineral content



Supplementation has a small effect at the upper limb, but the resultant ↑ in bone density is unlikely to result in a clinically important ↓ in risk of fracture

Winzenberg T, et al. Bmj. 2006 Oct 12;333(7572):775.

# CALCIUM SUPPLEMENTATION

**Combined effects of physical activity and calcium on bone health in children and adolescents: a systematic review of randomized controlled trials**

nine studies involving 908 participants included

results

physical activity + calcium supplementation plays an important role in **bone health of children and adolescents**

this combined effect was more pronounced, when **baseline calcium intake level was ↓** and **on early puberty stage**

prospective **studies of dose–response relationships** of bone mass with physical activity and calcium intake **are required**

Yang X, et al. World Journal of Pediatrics. 2020 Aug;16(4):356-65.

# IRON DEFICIENCY

- In children in whom iron deficiency (ID) or iron deficiency anemia (IDA) has been identified, therapeutic iron replacement **should be initiated**.
- Although ideal for supplementation and prevention, multivitamins containing iron **should not** be used for the treatment of ID and IDA.
- Many formulations of therapeutic oral iron are available.
- The recommended dosing range varies widely from 3 to 6 mg/kg/day, yet low-dose iron (3 mg/kg elemental iron administered once daily) has demonstrated efficacy even in patients with moderate to severe IDA

# IRON DEFICIENCY

- Several studies in adults also suggest that low-dose therapy is effective therapy while minimizing adverse effects and improving adherence.

- **60 to 120 mg/day of elemental iron** (1 to 2 tablets), administered once daily, in older children should be effective.

# ZINC SUPPLEMENTATION

- Systematic reviews have shown that in children with stunting, zinc supplementation was associated with significantly ↑ height and weight.

- When zinc deficiency is suspected, a zinc supplementation trial (usually 1 mg/kg per day) may provide a measurable response. The supplement can be administered as an **oral solution of zinc acetate** (30 mg of zinc acetate in 5 mL of water).

- The WHO recommends zinc supplementation (20 mg/day for 10–14 days for children 6 months and older, and 10 mg/day for children younger than 6 months) in combination with ORS for children with acute diarrhea. The precise dose of supplemental zinc that is most effective is unclear and currently under study.

# ZINC SUPPLEMENTATION

| Role of Zinc Supplementation in the Improvement of Acute Respiratory Infections among Iranian Children: A Systematic Review | | |
|---|---|---|
| | | level of blood zinc |

Moshtagh M, Amiri R.. Tanaffos. 2020 Jan;19(1):1.

# ZINC SUPPLEMENTATION

**The relationship between zinc intake and growth in children aged 1–8 years: a systematic review and meta-analysis**

9 RCT included (1316 children)

Supplement doses ranged from 3 to 20 mg Zn/day (median 10 mg), and the doses were provided daily in most studies

No statistically significant improvement of several indices of childhood growth following zinc supplementation in children aged 1–8 years of age

