Dietary Reference Intakes: Elements

Nutrient	Function	Life Stage Group	**RDA**/AI*	UL[a]	Selected Food Sources	Adverse effects of excessive consumption	Special Considerations
Arsenic	No biological function in humans although animal data indicate a requirement	Infants			Dairy products, meat, poultry, fish, grains and cereal	No data on the possible adverse effects of organic arsenic compounds in food were found. Inorganic arsenic is a known toxic substance. Although the UL was not determined for arsenic, there is no justification for adding arsenic to food or supplements.	None
		0–6 mo	ND[b]	ND			
		7–12 mo	ND	ND			
		Children					
		1–3 y	ND	ND			
		4–8 y	ND	ND			
		Males					
		9–13 y	ND	ND			
		14–18 y	ND	ND			
		19–30 y	ND	ND			
		31-50 y	ND	ND			
		50-70 y	ND	ND			
		> 70 y	ND	ND			
		Females					
		9–13 y	ND	ND			
		14–18 y	ND	ND			
		19–30 y	ND	ND			
		31-50 y	ND	ND			
		50-70 y	ND	ND			
		> 70 y	ND	ND			
		Pregnancy					
		≤ 18 y	ND	ND			
		19-30y	ND	ND			
		31-50 y	ND	ND			
		Lactation					
		≤ 18 y	ND	ND			
		19-30y	ND	ND			
		31–50 y	ND	ND			
Boron	No clear biological function in humans although animal data indicate a functional role	Infants		(mg/d)	Fruit-based beverages and products, potatoes, legumes, milk, avocado, peanut butter, peanuts	Reproductive and developmental effects as observed in animal studies.	None
		0–6 mo	ND	ND			
		7–12 mo	ND	ND			
		Children					
		1–3 y	ND	3			
		4–8 y	ND	6			
		Males					
		9–13 y	ND	11			
		14–18 y	ND	17			
		19–30 y	ND	20			
		31-50 y	ND	20			
		50-70 y	ND	20			
		> 70 y	ND	20			
		Females					
		9–13 y	ND	11			
		14–18 y	ND	17			
		19–30 y	ND	20			
		31-50 y	ND	20			
		50-70 y	ND	20			
		> 70 y	ND	20			
		Pregnancy					
		≤ 18 y	ND	17			
		19-30y	ND	20			
		31-50 y	ND	20			
		Lactation					
		≤ 18 y	ND	17			
		19-30y	ND	20			
		31–50 y	ND	20			

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[b]ND = Not determinable due to lack of data of adverse effects in this age group and concern with regard to lack of ability to handle excess amounts. Source of intake should be from food only to prevent high levels of intake.

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Dietary Reference Intakes: Elements

