Original research

Pan American Journal of Public Health

Nutrition situation in Latin America and the Caribbean: current scenario, past trends, and data gaps

Luis Galicia,[1] *Rubén Grajeda,*[1] *and Daniel López de Romaña*[2]

Suggested citation Galicia L, Grajeda R, López de Romaña D. Nutrition situation in Latin America and the Caribbean: current scenario, past trends, and data gaps. Rev Panam Salud Publica. 2016;40(2):104–13.

ABSTRACT

Objective. *To determine the current nutritional status in Latin America and the Caribbean (LAC) and identify data gaps and trends in nutrition surveillance.*

Methods. *A systematic Internet search was conducted to identify official sources that allowed for monitoring of LAC countries' nutritional status, including progress toward World Health Organization Global Nutrition Targets 2025. Reports from national nutrition surveillance systems and reports on nationally representative surveys were collected and collated to 1) analyze nutritional status, based on life-course anthropometric indicators and biomarkers, and 2) identify gaps in data availability and trends in nutritional deficiencies. Information on iron, vitamin A, iodine, folate, and vitamin B12 deficiency was also collected and collated.*

Results. *Twenty-two of the 46 LAC countries/territories (48%) had information on undernutrition (stunting, underweight, and wasting) in children under 5 years old and women of reproductive age (WRA). Seventeen countries (38%) had information on anemia in children under 5 years old and WRA, and 12 (27%) had information on anemia in pregnant women. Although overall nutritional status has improved in the past few decades in all countries in the region, some LAC countries still had a high prevalence of stunting and anemia in children and WRA. Overweight affected at least 50% of WRA in nine countries with available data, and was increasing in children. Data for school-age children, adolescents, adult males, and older adults were scarce in the region.*

Conclusions. *Overall nutritional status has improved in the LAC countries with available information, but more efforts are needed to scale up nutrition-sensitive and nutrition-specific interventions to tackle malnutrition in all its forms, as stunting, anemia, and vitamin A deficiency are still a public health problem in many countries, and overweight is an epidemic. Nutrition information systems are weak in the region, and countries need to strengthen their capacity to monitor nutritional status indicators.*

Key words Nutritional status; anemia; micronutrients, deficiency; Latin America; Caribbean region.

As highlighted in the International Food Policy Research Institute's recently published Global Nutrition Report (1), the world is not on track to meet the six World Health Organization (WHO) Global Nutrition Targets for 2025[3] (1, 2). Stunting, overweight, and obesity are major public health problems in many regions, and anemia is the most prevalent nutrition deficiency in the world, especially in young children and women of reproductive age (WRA). Latin America and the Caribbean (LAC) has achieved the greatest reduction worldwide in undernutrition (stunting, underweight, and wasting) (3), but has the highest prevalence of overweight worldwide (4, 5). In recent years, overweight and obesity have reached epidemic proportions in most LAC countries. Some countries in the region have a double burden of malnutrition in which stunting and/or micronutrient deficiencies coexist with overweight and obesity.

To improve maternal, infant, and young child nutrition, WHO member countries have committed to achieving the Global Nutrition Targets by 2025.

[1] Pan American Health Organization, Washington, D.C., United States of America. Send correspondence to: Luis Galicia, galicialui@paho.org

[2] Micronutrient Initiative, Ottawa, Ontario, Canada.

[3] Stunting: 40% reduction in the number of children under-5 who are stunted; anemia: 50% reduction of anemia in women of reproductive age; low birth weight: 30% reduction in low birth weight; childhood overweight: no increase in childhood overweight; breastfeeding: increase the rate of exclusive breastfeeding in the first 6 months up to at least 50%; wasting: reduce and maintain childhood wasting to less than 5%.

To meet these goals countries need nutrition status information systems for monitoring and measuring achievements and informing decision-making.

The objective of this study was to determine the current nutritional status in LAC countries and identify data gaps and trends in nutrition surveillance and research.