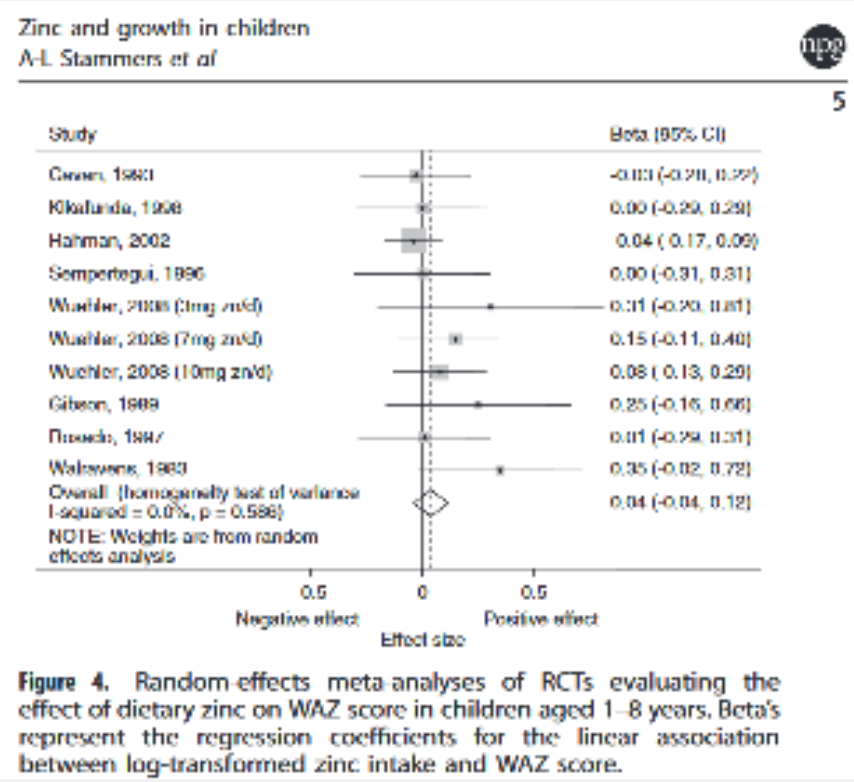



**Figure 4.** Random effects meta analyses of RCTs evaluating the effect of dietary zinc on WAZ score in children aged 1–8 years. Beta's represent the regression coefficients for the linear association between log-transformed zinc intake and WAZ score.

Stammers AL, et al. European journal of clinical nutrition. 2015 Feb;69(2):147-53.

# VITAMIN E

- For children with conditions associated with fat malabsorption (cystic fibrosis, cholestatic liver disease), **supplemental doses (25 IU/kg/day) of vitamin E** are required to prevent deficiency.

- The water miscible form of vitamin E, α-tocopherol polyethylene glycol succinate (TPGS) is the preferable form for oral supplementation during cholestasis and may even improve the absorption of other fat-soluble vitamins or drugs when given concurrently.

# VITAMIN B6

- Children deficient in vitamin B6 without neuritis should receive 5 to 25 mg/day of oral pyridoxine for 3 weeks followed by 1.5 to 2.5 mg/day orally in a multivitamin product.

- With peripheral neuropathy, the dosing is increased to 10 to 50 mg of oral pyridoxine for 3 weeks, then decreased to 1 to 2 mg/day.

# VITAMIN D DEFICIENCY

American Academy of Pediatrics recommendations:

- Adolescents who do not obtain 400 IU of vitamin D per day through vitamin D–fortified milk (100 IU per 8-oz serving) and vitamin D–fortified foods (such as fortified cereals and eggs [yolks]) should **receive a vitamin D supplement of 400 IU/day.**

- On the basis of the available evidence, serum 25-OH-D concentrations in infants and children **should be ≥50 nmol/L (20 ng/mL).**

# VITAMIN D DEFICIENCY

- Children with chronic fat malabsorption and those chronically taking antiseizure medications, may **continue to be vitamin D deficient despite an intake of 400 IU/day.**
- **Higher doses of vitamin D supplementation may be necessary** to achieve normal vitamin D status in these children, and this status should be determined with laboratory tests (eg, for serum 25-OH-D and PTH concentrations and measures of bone mineral status).
- If a vitamin D supplement is prescribed, 25-OH-D levels should be repeated at 3-month intervals until normal levels have been achieved.
- PTH and bone-mineral status should be monitored every 6 months until they have normalized.