Nutrient	Function	Life Stage Group	RDA/AI*	UL[a]	Selected Food Sources	Adverse effects of excessive consumption	Special Considerations
Calcium	Essential role in blood clotting, muscle contraction, nerve transmission, and bone and tooth formation	Infants	(mg/d)	(mg/d)	Milk, cheese, yogurt, corn tortillas, calcium-set tofu, Chinese cabbage, kale, broccoli	Kidney stones, hypercalcemia, milk alkali syndrome, and renal insufficiency	Amenorrheic women (exercise- or anorexia nervosa-induced) have reduced net calcium absorption. There is no consistent data to support that a high protein intake increases calcium requirement.
		0–6 mo	210*	ND[b]			
		7–12 mo	270*	ND			
		Children					
		1–3 y	500*	2,500			
		4–8 y	800*	2,500			
		Males					
		9–13 y	1,300*	2,500			
		14–18 y	1,300*	2,500			
		19–30 y	1,000*	2,500			
		31-50 y	1,000*	2,500			
		50-70 y	1,200*	2,500			
		> 70 y	1,200*	2,500			
		Females					
		9–13 y	1,300*	2,500			
		14–18 y	1,300*	2,500			
		19–30 y	1,000*	2,500			
		31-50 y	1,000*	2,500			
		50-70 y	1,200*	2,500			
		> 70 y	1,200*	2,500			
		Pregnancy					
		≤ 18 y	1,300*	2,500			
		19-30y	1,000*	2,500			
		31-50 y	1,000*	2,500			
		Lactation					
		≤ 18 y	1,300*	2,500			
		19-30y	1,000*	2,500			
		31–50 y	1,000*	2,500			
Chromium	Helps to maintain normal blood glucose levels	Infants	(µg/d)		Some cereals, meats, poultry, fish, beer	Chronic renal failure	None
		0–6 mo	0.2*	ND			
		7–12 mo	5.5*	ND			
		Children					
		1–3 y	11*	ND			
		4–8 y	15*	ND			
		Males					
		9–13 y	25*	ND			
		14–18 y	35*	ND			
		19–30 y	35*	ND			
		31-50 y	35*	ND			
		50-70 y	30*	ND			
		> 70 y	30*	ND			
		Females					
		9–13 y	21*	ND			
		14–18 y	24*	ND			
		19–30 y	25*	ND			
		31-50 y	25*	ND			
		50-70 y	20*	ND			
		> 70 y	20*	ND			
		Pregnancy					
		≤ 18 y	29*	ND			
		19-30y	30*	ND			
		31-50 y	30*	ND			
		Lactation					
		≤ 18 y	44*	ND			
		19-30y	45*	ND			
		31–50 y	45*	ND			

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Dietary Reference Intakes: Elements

Nutrient	Function	Life Stage Group	**RDA**/AI*	UL[a]	Selected Food Sources	Adverse effects of excessive consumption	Special Considerations
Copper	Component of enzymes in iron metabolism	Infants	(µg/d)	(µg/d)	Organ meats, seafood, nuts, seeds, wheat bran cereals, whole grain products, cocoa products	Gastrointestinal distress, liver damage	Individuals with Wilson's disease, Indian childhood cirrhosis and idiopathic copper toxicosis may be at increased risk of adverse effects from excess copper intake.
		0–6 mo	200*	ND[b]			
		7–12 mo	220*	ND			
		Children					
		1–3 y	**340**	1,000			
		4–8 y	**440**	3,000			
		Males					
		9–13 y	**700**	5,000			
		14–18 y	**890**	8,000			
		19–30 y	**900**	10,000			
		31-50 y	**900**	10,000			
		50-70 y	**900**	10,000			
		> 70 y	**900**	10,000			
		Females					
		9–13 y	**700**	5,000			
		14–18 y	**890**	8,000			
		19–30 y	**900**	10,000			
		31-50 y	**900**	10,000			
		50-70 y	**900**	10,000			
		> 70 y	**900**	10,000			
		Pregnancy					
		≤ 18 y	**1000**	8,000			
		19-30y	**1000**	10,000			
		31-50 y	**1000**	10,000			
		Lactation					
		≤ 18 y	**1300**	8,000			
		19-30y	**1300**	10,000			
		31–50 y	**1300**	10,000			
Fluoride	Inhibits the initiation and progression of dental caries and stimulates new bone formation	Infants	(mg/d)	(mg/d)	Fluoridated water, teas, marine fish, fluoridated dental products	Enamel and skeletal fluorosis	None
		0–6 mo	0.01*	0.7			
		7–12 mo	0.5*	0.9			
		Children					
		1–3 y	0.7*	1.3			
		4–8 y	1*	2.2			
		Males					
		9–13 y	2*	10			
		14–18 y	3*	10			
		19–30 y	4*	10			
		31-50 y	4*	10			
		50-70 y	4*	10			
		> 70 y	4*	10			
		Females					
		9–13 y	2*	10			
		14–18 y	3*	10			
		19–30 y	3*	10			
		31-50 y	3*	10			
		50-70 y	3*	10			
		> 70 y	3*	10			
		Pregnancy					
		≤ 18 y	3*	10			
		19-30y	3*	10			
		31-50 y	3*	10			
		Lactation					
		≤ 18 y	3*	10			
		19-30y	3*	10			
		31–50 y	3*	10			