MATERIALS AND METHODS

A systematic Internet search was conducted to identify official sources that allowed for monitoring of LAC countries' nutritional status, including progress toward the Global Nutrition Targets 2025. Information from reports of national nutrition surveillance systems and reports on nationally representative surveys was collected and collated in order to 1) perform a secondary data analysis of LAC countries' nutritional status, based on life-course anthropometric indicators and biomarkers, and 2) identify gaps in data availability and trends in nutritional deficiencies, particularly anemia. Information on iron, vitamin A, iodine, folate, and vitamin B12 deficiency was also collected and collated.

The search was conducted through the websites of health ministries, national statistics institutes, the Demographic and Health Surveys (DHS) Program (www.dhsprogram.com), the United Nations Children's Fund (UNICEF) Multiple Indicator Cluster Surveys (MICS) program (http://mics.unicef.org/surveys), and the WHO Vitamin and Mineral Nutrition Information System (VMNIS) (http://www.who.int/vmnis/database/en/). Systematic reviews, meta-analyses, and national and international reports on 1) nutritional status, measured by anthropometric indicators and 2) micronutrient status, published between 1985 and 2014, were scanned to identify official data sources. If no information was found using these search strategies, key persons at ministries of health or Pan American Health Organization (PAHO) country offices were contacted to request nationally representative surveys that met the abovementioned criteria. If no nationally representative reports were found using these strategies, the data were considered "not available."

WHO indicators and cutoff points were used to assess anthropometric and micronutrient status. The anthropometric indicators/biomarkers that were collated included stunting, underweight, wasting, and overweight. The following cutoff points were applied respectively, based on WHO Child Growth Standards 2006: height for age, < –2 SD (stunting); weight for age, < –2 SD (underweight); weight for height, < –2 SD (wasting); and weight for height, > +2 SD (overweight). Data on nutritional status of children under 5 years old published before 2006, which were based on the U.S. Centers for Disease Control and Prevention (CDC) National Center for Health Statistics (NCHS) criteria, were converted using algorithms based on the 2006 WHO Child Growth Standards (6). Anthropometric indicators of nutritional status for school-age children and adolescents were searched and the information collated according to WHO growth reference data for 2007 (7).

Anemia prevalence rates were extracted for children, WRA, and pregnant women from nationally representative health and nutrition reports. Anemia was defined as follows: hemoglobin < 110 g/L (children < 5 years old); hemoglobin < 115 g/L (school-age children 5–11 years old); hemoglobin < 120 g/L (adolescents 12–14 years old, and WRA); hemoglobin < 130 g/L (adolescents 15 years and older); and hemoglobin < 110 g/L (pregnant women).

Anemia prevalence was categorized as follows: < 5.0% (indicating no public health problem); 5.0%–19.9% (mild public health problem); 20.0%–39.9% (moderate public health problem); and ≥ 40.0% (severe public health problem) (8).

Iron deficiency prevalence, defined as serum ferritin < 12 µg/dL in children under 5 years old and < 15 µg/dL in WRA, was collated from nationally representative surveys.

Prevalence rates of vitamin A deficiency were obtained for children under 5 years old, WRA, and pregnant women. Vitamin A deficiency at the population level was defined as serum retinol < 0.70 µmol/L for all age groups. In children 6–71 months old, prevalence of low serum retinol as a public health problem was categorized by level of severity as follows: 2.0%–9.0% (mild); 10.0%–19.0% (moderate); ≥ 20.0% (severe) (9).

Median urinary iodine concentration in school-age children (6 years or older) was used to assess iodine status as follows: < 100 µg/L, insufficient iodine intake; 100–199 µg/L, adequate iodine intake; 200–299 µg/L, intake above iodine requirements; ≥ 300 µg/L, excessive intake (10).

Folate deficiency (serum folate 4 ng/mL or red blood cell folate < 151 ng/mL) and vitamin B12 deficiency (plasma vitamin B12 < 203 pg/mL) were obtained as a national prevalence.

Gaps in data availability were measured by counting the number of countries with no data available for a specific indicator and identifying the information that those countries do not have available. Current nutritional status was determined based on nutritional deficiency prevalence rates extracted from the most recent report. When countries had more than one survey measuring a specific nutritional deficiency, trends were calculated as follows: the annual rate of change in prevalence was obtained by subtracting the oldest rate from the newest rate and dividing the result by the number of years between them; the relative rate of change was calculated by subtracting the oldest rate from the newest rate and dividing the result by the initial value. The results are presented by country and grouped by PAHO subregions (11).

