Dietary Reference Intakes for the Cuban Population, 2008

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Recommended dietary reference intakes (DRI) for energy and nutrients for the Cuban population were first established by the Nutrition and Food Hygiene Institute (INHA, its Spanish acronym) in 1996.[1] International organizations and Cuban public health research subsequently generated a considerable volume of new information on food-based energy and nutrient requirements,[2–4] resulting in the need for a revision. Updated DRIs were therefore compiled by a multidisciplinary group of specialists and published in 2008 by INHA and the Cuban Ministry of Public Health.[5,6]

The current recommendations establish adequate intakes for energy, protein, essential amino acids, fats, carbohydrates, dietary fiber, 14 vitamins, and 15 minerals or trace elements, as well as tolerable upper intake levels for some nutrients. To facilitate dietary planning, population-averaged dietary reference intakes are provided for the total Cuban population (2300 kcal, 69 g protein, 53 g fat, and 387 g carbohydrates) and by age group. Important changes include the use of body weight corresponding to a Body Mass Index (BMI) of 21 to establish the recommended energy intake for adults, and setting the recommended fat intake as 20% of total energy—quantities aimed at preventing overweight and the noncommunicable chronic diseases most prevalent in Cuba.

The dietary reference intake is the amount of a particular nutrient required to sustain normal metabolic, physical and psychic functioning; promote health and quality of life; prevent deficiency diseases and excess intake; and guarantee certain reserves for emergency situations. Recommended amounts are calculated to meet these needs in the majority of the population, taking into account diverse environmental conditions and life situations.

Dietary recommendations are an important regulatory and educational tool for all sectors concerned with food and nutrition. They are fundamental to nutritional planning and to setting national policies aimed at safeguarding a healthy diet for the population. DRIs serve as targets in calculating availability of foodstuffs—domestically produced and imported—as well as in setting affordable pricing policies. Food and pharmaceutical industries use DRIs as guidelines for producing fortified foods and nutritional supplements for population groups with particular needs. They are also used as reference values for assessing food consumption surveys (at individual and macroeconomic levels) and for creating dietary guidelines.

The following is a summary version of the 2008 dietary recommendations for the Cuban population.[5]

Energy and Macronutrients (Tables 1 and 2)

Energy

- **Infants and children aged <3 years** Recommended amounts for this age group were based on 1985 Joint FAO/WHO Expert Committee criteria,[3] but 2006 WHO weight-for-height standards[7] were used as reference values for children aged <1 year, while 2006 Havana Growth and Development Study values[8] were used for children aged 1–3 years.
- **Children aged ≥3 years and adolescents** DRIs were based on the needs of this age group, classified as having an "active" physical activity level (PAL),[2–4,9,10] and on 2006 Havana Growth and Development Study weight-for-height reference values.[8]
- **Adults** DRIs were based on 2004 Joint FAO/WHO Expert Committee criteria,[3] which used the 1985 Committee's methodology for this age group.[11] Results of INHA's most recent research on Cuban adults were also taken into account.[12–16] Adults were grouped by PAL (sedentary, low active, active, very active, exceptionally active), and DRI was established for each group.[17] Given the high prevalence of overweight and chronic diseases in Cuban adults,[18] weight values corresponding to a Body Mass Index of 21 were used, as proposed by the World Health Organization, to prevent noncommunicable chronic diseases.[19]
- **Pregnant women** Additional energy recommendations for this group were established considering weight gains observed in a 2005–2007 study of pregnant women in Cuba.[20] Adding 85 kcal, 285 kcal, and 475 kcal in the first, second and third trimesters is recommended. For pregnant women who are malnourished and those with low weight for gestational age, an additional 675 kcal is recommended.
- **Lactating women** Additional energy needs were established assuming that a well-nourished woman's breast milk contains 0.67 kcal/g energy. An additional 500 kcal is recommended during the first 6 months of lactation and 400 kcal thereafter.

Proteins

Recommendations were based on the 2007 Joint WHO/FAO/UNU Expert Consultation on Protein and Amino Acid Requirements in Human Nutrition,[21] which propose that protein constitute 10% of total energy intake in children aged <1 year and 12% of total energy intake for all other ages. For children aged <1 year, 70% of total protein should be of animal origin; for all other ages, the recommendation is 50%. The same FAO/WHO Requirements were also used to establish DRIs for Essential Amino Acids.