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Dietary Reference Intakes: Elements

Nutrient	Function	Life Stage Group	RDA/AI*	UL[a]	Selected Food Sources	Adverse effects of excessive consumption	Special Considerations
Iodine	Component of the thyroid hormones; and prevents goiter and cretinism	Infants	(μg/d)	(μg/d)	Marine origin, processed foods, iodized salt	Elevated thyroid stimulating hormone (TSH) concentration	Individuals with autoimmune thyroid disease, previous iodine deficiency, or nodular goiter are distinctly susceptible to the adverse effect of excess iodine intake. Therefore, individuals with these conditions may not be protected by the UL for iodine intake for the general population.
		0–6 mo	110*	ND[b]			
		7–12 mo	130*	ND			
		Children					
		1–3 y	**90**	200			
		4–8 y	**90**	300			
		Males					
		9–13 y	**120**	600			
		14–18 y	**150**	900			
		19–30 y	**150**	1,100			
		31-50 y	**150**	1,100			
		50-70 y	**150**	1,100			
		> 70 y	**150**	1,100			
		Females					
		9–13 y	**120**	600			
		14–18 y	**150**	900			
		19–30 y	**150**	1,100			
		31-50 y	**150**	1,100			
		50-70 y	**150**	1,100			
		> 70 y	**150**	1,100			
		Pregnancy					
		≤ 18 y	**220**	900			
		19-30y	**220**	1,100			
		31-50 y	**220**	1,100			
		Lactation					
		≤ 18 y	**290**	900			
		19-30y	**290**	1,100			
		31–50 y	**290**	1,100			
Iron (mg/d)	Component of hemoglobin and numerous enzymes; prevents microcytic hypochromic anemia	Infants	(mg/d)	(mg/d)	Fruits, vegetables and fortified bread and grain products such as cereal (non-heme iron sources), meat and poultry (heme iron sources)	Gastrointestinal distress	Non-heme iron absorption is lower for those consuming vegetarian diets than for those eating nonvegetarian diets. Therefore, it has been suggested that the iron requirement for those consuming a vegetarian diet is approximately 2-fold greater than for those consuming a nonvegetarian diet. Recommended intake assumes 75% of iron is from heme iron sources.
		0–6 mo	0.27*	40			
		7–12 mo	**11**	40			
		Children					
		1–3 y	**7**	40			
		4–8 y	**10**	40			
		Males					
		9–13 y	**8**	40			
		14–18 y	**11**	45			
		19–30 y	**8**	45			
		31-50 y	**8**	45			
		50-70 y	**8**	45			
		> 70 y	**8**	45			
		Females					
		9–13 y	**8**	40			
		14–18 y	**15**	45			
		19–30 y	**18**	45			
		31-50 y	**18**	45			
		50-70 y	**8**	45			
		> 70 y	**8**	45			
		Pregnancy					
		≤ 18 y	**27**	45			
		19-30y	**27**	45			
		31-50 y	**27**	45			
		Lactation					
		≤ 18 y	**10**	45			
		19-30y	**9**	45			
		31–50 y	**9**	45			

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Dietary Reference Intakes: Elements