# VITAMIN D DEFICIENCY

## Effects of vitamin D supplementation on cardiometabolic outcomes in children and adolescents: a systematic review and meta-analysis of randomized controlled trials

effects of **vitamin D supplementation** compared to placebo or a lower dose of vitamin D

on blood glucose, insulin, homeostatic model assessment of insulin resistance (HOMA-IR), glycated hemoglobin, cholesterol [total, high-density, and low-density lipoprotein (LDL-C)], triglycerides, or blood pressure

Fourteen RCTs with a total of 1088 participants aged 4–19 years were included

# VITAMIN D DEFICIENCY

**Effects of vitamin D supplementation on cardiometabolic outcomes in children and adolescents: a systematic review and meta-analysis of randomized controlled trials**

## results

- vitamin D supplementation **has no or little beneficial effect on cardiometabolic outcomes** in children and adolescent
- but may ↑ LDL-C, with no differences in effect by subgroups according to BMI and baseline S-25(OH)D.
- meta-regression analysis indicated a beneficial effect of increasing S-25(OH)D above 70 nmol/L on insulin resistance in obese children and adolescents

Hauger H, et al. European journal of nutrition. 2020 Apr;59(3):873-84.

# VITAMIN D DEFICIENCY

## Daily vitamin D3 in overweight and obese children and adolescents: a randomized controlled trial

### methods

- 378 children and adolescents
- 6-13 years of age
- body mass index(BMI) Z-score ≥ 1(according to the World Health Organization criteria)
- allocated to receive 600, 1000, and 2000 IU vitamin $D_3$/days

### Results

- Increases in 25(OH)D concentration were found with supplementation of 1000 and 2000 IU, compared with 600 IU/days
- there was no evidence of iPTH suppression or change in serum calcium, phosphorus, and alkaline phosphatase among children with excess weight

Asghari G, et al. European Journal of Nutrition. 2021 Aug;60(5):2831-40.

# VITAMIN D DEFICIENCY

## Effect of Vitamin D Supplementation, Food Fortification, or Bolus Injection on Vitamin D Status in Children Aged 2–18 Years: A Meta-Analysis

included 26 trials (5403 children) with interventions (*n* = 9 fortified foods, *n* = 15 supplements, *n* = 2 bolus injections) from 100–4000 IU vitamin D/d over 4 wk to 2 y.

mean increase of 1.0 nmol/L (95% CI: 0.3, 1.7 nmol/L) for each increase of 100 IU vitamin D/d (per 1 µg/d : 0.4 nmol/L; 95% CI: 0.1, 0.7 nmol/L).

the serum 25(OH)D response to vitamin D intake differs on the basis of baseline status, intakes, and delivery mode, but not age, sex, or latitude.

Hauger H, et al. European journal of nutrition. 2020 Apr;59(3):873-84.

# SUPPLEMENTATION OF CHILDREN AT NUTRITIONAL RISK

# VEGETARIAN DIET

- If food sources of vitamin B12 are not consumed regularly (at least 3 servings per day) **a daily vitamin B12 supplement of 5 to 10 µg or a weekly dose of 2000 µg is recommended**.

- Postmenarcheal adolescent girls who are capable of becoming pregnant should **consume 400 µg of folic acid as a supplement** or in fortified foods in addition to usual food sources of the nutrient

- Serum carnitine and taurine concentrations are decreased in lacto-ovovegetarian and vegan diets; however, the functional significance of this is not apparent, and therefore, supplementation does not seem to be warranted

# KETOGENIC DIET

- Individuals should receive an age-appropriate low-carbohydrate multivitamin every day, as well as a carbohydrate-free calcium supplement with vitamin D.

- Recommendations from the Institute of Medicine for vitamin D intake include 400 IU/day for infants up to 1 year of age and 600 IU/day for children 1 to 18 years of age

- Carnitine concentrations should be routinely monitored and supplemented as needed

# CONSTIPATION

- the benefit of increased dietary fiber in the treatment and prevention of constipation in children is unclear given the variation in types and dose of fibers used (eg, general increase in dietary fiber versus use of a fiber supplement).

- A recent report by the North American Society for Pediatric Gastroenterology, Hepatology and Nutrition **did not recommend fiber supplements in the treatment of constipation.**

# TYPE 1 DIABETES

- Routine supplementation with antioxidants, such as **vitamins E and C and beta-carotene, is not advised because of lack of evidence of efficacy** and concerns related to long-term safety.

- Individualized meal planning should include optimization of food choices to meet RDA/DRI for all micronutrients.