Fats

DRIs were established as a percentage of total energy intake: 40% for infants aged <6 months; 35% for children aged 6 months to 2 years; 25% for children aged 2–6 years, pregnant and lactating women, and exceptionally active adults; 23% for children aged 7–13 years, and 20% for all other ages. Minimum fat intake should cover at least 15% of total energy intake. Fatty acid composition in baby formula should match fatty acid amounts and proportions in breast milk. Total energy intake should not include more than 10% saturated fatty acid, 15% monounsaturated fatty acid or 7% polyunsaturated fatty acid. Desirable intake of linoleic acid should provide 5% of energy. The recommended ratio of omega-6 to omega-3 fatty acids is 5:1. Cholesterol consumption should be less than 300 mg,[4] and it is recommended that trans

Table 1: Dietary Reference Intakes, Energy and Macronutrients, Cuban Females

Group	Age*	Height†	Weight†	Energy		Protein‡		Fat§	CHO||
		(m)	(kg)	kcal/day	kcal/kg weight	g/kg weight	g/day	(g)	(g)
	months								
Girls aged <1 year	0–3	0.55	4.5	500	112	2.78	13	22	63
	3–6	0.63	6.6	630	95	2.39	16	28	79
	6–9	0.68	7.8	755	97	2.42	19	29	104
	9–12	0.73	8.6	917	107	2.67	23	36	126
	years								
Girls and Adolescents	1–2	0.80	10.7	1190	111	3.36	36	46	158
	2–3	0.90	13.0	1330	102	3.08	40	52	176
	3–5	1.03	16.5	1501	91	2.73	45	42	236
	5–7	1.17	20.7	1667	81	2.42	50	46	263
	7–10	1.31	26.6	1851	70	2.09	56	47	301
	10–12	1.46	35.5	2074	59	1.75	62	53	337
	12–14	1.55	43.3	2228	52	1.54	67	57	362
	14–16	1.60	48.7	2295	47	1.41	69	51	390
	16–18	1.61	51.7	2274	44	1.32	68	51	387
	years								
Sedentary–Low Active Lifestyle PAL=1.55	18–30	1.6	53.8	1989	37	1.11	60	44	338
		1.7	60.7	2148	35	1.06	64	48	365
		1.8	68.0	2317	34	1.02	70	51	394
	30–0	1.6	53.8	1988	37	1.11	60	44	338
		1.7	60.7	2075	34	1.03	62	46	353
		1.8	68.0	2168	32	0.96	65	48	369
	≥60	1.6	53.8	1777	33	0.99	53	39	302
		1.7	60.7	1875	31	0.93	56	42	319
		1.8	68.0	1978	29	0.87	59	44	336
	years								
Active Lifestyle PAL=1.85	18–30	1.6	53.8	2374	44	1.32	71	53	404
		1.7	60.7	2564	42	1.27	77	57	436
		1.8	68.0	2765	41	1.22	83	61	470
	30–60	1.6	53.8	2373	44	1.32	71	53	403
		1.7	60.7	2477	41	1.22	74	55	421
		1.8	68.0	2587	38	1.14	78	57	440
	≥60	1.6	53.8	2121	39	1.18	64	47	361
		1.7	60.7	2238	37	1.11	67	50	380
		1.8	68.0	2361	35	1.04	71	52	401
	years								
Very Active Lifestyle PAL=2.20	18–30	1.6	53.8	2823	52	1.57	85	63	480
		1.7	60.7	3049	50	1.51	91	68	518
		1.8	68.0	3289	48	1.45	99	73	559
	30–60	1.6	53.8	2821	52	1.57	85	63	480
		1.7	60.7	2945	49	1.46	88	65	501
		1.8	68.0	3077	45	1.36	92	68	523
	≥60	1.6	53.8	2523	47	1.41	76	56	429
		1.7	60.7	2661	44	1.32	80	59	452
		1.8	68.0	2808	41	1.24	84	62	477
	trimester								
Pregnant Women	1st			+ 85			+ 1	25% E	
	2nd			+ 285			+ 10	25% E	
	3rd			+ 475			+ 31	25% E	
	semester								
Lactating Women	1st			+ 500			+ 19	25% E	
	2nd			+ 400			+ 13	25% E	