Nutrient	Function	Life Stage Group	RDA/AI*	UL[a]	Selected Food Sources	Adverse effects of excessive consumption	Special Considerations
Magnesium	Cofactor for enzyme systems	Infants	(mg/d)	(mg/d)	Green leafy vegetables, unpolished grains, nuts, meat, starches, milk	There is no evidence of adverse effects from the consumption of naturally occurring magnesium in foods. Adverse effects from magnesium containing supplements may include osmotic diarrhea. The UL for magnesium represents intake from a pharmacological agent only and does not include intake from food and water.	None
		0–6 mo	30*	ND[b]			
		7–12 mo	75*	ND			
		Children					
		1–3 y	**80**	65			
		4–8 y	**130**	110			
		Males					
		9–13 y	**240**	350			
		14–18 y	**410**	350			
		19–30 y	**400**	350			
		31-50 y	**420**	350			
		50-70 y	**420**	350			
		> 70 y	**420**	350			
		Females					
		9–13 y	**240**	350			
		14–18 y	**360**	350			
		19–30 y	**310**	350			
		31-50 y	**320**	350			
		50-70 y	**320**	350			
		> 70 y	**320**	350			
		Pregnancy					
		≤ 18 y	**400**	350			
		19-30y	**350**	350			
		31-50 y	**360**	350			
		Lactation					
		≤ 18 y	**360**	350			
		19-30y	**310**	350			
		31–50 y	**320**	350			
Manganese	Involved in the formation of bone, as well as in enzymes involved in amino acid, cholesterol, and carbohydrate metabolism	Infants	(mg/d)	(mg/d)	Nuts, legumes, tea, and whole grains	Elevated blood concentration and neurotoxicity	Because manganese in drinking water and supplements may be more bioavailable than manganese from food, caution should be taken when using manganese supplements especially among those persons already consuming large amounts of manganese from diets high in plant products. In addition, individuals with liver disease may be distinctly susceptible to the adverse effects of excess manganese intake.
		0–6 mo	0.003*	ND			
		7–12 mo	0.6*	ND			
		Children					
		1–3 y	1.2*	2			
		4–8 y	1.5*	3			
		Males					
		9–13 y	1.9*	6			
		14–18 y	2.2*	9			
		19–30 y	2.3*	11			
		31-50 y	2.3*	11			
		50-70 y	2.3*	11			
		> 70 y	2.3*	11			
		Females					
		9–13 y	1.6*	6			
		14–18 y	1.6*	9			
		19–30 y	1.8*	11			
		31-50 y	1.8*	11			
		50-70 y	1.8*	11			
		> 70 y	1.8*	11			
		Pregnancy					
		≤ 18 y	2.0*	9			
		19-30y	2.0*	11			
		31-50 y	2.0*	11			
		Lactation					
		≤ 18 y	2.6*	9			
		19-30y	2.6*	11			
		31–50 y	2.6*	11			

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Dietary Reference Intakes: Elements

Nutrient	Function	Life Stage Group	**RDA**/AI*	UL[a]	Selected Food Sources	Adverse effects of excessive consumption	Special Considerations
Molybdenum	Cofactor for enzymes involved in catabolism of sulfur amino acids, purines and pyridines.	Infants	(μg/d)	(μg/d)	Legumes, grain products and nuts	Reproductive effects as observed in animal studies.	Individuals who are deficient in dietary copper intake or have some dysfunction in copper metabolism that makes them copper-deficient could be at increased risk of molybdenum toxicity.
		0–6 mo	2*	ND[b]			
		7–12 mo	3*	ND			
		Children					
		1–3 y	**17**	300			
		4–8 y	**22**	600			
		Males					
		9–13 y	**34**	1,100			
		14–18 y	**43**	1,700			
		19–30 y	**45**	2,000			
		31-50 y	**45**	2,000			
		50-70 y	**45**	2,000			
		> 70 y	**45**	2,000			
		Females					
		9–13 y	**34**	1,100			
		14–18 y	**43**	1,700			
		19–30 y	**45**	2,000			
		31-50 y	**45**	2,000			
		50-70 y	**45**	2,000			
		> 70 y	**45**	2,000			
		Pregnancy					
		≤ 18 y	**50**	1,700			
		19-30y	**50**	2,000			
		31-50 y	**50**	2,000			
		Lactation					
		≤ 18 y	**50**	1,700			
		19-30y	**50**	2,000			
		31–50 y	**50**	2,000			
Nickel	No clear biological function in humans has been identified. May serve as a cofactor of metalloenzymes and facilitate iron absorption or metabolism in microorganisms.	Infants		(mg/d)	Nuts, legumes, cereals, sweeteners, chocolate milk powder, chocolate candy	Decreased body weight gain Note: As observed in animal studies	Individuals with preexisting nickel hypersensitivity (from previous dermal exposure) and kidney dysfunction are distinctly susceptible to the adverse effects of excess nickel intake
		0–6 mo	ND	ND			
		7–12 mo	ND	ND			
		Children					
		1–3 y	ND	0.2			
		4–8 y	ND	0.3			
		Males					
		9–13 y	ND	0.6			
		14–18 y	ND	1.0			
		19–30 y	ND	1.0			
		31-50 y	ND	1.0			
		50-70 y	ND	1.0			
		> 70 y	ND	1.0			
		Females					
		9–13 y	ND	0.6			
		14–18 y	ND	1.0			
		19–30 y	ND	1.0			
		31-50 y	ND	1.0			
		50-70 y	ND	1.0			
		> 70 y	ND	1.0			
		Pregnancy					
		≤ 18 y	ND	1.0			
		19-30y	ND	1.0			
		31-50 y	ND	1.0			
		Lactation					
		≤ 18 y	ND	1.0			
		19-30y	ND	1.0			
		31–50 y	ND	1.0			