RESULTS

Anthropometry

Twenty-two of the 46 LAC countries and territories had at least one nationally representative survey (e.g., DHS, MICS, Nutrition and Health Survey (NHS), or National Micronutrient Survey (NMS)[4]) that included height for age, weight for age, and weight for height in children under 5 years old. Sixteen of those 22 countries had at least two surveys. Table 1 shows the most recent prevalence data found in this study for stunting, underweight, wasting, and overweight in children under 5 years old and overweight and obesity in WRA. A complete list of available data by country is provided in the Supplementary Material Table 1. No reports from national health information systems were found.

Nationally representative surveys on nutritional status in school-age children

[4] The DHS, MICS, and NMS programs have quality control criteria and designs and have been validated in several countries as a reliable source of information (12).

TABLE 1. Prevalence (%) of anthropometric indicators of nutritional status and anemia in children under 5 years old and women of reproductive age (WRA) in countries with available nationally representative data, Latin America and the Caribbean, 1985–2014

	Children < 5 years old					WRA			Pregnant women
Subregion/country (survey year)	Stunting (HAZ[a] < −2 SD[b])	Underweight (WAZ[c] < −2 SD)	Wasting (WHZ[d] < −2 SD)	Overweight (WHZ > +2 SD)	Anemia (hemoglobin < 110 g/L)	Overweight (BMI[e] ≥ 25 kg/m²)	Obesity (BMI ≥ 30 kg/m²)	Anemia (hemoglobin < 120 g/L)	Anemia (hemoglobin < 110 g/L)
Mexico									
Mexico (2012)	13.6	2.8	1.6	9.7[f]	23.3	–[g]	–	11.6	17.9
Central America									
Belize (2011)	19.3	6.2	3.3	7.9	20.6	–	–	22.7	18.4
Costa Rica (2008–2009)	5.6	1.1	1.0	8.1	7.6	59.7	–	10.2	–
El Salvador (2008)	19.2	5.5	1.0	6.0	22.9	57.2	25.6	10.0	7.5
Guatemala (2008–2009)	49.8	13.1	1.4	5.7[h]	47.7	50.5	15.4	21.4	29.1
Honduras (2011–2012)	22.6	7.0	1.4	5.1	29.1	51.3	22.1	15.1	18.8
Nicaragua (2011–2012)	17.3	5.0	2.1	–	10.5	50.0[i]	17.1[i]	1.5	–
Panama (2008)	19.1	3.9	1.6[f]	11.3[f]	36.0	49.1[j]	18.7[j]	40.3	36.4
Latin Caribbean									
Dominican Republic (2013)	6.9	3.8	2.0	7.3	28.1	50.5	20.8	33.8	–
Haiti (2012)	21.9	11.4	5.1	3.6	65.0	25.3	7.8	49.3	53.9
Andean subregion									
Bolivia (2008)	27.1	4.3	1.4	8.5	61.3	49.7	17.4	34.9	49.4
Colombia (2010)	13.2	3.4	0.9	4.8	27.5	45.3	15.3	7.6	17.9
Ecuador (2011–2013)	25.3	6.4	2.4	8.6	25.7	60.8	20.4	15.0	–
Peru (2013)	17.5	3.5	0.4	–	34.0	56.4	20.2	18.7	29.5
Brazil									
Brazil (2006)	6.7	1.8	1.5	7.3	29.4	–	16.1	29.4	–
Southern Cone									
Argentina (2007)	8.2	2.3	1.2	9.8	16.5[k]	44.3	19.4	18.7[l]	30.5[l]
Paraguay (1990)	21.8	3.2	0.5	–	–	–	–	–	–
Non-Latin Caribbean									
Barbados (2012)	7.7	3.5	6.8	12.2	–	–	–	–	–
Guyana (2009)	18.2	10.5	5.3	6.2	39.3	48.0	21.7	37.4	37.5
Saint Lucia (2012)	2.5	2.8	3.7	6.3	–	–	–	–	–
Suriname (2010)	8.8	5.8	5.0	4.0	–	–	–	–	–
Trinidad & Tobago (2000)	5.6	5.2	5.6	5.5[m]	–	–	–	–	–

Source: Prepared by the authors based on information from the surveys listed in Supplementary Material Table 1.