PAL: Physical Activity Level
E: Total energy intake
* Age intervals do not include upper limit.
† Height and Weight. Girls aged <1 year: Median is the midpoint of the age interval, WHO, 2006.[7] Girls and adolescents: Median is the midpoint of the age interval, Metropolitan Havana, 2006.[8] Adults: Ideal weight for BMI=21.
‡ Protein calculated as percentage of total daily energy intake. Aged <1 year: 10% (70% animal protein); aged ≥1 year: 12% (50% animal protein).
§ Fat calculated as percentage of total daily energy intake (60% vegetable origin). Aged <6 months: 40%; aged 6 months to 2 years: 35%; aged 3–6 years and pregnant, lactating or exceptionally active women: 25%; aged 7–13 years, 23%; aged ≥13 years: 20%.
|| CHO (Carbohydrates) calculated as difference in percentage of total daily energy intake after protein and fat values established. Complex CHO: 75%. Dietary fiber, aged 19–50 years: 25 g/day. Sugar: ≤10%.

Table 2: Dietary Reference Intakes, Energy and Macronutrients, Cuban Males

Group	Age*	Height†	Weight†	Energy		Protein‡		Fat§	CHO‖
		(m)	(kg)	kcal/day	kcal/kg weight	g/kg weight	g/day	(g)	(g)
	months								
Boys aged <1 year	0–3	0.56	4.6	543	119	2.97	14	24	68
	3–6	0.65	7.2	693	96	2.40	17	31	87
	6–9	0.70	8.5	810	95	2.38	20	32	111
	9–12	0.76	9.3	983	106	2.65	25	38	135
	years								
Boys and Adolescents	1–2	0.81	11.3	1190	105	3.16	36	46	158
	2–3	0.91	13.4	1410	105	3.16	42	55	187
	3–5	1.04	16.8	1591	95	2.84	48	44	251
	5–7	1.18	21.3	1779	84	2.51	53	49	280
	7–10	1.31	26.6	1966	74	2.22	59	50	319
	10–12	1.43	33.6	2193	65	1.96	66	56	356
	12–14	1.54	41.3	2452	59	1.78	74	63	398
	14–16	1.67	51.9	2826	55	1.63	85	63	480
	16–18	1.73	59.4	3011	51	1.52	90	67	512
	years								
Sedentary–Low Active Lifestyle PAL=1.55	18–30	1.6	53.8	2328	43	1.30	70	52	396
		1.7	60.7	2489	41	1.23	75	55	423
		1.8	68.8	2661	39	1.17	80	59	452
	30–60	1.6	53.8	2309	43	1.29	69	51	393
		1.7	60.7	2432	40	1.20	73	54	413
		1.8	68.8	2563	38	1.13	77	57	436
	≥60	1.6	53.8	1887	35	1.05	57	42	321
		1.7	60.7	2013	33	0.99	60	45	342
		1.8	68.8	2146	32	0.95	64	48	365
	years								
Active Lifestyle PAL=1.85	18–30	1.6	53.8	2778	52	1.55	83	62	472
		1.7	60.7	2971	49	1.47	89	66	505
		1.8	68.8	3176	47	1.40	95	71	540
	30–60	1.6	53.8	2756	51	1.54	83	61	469
		1.7	60.7	2903	48	1.43	87	65	494
		1.8	68.8	3059	45	1.35	92	68	520
	≥60	1.6	53.8	2252	42	1.26	68	50	383
		1.7	60.7	2402	40	1.19	72	53	408
		1.8	68.8	2561	38	1.13	77	57	435
	years								
Very Active Lifestyle PAL=2.20	18–30	1.6	53.8	3304	61	1.84	99	73	562
		1.7	60.7	3533	58	1.75	106	79	601
		1.8	68.0	3777	56	1.67	113	84	642
	30–60	1.6	53.8	3278	61	1.83	98	73	557
		1.7	60.7	3453	57	1.71	104	77	587
		1.8	68.8	3638	54	1.61	109	81	618
	≥60	1.6	53.8	2678	50	1.49	80	60	455
		1.7	60.7	2857	47	1.41	86	63	486
		1.8	68.8	3046	45	1.34	91	68	518
	years								
Exceptionally Active Lifestyle PAL=2.70	18–30	1.6	53.8	4054	75	2.26	122	113	639
		1.7	60.7	4336	71	2.14	130	120	683
		1.8	68.8	4635	68	2.04	139	129	730
	30–60	1.6	53.8	4023	75	2.24	121	112	634
		1.7	60.7	4237	70	2.09	127	118	667
		1.8	68.0	4465	66	1.97	134	124	703
	≥60	1.6	53.8	3287	61	1.83	99	91	518
		1.7	60.7	3506	58	1.73	105	97	552
		1.8	68.0	3738	55	1.65	112	104	589