- Concerns regarding potential toxicity associated with **chromium supplementation** should preclude its routine use, especially in the pediatric population.

- Vitamin D status of children with T1D and T2D appears to be no different from that of children without diabetes.

# IMMUNITY

- Given the high rates of common infectious diseases (eg, common cold, influenza) among young children, parents may choose to use such supplements.
- There is little evidence to support vitamin D supplementation of vitamin D-replete children to support immune function.
- High-dose vitamin E supplements can improve immune function in healthy elderly subjects, it is unclear whether they are effective in children.
- A comprehensive meta-analysis indicates that high-dose vitamin C (1 g or more daily) does not reduce the incidence of the common cold, although it may slightly reduce the duration of the infection.
- There is no evidence that high-dose vitamin C supplements have any general immunologic benefit for pediatric populations.

# IMMUNITY

- As with the other vitamins, **there is no evidence that providing B vitamins to replete, healthy children has any benefit on immune function.**

- Studies are needed to determine whether supplementation or fortification of foods with DHA and arachidonic acid have clinically effects on inflammation, immune responses, mucosal immune system development, and long-term immunocompetence in infants and children.

- **There is no direct evidence that zinc supplementation may benefit zinc-replete children**. When given in quantities higher than twice the Recommended Dietary Allowance, zinc may in fact impair immunity, and there is a risk that zinc supplements may also impair copper absorption.

# EATING DISORDERS

- Most studies show that approximately 30% of patients with AN have 25(OH)D levels below 20 ng/mL.

- Such patients should be treated with 50000 IU of vitamin D2 or D3 once a week for 6 to 8 weeks or 2000 IU of vitamin D2 or D3 daily for 6 to 8 weeks, followed by a maintenance dose of 600 to 1000 IU/day.

# SICKLE CELL DISEASE AND THALASSEMIA

- As to SCD, a 2004 statement from the NHLBI stressed the importance of nutritional counseling but made no specific recommendations for monitoring or intervention.

- The **only routine nutritional supplement recommended by the NHLBI is folate**, but a recent Cochrane review did not support routine folic acid supplementation for children with SCD.

# SICKLE CELL DISEASE AND THALASSEMIA

- Guidelines for the nutritional management of children with thal receiving chronic transfusions are available.

- Vitamin D levels are to be checked every 6 months, given the seasonal variability in vitamin D concentrations children should take vitamin D at 2000 IU.

- A diet rich in vitamin E (ie, eggs, vegetable oils, nuts, and cereals) is recommended, and **supplementation with 400 IU/day may be helpful.**

# SICKLE CELL DISEASE AND THALASSEMIA

- **Vitamin C is potentially toxic** as it increases iron absorption, so is to be given only with a chelator to increase iron excretion.

- if children are infrequently being transfused red blood cells or not at all, folic acid, **1 mg/day, is recommended.**

- Zinc levels are to be monitored every 6 months, **especially if iron chelators are prescribed**. Zinc sulfate, 220 mg, 3 times daily, is recommended.

# CELIAC DISEASE AND IBD

- **Dietary supplementation of selected nutrients** may be warranted on the basis of a nutritional assessment of the individual patient.

- Provide **adequate calcium and vitamin D** intake for all children with celiac disease and IBD. Patients at greatest risk of osteopenia and osteoporosis may be monitored by bone mineral density assessment.

- **folate supplementation is recommended** for all IBD patients receiving medications that may interfere with folate metabolism, such as sulfasalazine and methotrexate.

# NON-VITAMIN/
# NON-MINERAL DIETARY SUPPLEMENTS

# ARGININE SUPPLEMENTATION

- Arginine is essential in patients with defects of the urea cycle.
- Arginine is also important for immune function and is the precursor for nitric oxide, which is an intracellular signaling molecule.
- During critical illness, there is an accelerated loss of arginine, which diminishes its availability to support immune function and is believed to contribute to an increased risk of infection in critically ill patients.