[a] HAZ: Z-score height for age.
[b] SD: standard deviation.
[c] WAZ: Z-score for weight for age.
[d] WHZ: Z-score for weight for height.
[e] BMI: body mass index.
[f] Prevalence corresponds to data measured with BMI for age.
[g] Data not available.
[h] Data correspond to survey from 2002.
[i] Data correspond to survey from 2009.
[j] Data correspond to survey from 2003.
[k] In children 6–72 months old.
[l] In women 10–49 years old.
[m] Data correspond to survey from 1987.

and adolescents were available only for Brazil, Colombia, Dominican Republic, Ecuador, and Mexico, and the age groups assessed by each survey varied by country.

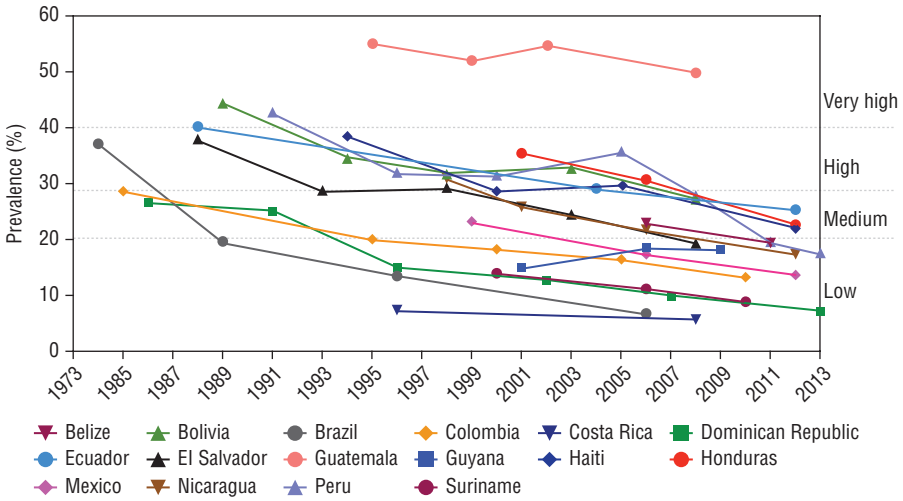
Stunting. Guatemala had the highest prevalence of stunting in children under 5 years old (49.8%). Based on WHO Expert Committee criteria (13), prevalence of stunting in the under-5 age group is very high in Guatemala, and low in Belize, Brazil, Colombia, Costa Rica, Dominican Republic, El Salvador, Mexico, Nicaragua, Peru, and Suriname (Figure 1). Prevalence of stunting in that age group decreased by at least 15% between the first and last reported prevalence for all countries with available data except Guatemala (where it decreased by 9.6%), and the relative reduction was largest in Brazil (82%), followed by Dominican Republic (72%), Peru (59%), and El Salvador (49%) (Figure 1).

Underweight. Underweight in children under 5 years old decreased in all countries except Belize and Dominican Republic, where there was an increase of 10.7% and 22.6% respectively (Supplementary Material Figure 1). Brazil had the largest decrease in underweight (67%) in this age group and Guatemala had the lowest (44%).

Wasting. According to the latest available information (2006–2013), wasting prevalence in children under 5 years old was below 5% for most countries, a level considered acceptable by WHO (Table 1).