PAL: Physical Activity Level
* Age intervals do not include upper limit.
† Height and Weight. Boys aged <1 year: Median is the midpoint of the age interval, WHO data, 2006.[7] Boys and adolescents: Median is the midpoint of the age interval, Metropolitan Havana data, 2006.[8] Adults: Ideal weight for BMI=21.
‡ Protein calculated as percentage of total daily energy intake. Aged <1 year: 10% (70% animal protein); aged ≥1 year: 12% (50% animal protein).
§ Fat calculated as percentage of total daily energy intake (60% vegetable origin). Aged <6 months: 40%; aged 6 months to 2 years: 35%; aged 3–6 years and exceptionally active men: 25%; aged 7–13 years, 23%; aged ≥13 years: 20%.
‖ CHO (Carbohydrates) calculated as difference in percentage of total daily energy intake after protein and fat values established. Complex CHO: 75%. Dietary fiber, aged 19–50 years: 38 g/day. Sugar: ≤10%.

isomer fatty acid intake be limited to 1% total energy, equivalent to 2 g/day in a 2000 kcal diet.[22]

Carbohydrates

DRIs have been established only recently. For the first time, a 130 g minimum carbohydrate intake was established for everyone except children aged <1 year, based on the brain's average glucose demand. DRIs for carbohydrates are calculated as the percentage remaining once protein and fat portions of total energy intake has been established. Complex carbohydrates should make up 75% of the recommended carbohydrate intake and simple carbohydrates the remaining 25%. Sugar should not exceed 10% of total energy intake.

Dietary Fiber

For children aged >2 years, adequate intake values proposed by CJ Williams in 1995 were used,[23] calculated as age plus an additional 5 g/day (8 g/day for children aged 3 years up to 25 g/day at age 20 years). For adults aged 19–50, adequate intake is 25 g/day for women and 38 g/day for men, and for those aged >50 years, 21 g/day for women and 30 g/day for men.[4] The tolerable upper intake level is 55 g/day for adults and the sum of age plus 10 g/day for children.

Vitamins

DRIs for vitamins in Cuba were based on recommendations proposed by the 2001 FAO Expert Committee,[24] the Food and Nutrition Board of the US National Academy of Sciences,[4] and the most recent results of INHA research on the Cuban population's vitamin nutritional status.[25–37]

Vitamin A

DRIs were established as 375–400 µg Retinol Activity Equivalent (RAE) for children aged <1 year, 400–600 µg RAE for children aged ≥1 year and adolescents, 600 µg RAE for men, 500 µg RAE for women, 800 µg RAE for pregnant women, and 850 µg RAE for lactating women. The following new conversion factors for carotenoids in active Vitamin A were used:

1µg RAE = 1 µg all-trans retinol or 12 µg β-carotene or 24 µg α-carotene or β-criptoxantine

1 IU retinol = 0.3 µg retinol or 3 IU β-carotene.

Tolerable upper intake levels for Vitamin A (retinol only) are 600–900 µg for children aged ≤8 years, 1700 µg for those aged 9–13 years and 3000 µg for adults. Tolerable upper intake levels for pregnant women were set by INHA in 1998.[38]

Vitamin D

Recommendations were set at 5 µg colecalcipherol for children and adults aged 0–50 years, 10 µg for adults aged 50–65 years, and 15 µg for adults aged >65 years. Tolerable upper intake level is 25 µg for infants and 50 µg for children and adults.