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[b]ND = Not determinable due to lack of data of adverse effects in this age group and concern with regard to lack of ability to handle excess amounts. Source of intake should be from food only to prevent high levels of intake.

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Dietary Reference Intakes: Elements

Nutrient	Function	Life Stage Group	RDA/AI*	UL[a]	Selected Food Sources	Adverse effects of excessive consumption	Special Considerations
Phosphorus	Maintenance of pH, storage and transfer of energy and nucleotide synthesis	Infants	(mg/d)	(mg/d)	Milk, yogurt, ice cream, cheese, peas, meat, eggs, some cereals and breads	Metastatic calcification, skeletal porosity, interference with calcium absorption	Athletes and others with high energy expenditure frequently consume amounts from food greater than the UL without apparent effect.
		0–6 mo	100*	ND[b]			
		7–12 mo	275*	ND			
		Children					
		1–3 y	**460**	3,000			
		4–8 y	**500**	3,000			
		Males					
		9–13 y	**1,250**	4,000			
		14–18 y	**1,250**	4,000			
		19–30 y	**700**	4,000			
		31-50 y	**700**	4,000			
		50-70 y	**700**	4,000			
		> 70 y	**700**	3,000			
		Females					
		9–13 y	**1,250**	4,000			
		14–18 y	**1,250**	4,000			
		19–30 y	**700**	4,000			
		31-50 y	**700**	4,000			
		50-70 y	**700**	4,000			
		> 70 y	**700**	3,000			
		Pregnancy					
		≤ 18 y	**1,250**	3,500			
		19-30y	**700**	3,500			
		31-50 y	**700**	3,500			
		Lactation					
		≤ 18 y	**1,250**	4,000			
		19-30y	**700**	4,000			
		31–50 y	**700**	4,000			
Selenium	Defense against oxidative stress and regulation of thyroid hormone action, and the reduction and oxidation status of vitamin C and other molecules	Infants	(µg/d)	(µg/d)	Organ meats, seafood, plants (depending on soil selenium content)	Hair and nail brittleness and loss	None
		0–6 mo	15*	45			
		7–12 mo	20*	60			
		Children					
		1–3 y	**20**	90			
		4–8 y	**30**	150			
		Males					
		9–13 y	**40**	280			
		14–18 y	**55**	400			
		19–30 y	**55**	400			
		31-50 y	**55**	400			
		50-70 y	**55**	400			
		> 70 y	**55**	400			
		Females					
		9–13 y	**40**	280			
		14–18 y	**55**	400			
		19–30 y	**55**	400			
		31-50 y	**55**	400			
		50-70 y	**55**	400			
		> 70 y	**55**	400			
		Pregnancy					
		≤ 18 y	**60**	400			
		19-30y	**60**	400			
		31-50 y	**60**	400			
		Lactation					
		≤ 18 y	**70**	400			
		19-30y	**70**	400			
		31–50 y	**70**	400			