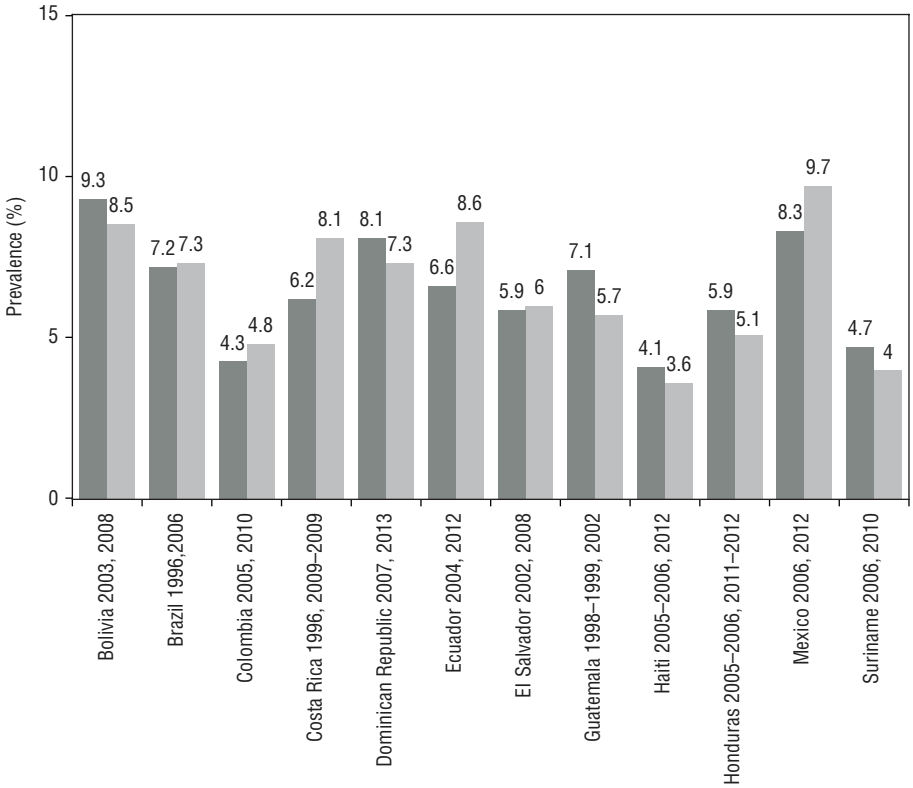
Overweight and obesity. Overweight and obesity in children under 5 years old was above 5% in most countries (Table 1). Six out of 12 countries with at least two surveys experienced a decrease in the prevalence of overweight in children under 5 years old over a five- or six-year period (Figure 2).

FIGURE 1. Trends in the prevalence of stunting in children under 5 years old in countries with available, nationally representative data,[a] Latin America and the Caribbean, 1974–2014



Source: Prepared by the authors based on information from the surveys listed in Supplementary Material Table 1.
[a] Z-score height for age (HAZ) < –2 standard deviation.

FIGURE 2. Trends in the prevalence of overweight in children under 5 years old in countries with available, nationally representative data,[a] Latin American and the Caribbean, 1985–2014



Source: Prepared by the authors based on information from the surveys listed in Supplementary Material Table 1.
[a] Z-score for weight for height (WHZ) > +2 standard deviation.

In countries with available data, overweight in school-age children ranged from 18.9% (Colombia) to 33.5% (Mexico) and obesity ranged from 5.2% (Colombia) to 14.6% (Mexico). In adolescents, overweight ranged from 16.7% (Colombia) to 43.9% (Mexico), and obesity ranged from 3.4% (Colombia) to 13.3% (Mexico) in countries with available data.

Overweight in WRA is above 40% for all countries in the region except Haiti (25.3%), and obesity is above 10% for all countries except Haiti (7.8%).

Anemia

National reports on anemia prevalence in children under 5 years old and WRA were found for 17 of 46 countries/territories; data for pregnant women were found for 12 countries (Table 1); and four countries reported anemia in adolescent boys and girls (not shown). Sixteen reports were published between 2006 and 2013 and half of them were reports on NHS or NMS. Eleven countries had more than one data point for anemia in children under 5 years old (not shown), 10 countries had more than one data point for WRA (Figure 3), and six countries had more than one data point for pregnant women (not shown).