# ARGININE AND GROWTH HORMONE

- L-arginine **promotes the synthesis and secretion of GH and IGF-1 in vitro**

- Most studies using oral arginine have shown **that arginine alone increases the resting growth hormone levels at least 100%**

- At rest oral L-arginine ingestion will enhance the growth hormone response and the combination of arginine plus exercise increases growth hormone, but this increase may be less than seen with exercise alone. This diminished response is seen in both in both younger and older individuals.

Oh HS, et al. Food science and biotechnology. 2017 Dec;26(6):1749-54.

Kanaley JA. Current Opinion in Clinical Nutrition & Metabolic Care. 2008 Jan 1;11(1):50-4.

# ARGININE AND GROWTH HORMONE

- Effect of dietary arginine on growth velocity in children between 7 and 13 years of age were investigated

- The results of the recent study suggest a dose-dependent physiological role of habitual protein intake, and specifically arginine intake, on linear growth in normally growing children.

- **Supplementation in children/ adolescents??**

van Vught AJ, et al. British journal of nutrition. 2013 Mar;109(6):1031-9.

# CURCUMIN SUPPLEMENTATION

- Clinical efficacy and safety of curcumin were assessed in children with inflammatory and immune disorders (including asthma, IBD, and juvenile idiopathic arthritis), metabolic disorders, autosomal dominant polycystic kidney disease (ADPKD), cystic fibrosis (CF), tetralogy of Fallot (TOF), and infectious diseases.

- Curcumin was administered in a wide range of doses (45 mg-4000 mg daily) and durations (2-48 weeks). Overall, curcumin was well tolerated in all studies and improved the severity of inflammatory and immune disorders and metabolic diseases.

- more studies are needed to clarify the role of curcumin supplementation among children with ADPKD, CF, TOF, and infectious diseases.

Heidari Z, et al. Phytotherapy Research. 2022 Apr;36(4):1442-58.

# PROBIOTIC SUPPLEMENTATION

**Prevention of Atopic Dermatitis in Infants and Children:**

- Meta-analysis showed that probiotic supplementation during both the prenatal and the postnatal period reduced the incidence of AD in infants and children.

- Findings suggest that starting probiotic treatment during gestation and continuing through the first 6 months of the infant's life may be of benefit in the prevention of AD.

Li L, et al. Am J Clin Dermatology. 2019 Jun;20(3):367-77.

# PROBIOTIC SUPPLEMENTATION

**Cognitive function in children and adolescents** (a systematic review of randomized trials):

- The favorable effect of probiotic supplementation on cognitive function in children and adolescents was observed in one study by a risk reduction of developing ADHD or Asperger syndrome (i.e. autism).

- More long-term and follow-up trials using probiotics identifying the effect on cognition are warranted before routine use.

Rianda D, et al. Benef. Microbes. 2019 Dec 9;10(8):873-82.

# PROBIOTIC SUPPLEMENTATION

**Promotion of Growth in Children** (A Systematic Review and Meta-Analysis):

- There was no evidence that probiotics affected the risk of adverse events.
- In healthy children aged 0–59 months, probiotics may have a small but heterogenous effect on weight and height in low- and middle-income countries but not in children from high-income countries.

Catania J, et al. Nutrients. 2021 Dec 25;14(1):83.

# PROBIOTIC SUPPLEMENTATION

**Probiotic supplementation increases obesity with no detectable effects on liver fat or gut microbiota in obese Hispanic adolescents: a 16-week, randomized, placebo-controlled trial**

## method

- double-blind, randomized placebo-controlled trial in 19 obese Latino adolescents.
- three packets per day of VSL#3® or a matched placebo for 16 weeks.
- a probiotic supplement (VSL#3®)

## results

- VSL#3 supplementation may lead to increased adiposity in obese Latino adolescents with no significant detectable changes in gut microbiota, gut appetite-regulating hormones, liver fat and fibrosis and dietary intake.

Jones RB, et al. Pediatric obesity. 2018 Nov;13(11):705-14.

# ANY QUESTION?