Vitamin E

Given the varied activities of different Vitamin E compounds, Vitamin E activity is expressed as α-tocopherol (α-ET):

1 α-ET = 1 mg α-tocopherol or 2 mg β-tocopherol or 3 mg α-tocotrienol or 10 mg γ-tocopherol.

DRI is 4–6 α-ET for children aged <1 year, 6–7 α-ET for children aged 1–9 years, 11 α-ET for those aged 10–13 years, and 15 α-ET for adolescents and adults aged ≥14 years. The tolerable upper intake level is 200–800 α-ET for children and adolescents, and 1000 α-ET for adults.

Vitamin K

Research appears to indicate that 1 µg/kg/day intake is sufficient to maintain normal coagulation time in adults. DRIs were therefore set at 5–10 µg for children aged <1 year, 15–58 µg for children and adolescents, 55 µg for adult women, including those pregnant and lactating, and 65 µg for men. No tolerable upper intake level data is available for this vitamin.

Vitamin C

DRI is 25–30 mg for children aged <1 year and 30–40 mg for older children and adolescents. In order to enhance this nutrient's antioxidant action, 75 mg is recommended for women, 90 mg for men, 100 mg for pregnant women, and 120 mg for lactating women. An additional 35 mg is recommended for smokers, given the high oxidative stress associated with smoking. Tolerable upper intake levels are 400 mg for children aged <3 years, 650 mg for children aged ≤8 years, 1200–1800 mg for children aged 9–18 years, and 2000 mg for adults.

Vitamin B Complex and Choline

The DRI for each B-complex component was established based on its general organic functions and on deficiency prevention.

- **Folic acid** The term "Dietary Folate Equivalent" (DFE) was adopted in response to the variable absorption of different folic acid compounds: 1 DFE = 1.0 µg folate content in food or 0.6 µg added to or taken with food, or 0.5 µg as a medical supplement taken on an empty stomach. Folic acid recommendations are 65–200 DFE for children aged ≤6 years, 300 DFE for children aged 7–13 years, 400 DFE for everyone aged ≥14 years, 500 DFE for lactating women, and 600 DFE for pregnant women as prevention against neural tube defects in newborns. The tolerable upper intake level was established as 800–1000 DFE. As it is difficult for pregnant and lactating women to obtain the high folic acid DRI levels from natural food, fortified foods or safe pharmacological supplements are recommended.
- **Vitamin B1 (Thiamine)** The recommendation for this nutrient is closely related to energy and carbohydrate metabolism. Adequate nutritional status is provided by 0.5 mg/1000 kcal; for pregnant and lactating women, 0.6 mg/1000 kcal is recommended. For a wider safety margin, given the high sugar consumption in the Cuban population, the higher intakes proposed in 1996, based on higher recommended energy intakes, were maintained. Minimum recommended intake for adults is 1 mg if less than 1000 kcal are consumed. No tolerable upper intake level data is available.
- **Vitamin B2 (Riboflavin)** Intake requirements of 1–3 mg for this nutrient have not been modified greatly in recent years. Like thiamine, riboflavin is closely related to energy metabolism. A 0.6 mg/1000 kcal recommendation is acceptable; pregnant and lactating women should add 0.3 mg and 0.5 mg, respectively. As with thiamine, and for the same reason, the 1996 recommendations are maintained. Minimum recommended intake for adults is 1.2 mg. No tolerable upper intake level data is available.
- **Niacin** Protein metabolism and niacin are closely related. A share of this nutrient's requirement is fulfilled by tryptophan in

the diet: 60 mg tryptophan supplies an average of 1 mg niacin. The niacin equivalent (NE) is based on this ratio: 1 NE = 1 mg niacin = 60 mg dietary tryptophan. Niacin recommendations are based on caloric contribution. For children aged <6 months, 8 mg/100 kcal is recommended; for all other ages, 7 mg/1000 kcal. An additional 2 mg and 5 mg, are recommended during pregnancy and lactation, respectively. Tolerable upper intake values are 10–15 mg for children aged 1–8 years, 20 mg for children aged 9–13 years, and 30–35 mg for adults.