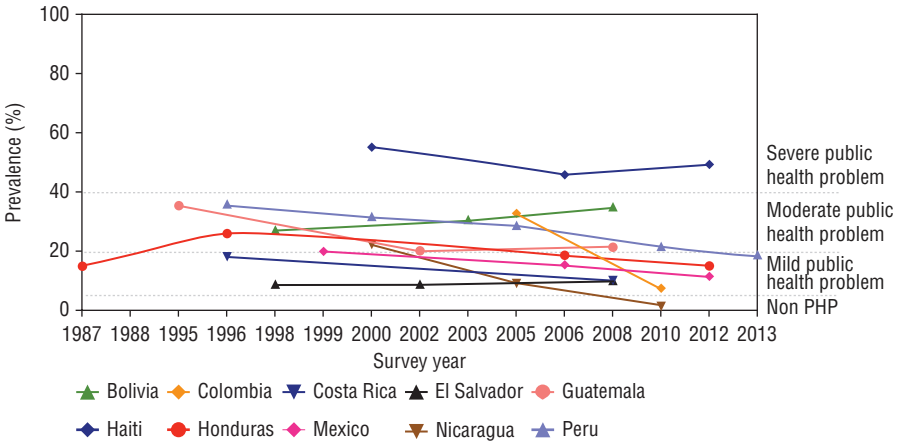
According to the most recent data available, the prevalence of anemia in children under 5 years old ranged from 7.6% to 65.0% (Table 1). Costa Rica and Nicaragua were the only countries in the region where anemia is a mild public health problem in this age group.[5] In 11 countries, anemia is considered a moderate public health problem for this age group (with prevalence between 20.0%–39.9%). In Guatemala, Bolivia, and Haiti, anemia in children under 5 years old is a severe public health problem, with a prevalence of 47.7%, 61.3%, and 65.0% respectively. A downward trend was observed in Colombia (–1.1 percentage points per year), Costa Rica (–1.6), Honduras (–1.3), Mexico (–0.01), Nicaragua (–2.3), and Peru (–1.5), but an upward trend was observed in Bolivia (+2.1 percentage points per year), Ecuador (+0.4), El Salvador (+0.6), Guatemala (+1.5), and Haiti (+0.7) (not shown).

For adolescents, Mexico reported the lowest prevalence rate (5.6%; 12–19 years old), followed by Ecuador (7.0%; 12–19 years old), Colombia (10.6%; 13–17 years old), and Dominican Republic (30.9%; 12–14 years old) (not shown).

According to the most recent data, the lowest anemia prevalence rate in WRA was reported by Nicaragua (1.5%)—the

[5] Argentina also reported a prevalence rate for anemia that qualified it as a "mild" public health problem (16.5%), but the survey cohort was from 6 to 72 months of age, so it was not included here.

FIGURE 3. Trends in the prevalence of anemia in women of reproductive age in countries with available, nationally representative data,[a] Latin America and the Caribbean, 1985–2014



Source: Prepared by the authors based on information from the surveys listed in Supplementary Material Table 1.
[a] Hemoglobin (Hgb < 120 g/L).

only country studied where anemia is not a public health problem. Anemia is a mild public health problem for this group in eight countries, moderate in six, and severe in two (Haiti and Panama, which had a prevalence of 49.3% and 40.3% respectively). Anemia in WRA has decreased in seven countries (Figure 3), where the rate of change varied from 0.5 to 5.0 percentage points per year. In Nicaragua, WRA anemia prevalence decreased by 93% over 10 years (from 22.3% to 1.5%); Colombia also had a large decrease (a drop of 77% over five years). Anemia in WRA dropped in Costa Rica, Guatemala, Mexico, and Peru by close to 45%, and in Haiti by 10%. However, in Bolivia and El Salvador, anemia increased by nearly 30% and 15% respectively, and by less than one percentage point in Honduras (0.7%).

Prevalence of anemia in pregnant women varied across the countries with available data from 7.5% (El Salvador) to 53.9% (Haiti) (Table 1). Anemia is a mild public health problem for this population in five countries (36% of the countries with available data), a moderate public health problem in five countries, and a severe public health problem in two countries—Bolivia and Haiti, which had a prevalence of 49.4% and (53.9% respectively). Trend analysis for the countries with more than one data point showed that anemia in pregnant women increased 2.1 percentage points per year in Bolivia, a total increase of 77% over 10 years. An opposite trend for this group was observed in Colombia (–60% in five years), Guatemala (–25.6% in 13 years), Haiti (–15% in 12 years), Honduras (–41% in 15 years), Mexico (–31.7% in 13 years), and Peru (–16% in 17 years).