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Dietary Reference Intakes: Elements

Nutrient	Function	Life Stage Group	RDA/AI*	UL[a]	Selected Food Sources	Adverse effects of excessive consumption	Special Considerations
Silicon	No biological function in humans has been identified. Involved in bone function in animal studies.	Infants			Plant-based foods	There is no evidence that silicon that occurs naturally in food and water produces adverse health effects.	None
		0–6 mo	ND[b]	ND			
		7–12 mo	ND	ND			
		Children					
		1–3 y	ND	ND			
		4–8 y	ND	ND			
		Males					
		9–13 y	ND	ND			
		14–18 y	ND	ND			
		19–30 y	ND	ND			
		31-50 y	ND	ND			
		50-70 y	ND	ND			
		> 70 y	ND	ND			
		Females					
		9–13 y	ND	ND			
		14–18 y	ND	ND			
		19–30 y	ND	ND			
		31-50 y	ND	ND			
		50-70 y	ND	ND			
		> 70 y	ND	ND			
		Pregnancy					
		≤ 18 y	ND	ND			
		19-30y	ND	ND			
		31-50 y	ND	ND			
		Lactation					
		≤ 18 y	ND	ND			
		19-30y	ND	ND			
		31–50 y	ND	ND			
Vanadium	No biological function in humans has been identified.	Infants		(mg/d)	Mushrooms, shellfish, black pepper, parsley, and dill seed.	Renal lesions as observed in animal studies.	None
		0–6 mo	ND	ND			
		7–12 mo	ND	ND			
		Children					
		1–3 y	ND	ND			
		4–8 y	ND	ND			
		Males					
		9–13 y	ND	ND			
		14–18 y	ND	ND			
		19–30 y	ND	1.8			
		31-50 y	ND	1.8			
		50-70 y	ND	1.8			
		> 70 y	ND	1.8			
		Females					
		9–13 y	ND	ND			
		14–18 y	ND	ND			
		19–30 y	ND	1.8			
		31-50 y	ND	1.8			
		50-70 y	ND	1.8			
		> 70 y	ND	1.8			
		Pregnancy					
		≤ 18 y	ND	ND			
		19-30y	ND	ND			
		31-50 y	ND	ND			
		Lactation					
		≤ 18 y	ND	ND			
		19-30y	ND	ND			
		31–50 y	ND	ND			

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Dietary Reference Intakes: Elements

Nutrient	Function	Life Stage Group	RDA/AI*	UL[a]	Selected Food Sources	Adverse effects of excessive consumption	Special Considerations
Zinc	Component of multiple enzymes and proteins; involved in the regulation of gene expression.	Infants	(mg/d)	(mg/d)	Fortified cereals, red meats, certain seafood	Reduced copper status	Zinc absorption is lower for those consuming vegetarian diets than for those eating nonvegetarian diets. Therefore, it has been suggested that the zinc requirement for those consuming a vegetarian diet is approximately 2-fold greater than for those consuming a nonvegetarian diet.
		0–6 mo	2*	4			
		7–12 mo	**3**	5			
		Children					
		1–3 y	**3**	7			
		4–8 y	**5**	12			
		Males					
		9–13 y	**8**	23			
		14–18 y	**11**	34			
		19–30 y	**11**	40			
		31-50 y	**11**	40			
		50-70 y	**11**	40			
		> 70 y	**11**	40			
		Females					
		9–13 y	**8**	23			
		14–18 y	**9**	34			
		19–30 y	**8**	40			
		31-50 y	**8**	40			
		50-70 y	**8**	40			
		> 70 y	**8**	40			
		Pregnancy					
		≤ 18 y	**12**	34			
		19-30y	**11**	40			
		31-50 y	**11**	40			
		Lactation					
		≤ 18 y	**13**	34			
		19-30y	**12**	40			
		31–50 y	**12**	40			

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