- **Vitamin B6 (Piridoxine.** Based on the relationship between this nutrient and protein, DRI is 0.02 mg/g protein. Tolerable upper intake levels are 30 mg for children aged 1–3 years and 100 mg for adults.
- **Vitamin B12 (Ciancobalamine)** DRI is 1.1–2.4 µg for children and adults. Until more reliable data is available on requirements for older adults, pharmacological supplements or fortified foods are recommended. Vitamin B12 is only found in animal products, so strictly vegetarian diets can be lacking in this nutrient. In such cases, fortified foods or supplements are recommended. No tolerable upper intake level data is available.
- **Pantothenic acid** No intake requirement has been established; DRI is based on observed intake sufficient to replace urinary excretion levels in healthy populations. Adequate intake 1.7–5.0 mg, depending on age, 6.0 mg for pregnant women, and 7.0 mg for lactating women. No tolerable upper intake level data is available.
- **Biotine** Adequate intake, based on observed intake in limited groups, ranges from 5 µg for infants to 30 µg for adults and pregnant women, and 35 µg for lactating women. No tolerable upper intake level data is available.
- **Choline** Adequate intake is based primarily on levels necessary to maintain liver function and prevent memory disorders. Recommended adequate intake, first established in 2002 by the Food and Nutrition Board of the US National Academy of Sciences, are 125–150 mg/day for children aged <1 year, 200–250 mg/day for children aged 1–8 years, 375 mg/day for those aged 9–13 years, 400–550 mg/day for children aged ≥13 years and adults, 450 mg/day for pregnant women, and 550 mg/day for lactating women. Tolerable upper intake levels of 1–3.5 grams have been proposed.[4]

Minerals and Trace Elements

DRIs were based on the 1996 Energy and Nutrient Recommendations for the Cuban Population;[1] on criteria established by the 2001 Joint FAO/WHO Expert Committee,[24] the Food and Nutrition Board of the US National Academy of Sciences, and other countries; and on results of recent INHA studies of the Cuban population's nutritional status for minerals and trace elements.[39–45] For sodium, chlorine and potassium, minimum requirements are proposed, since available elements are insufficient to establish recommended or adequate intake levels.