Micronutrients

Seven (15%) of the 46 LAC countries and territories had recent data on iron deficiency measured by serum ferritin. Information on folate status in both children and WRA was found for three countries (7%). Three countries had available information on the vitamin B12 status of children, four countries (9%) had information for WRA, and two countries (4%) had information for pregnant women. Nineteen countries had at least one nationally representative survey on vitamin A status in children under 5 years old, and of those, nine were conducted between 2006 and 2014 and 10 were conducted between 1995 and 2005. Three countries had more than one data point for vitamin A status between 1996 and 2014 (Supplementary Material Table 1).

Iron. Prevalence of iron deficiency in children 6–59 months old for the four countries with available information ranged from 9.9% (Ecuador) to 32.9% (Bolivia) (Table 2). In the five countries with available information on iron deficiency for nonpregnant WRA, prevalence ranged from 8.0% (Nicaragua) to 18.7% (Argentina).

Folate and vitamin B12. Folate deficiency prevalence was less than 6% for all groups in the five countries with available information. Vitamin B12 deficiency was found in 18.2% of pregnant women in Argentina and in 18.6% of pregnant women in Colombia; 13.2% of WRA in Colombia had vitamin B12 deficiency.

Vitamin A. In children under 5 years old, in the 19 countries with recent data available, vitamin A deficiency was a severe public health problem in four countries, a moderate public health problem in four countries, and a mild public health problem in eight countries (Table 2). Vitamin A deficiency was not a public health problem in Belize or Guatemala. The most recent NMS in Guatemala showed that 88% of children 6–59 months old have serum retinol above 30 µg/L (14).

Iodine. Iodine deficiency has decreased in recent years in the LAC region. Among the countries with available data, iodine nutrition in school-age children was adequate (median urinary excretion 100–199 µg/L) in five and above the recommended threshold (≥ 200 µg/L) in 11 above the recommended threshold (≥ 200 µg/L) (Table 2). For example, as shown in the table, median urinary iodine excretion in that age group ranged from 200 to 299 µg/L in Chile, Dominican Republic, Ecuador, Nicaragua, and Peru, and was more than 300 µg/L in Brazil, Colombia, Costa Rica, Honduras, Paraguay, and Uruguay, according to the latest data available.

DISCUSSION

LAC countries have committed to achieving the Global Nutrition Targets for 2025, and part of this effort involves establishing reliable and timely information systems that allow for informed decision-making, accountability, and reporting of achievement levels. WHO recognizes that information systems are weak in many countries (15). Therefore, the information obtained from them is subject to modeling to provide comparable information for monitoring indicators (15).

Life-course nutrition surveillance in the region is mainly limited to anthropometric indicators of nutritional status and anemia for children under 5 years old and WRA; only a few LAC countries collect data for monitoring nutritional status of school-age children, adolescents, adult males, and/or older adults. Available data from the region on

TABLE 2. Prevalence of micronutrient deficiencies for selected population groups in countries with publicly available, nationally representative information, Latin America and the Caribbean, 1985–2014