- **Sodium** The minimum sodium requirement ranges from 120 mg in the first months of life to 500 mg in adulthood and during pregnancy and lactation, and may be higher when there is profuse sweating or with certain illnesses. More than 2.3 g/day sodium (5.8 g kitchen salt) is not recommended. Tolerable upper intake levels are 1.5–1.9 g for children aged 1–8 years and 2.3 g for all other ages.
- **Chlorine** Minimum requirements range from 180 mg in the first months of life to 750 mg for pregnant and lactating women. A 5 g/day intake of common salt provides 2100 mg of chlorine, almost three times the highest minimum requirement.
- **Potassium** Minimum requirements range from 500 mg for infants to 2000 mg for adults. Adult tolerable upper intake level is 3500 mg/day.
- **Calcium** Calcium deficiency, as well as the inefficient utilization of calcium by metabolism, is a current topic in nutrition research. Many dietary, hormonal and lifestyle factors influence the bioavailability of this nutrient; therefore, increasing recommended intake levels does not make sense without considering these other factors. Adequate intakes (AIs) have been proposed that can be attained practically: 300–600 mg for children aged <7 years; 800 mg for children aged ≥7 years and adults; and 1000 mg for pregnant and lactating women. Tolerable upper intake levels are 2500 mg/day for children aged >1 year and adults.
- **Phosphorus** DRIs are determined by calcium AIs and were therefore set at 200–275 mg for children aged <1 year, 500–600 mg for children aged 1–7 years, 800 mg for children aged ≥7 years and adults, and 1000 mg for pregnant and lactating women. The calcium to phosphorus ratio is 1.5 for children aged <1 year and 1.0 for all other ages. Tolerable upper intake levels are 3000 mg for children aged 1–8 years and adults aged ≥70 years; 4000 mg for children and adults aged 9–69; 3500 mg for pregnant women and 4000 mg for lactating women.
- **Magnesium** Given this mineral's importance, the DRIs established in 1996 are considered adequate and were maintained, ranging from 50–150 mg for children aged <2 years to 500 mg during pregnancy and lactation. Tolerable upper intake level is 65–110 mg for children and 350 mg for adults (only as chemically-synthesized supplements and not from food).
- **Iron** The most recent research on iron metabolism and Cuba's nutritional status for iron were taken into account. DRI calculations assumed that Cubans consume a mixed diet with intermediate iron bioavailability. Recommended amounts were raised for children aged 6 months to 12 years, adults aged ≥18 years, and lactating women. Iron bioavailability is affected by many factors that should be considered when creating diets. For example, simultaneous intake of 25–100 mg of vitamin C can increase non-heminic iron absorption 2–4 times. Given the high recommended iron intake for pregnant women (30 mg), foods fortified with this nutrient or pharmacological supplements are recommended. Tolerable upper intake levels are 40 mg for children and adolescents, and 45 mg for adults.
- **Selenium** The 1996 DRI was maintained without including the 2001 Joint FAO/WHO Expert Committee proposal to reduce it by 50%. These much higher recommendations should help protect against frequent complications of the chronic diseases most prevalent in Cuba. The safety margin provided by the 400 µg adult tolerable upper intake level is adequate to sustain these recommendations. Tolerable upper intake levels are 45–90 µg for children aged ≥3 years, 150–280 µg for children aged 4–13 years, and 400 µg for all other ages.
- **Manganese** Since existing data is insufficient to establish DRIs, adequate intake amounts were proposed. Tolerable upper intake levels are 2–6 mg for children and 11 mg for adults.

- **Zinc** In order to provide a wider safety margin, low bioavailabilty of this nutrient in the diet was assumed. Adult tolerable upper intake level is 40 mg/day.
- **Copper** DRIs for this nutrient were set for the first time at 400–700 μg for children <1 year and 900 μg for all other ages, including pregnant and lactating women. Tolerable upper intake levels are 1000–5000 μg for children aged 1–13 years and 10,000 μg for adults.
- **Iodine** The DRI for children aged <6 months was raised considerably, compared to the 1996 recommendation, but is similar for all other groups, reaching 200 μg for pregnant and lactating women. Tolerable upper intake level is 200–600 μg for children aged 1–13 years and 1100 μg for adults.
- **Fluoride** Adequate intake is the amount required to reduce risk of dental cavities without producing side effects. Tolerable upper intake level for adults is 10 mg.
- **Molybdenum** DRI is 45 mg for men and women, and 50 mg for pregnant and lactating women. This value is significantly lower than the 75–250 μg previously proposed by the Food and Nutrition Board of the US National Academy of Sciences. Tolerable upper intake levels are 100–600 μg for children aged 1–8 years, 1100 μg for children aged 9–13 years and 1700–2000 μg for adults.
- **Chromium** Adequate intake values are 35 μg for men, 25 μg for women, 30 μg during pregnancy and 45 μg for lactating women. Although tolerable upper intake levels are not established, caution is recommended to avoid exceeding established limits.

Population-Averaged Dietary Reference Intakes for Cuba (Table 3)

Population-averaged food energy and macronutrient reference intakes are essential inputs for national food planning and availability assessment. Averaged dietary reference intakes from 2001 were updated based on the new DRIs for energy and nutrients presented in this document and calculated using the 1990 FAO methodology,[46] the 2006 Cuban population structure according to the National Statistics Bureau (ONE, its Spanish acronym), and population groupings used by the Cuban Ministry of Domestic Trade for food distribution.

Table 3: Population-Averaged Dietary Reference Intakes, Cuba

	Total Population	Age Groups (years)					
		0–2	3–6	7–13	14–17	18–60	>60
Energy (kcal)	2300	1074	1638	2101	2611	2457	2079
Protein (g)	69	31	49	63	78	74	62
Fat (g)	53	42	46	54	58	55	46
Essential Fatty Acids (g)	20	11	15	19	23	22	19
Total Carbohydrates (g)	385	142	258	341	444	418	354
Complex Carbohydrates (g)	288	107	192	257	333	313	265
Simple Carbohydrates (g)	97	35	66	84	111	105	88
Vitamins							
Vitamin A (μg)	553	400	450	557	600	550	600
Vitamin D (μg)	7	5	5	5	5	5	15
Vitamin E (mg)	14	6	7	9	15	15	15
Vitamin K (μg)	54	13	20	37	47	60	60
Vitamin C (mg)	72	30	30	38	40	82	83
Vitamin B_1 (mg)	1.2	0.6	0.8	1.0	1.2	1.4	1.2
Vitamin B_2 (mg)	1.5	0.7	1.0	1.2	1.5	1.6	1.4
Niacin (mg)	17	8	12	15	18	19	17
Vitamin B_6 (mg)	2.0	0.8	1.3	1.7	2.0	2.1	2.1
Vitamin B_{12} (μg)	2.3	1.0	1.7	2.2	2.4	2.4	2.4
Folic acid (μg)	373	116	200	300	400	400	400
Pantothenic acid (mg)	5	2	3	5	5	5	5
Biotine (μg)	28	7	12	23	25	30	30
Minerals							
Calcium (mg)	785	378	553	800	800	800	800
Phosphorous (mg)	702	288	447	672	900	700	800
Iron (mg)	16	11	12	14	17	17	13
Zinc (mg)	12	4	9	14	16	12	12
Copper (μg)	893	658	853	900	900	900	900
Sodium (mg)	482	168	354	479	500	500	500
Potassium (mg)	1930	700	1400	1900	2000	2000	2000
Magnesium (mg)	309	82	169	293	351	325	324
Manganese (mg)	2	1	1	2	2	2	2
Iodine (μg)	146	90	115	137	150	150	150
Chromium (μg)	27	4	12	22	30	30	25
Selenium (μg)	50	14	19	31	50	55	55
Fluoride (mg)	2	0	1	3	3	3	5
Energy Contribution (%)							
Protein	12	12	12	12	12	12	12
Total fat	21	35	25	23	20	20	20
Essential fatty acids	8	9	8	8	8	8	8
Total carbohydrates	67	53	63	65	68	68	68
Complex carbohydrates	50	40	47	49	51	51	51
Simple carbohydrates	17	13	16	16	17	17	17

Reference intakes for food energy corresponding to an "active" PAL were used for adult men, while intakes corresponding to a "low active" PAL was used for women. Height values of 1.72 m for men and 1.60 m for women, representing the 75th percentile in anthropometric charts of the Cuban population, were used.[47] Additional requirements of pregnant and lactating women were estimated based on 115,000 pregnant women per year (considering the number of live births), a figure obtained from the Cuban Ministry of Health's 2007 Statistical Yearbook.[48]

The following percentages of macronutrient contributions to total energy intake from food were used:
Protein: 10% energy, children aged <1 year, 12% all other ages.
Fat: 40% energy for infants aged <6 months, 35% for children

aged 6 months to 2 years, 25% for children aged 2–6 years, 23% for children aged 7–13 years, and 20% for all other ages.

Essential amino acids: 8% total energy.

Carbohydrates: Calculated as the percentage remaining once protein and fat portions of total energy intake has been established. Complex carbohydrates should make up 75% of the recommended carbohydrate intake.

For dietary planning purposes, adding 20% to the 2300 kcal/day averaged reference intake for the Cuban population is recommended.

Nutritional Supplements and Fortified Foods At present, no study has demonstrated that taking isolated chemically-synthesized nutrients has the same beneficial effect as that associated with eating fruits, vegetables, whole grains, legumes and other natural food. These effects may be due to the combined, synergistic action of multiple components in food, many of which are as yet unidentified. This point of view is timely in an age when supplements and fortified foods in relatively concentrated form are heavily abused for the purpose of satisfying dietary reference intake amounts. Ideally, nutritional needs can be satisfied with food, although consideration can be made for some nutrients and vulnerable groups, such as iron and folic acid for pregnant women, whose high demands are not easily met with current diets.

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