Nutrient	Country	Year	–	Prevalence of deficiency (%)
Iron (Serum ferritin < 12 µg/dL in children < 5 years old; < 15 µg/dL for women of reproductive age)	Argentina	2008	Children 6–23 months	35.5
			Non-pregnant females 10–49 years	18.7
			Pregnant females 10–49 years	36.7
	Bolivia	2002	Children 6–59 months	32.9
	Costa Rica	2008–2009	Children 1–6 years	5.9
			Non-pregnant women 15–44 years	8.7
	Dominican Republic	2012	Children 6–14 years	2.1
	Ecuador	2012	Children 6–59 months	9.9
			Children 5–11 years	1.8
			Adolescents 12–19 years	7.1
			Men 20–59 years	0.6
			Women 20–49 years	14.6
	Guatemala	2009–2010	Children 6–59 months	18.6
			Women 15–44 years	11.7
	Nicaragua	2009	Children 6–59 months	18.7
			Women 15–49 years	8.0
Vitamin A (serum retinol < 70 µmol/L)	Antigua & Barbuda	1997	Children 1–5 years	7.4
	Argentina	2007	Children 2–5 years	14.3
	Belize	2011–2012	Children 6–59 months	1.0
			Women 15–49 years	1.2
	Colombia	2010	Children 1–4 years	24.3
	Costa Rica	2008–2009	Children 1–6 years	2.8
			Children 7–12 years	2.1
	Cuba	2002	Children 6–24 months	3.6
	Dominica	2002	Children 1–5 years	4.2
	Dominican Republic	2012	Children 6–14 years	7.2[a]
	Ecuador	2011–2013	Children 6–59 months	17.5
			Children 5–9 years	10.9
	Guatemala	2009–2010	Children 6–59 months	0.0
	Guyana	2002	Children 1–5 years	4.1
	Haiti	2005	Children 6–59 months	32.0
	Honduras	1996	Children 1–5 years	13.8
	Jamaica	1998	Children 1–5 years	29.4
	Mexico	1999	Children 0–4 years	27.3
			Children 5–11 years	21.7
			Females 12–49 years	4.4
	Nicaragua	2009	Children 6–59 months	3.1
	Panama	1999	Children 12–59 months	9.4
	Peru	2008	Children < 5 years	12.1
			Women 15–49 years	1.5
	Saint Vincent & the Grenadines	2002	Children 12–59 months	2.1
Vitamin B12 (serum vitamin B12 < 200 pg/mL)	Argentina	2007	Females 10–49 years	3.4[b]
			Pregnant females 10–49 years	18.2
	Chile	2009–2010	Adults ≥ 65 years	8.5
	Colombia	2010	Children 1–4 years	0.0
			Children 5–12 years	2.8
			Females 13–49 years	13.2
			Pregnant females 13–49 years	18.6
	Costa Rica	2008–2009	Women 15–44 years	4.8
			Women 20–64 years	6.4
			Men 20–64 years	2.9
			Adults ≥ 65 years	5.3
	Dominican Republic	2012	Children 6–14 years	12.2
	Ecuador	2011–2013	Females 10–59 years	5.5
	Guatemala	2009	Children 6–59 months	22.5

(*Continued*)

TABLE 2. (*Continued*). Prevalence of micronutrient deficiencies for selected population groups in countries with publicly available, nationally representative information, Latin America and the Caribbean, 1985–2014

Nutrient	Country	Year	Group	Prevalence of deficiency (%)
Folate	Argentina	2007	Females 10–49 years	0.8[c]
	Costa Rica	2008–2009	Women 15–44 years	3.8[d]
			Adults ≥ 65 years	1.4[d]
	Dominican Republic	2012	Children 6–14 years	5.9[e]
	Ecuador	2012	Children 6–50 months	0.5[f]
			Children 5–9 years	0.2[e]
			Children 12–14 years	1.1[e]
			Children 15–19 years	1.4[e]
			Females 12–49 years	0.8[e]
	Guatemala	2009	Children 6–59 months	0.0[c]
			Children 6–59 months	2.1[g]
Iodine	Belize	1995	Children 7–9 years	184.0
	Bolivia	2006	Children 7–9 years	191.5
	Brazil	2000	Children 6–12 years	360.0
	Chile	2006	Children 7–9 years	252.0
	Colombia	2002	Children 7–9 years	415.0
	Costa Rica	2008–2009	Children 7–12 years	314.0
	Cuba	2011–2012	Children 6–11 years	176.3
	Dominican Republic	2012	Children 6–14 years	223.0
	Ecuador	2012	Children 6–12 years	234.0
			Women 20–49 years	203.0
	Honduras	2005	Children 6–14 years	356.0
	Nicaragua	2000	Children 6–9 years	271.0
	Panama	2008	Children 7–9 years	198.0
	Paraguay	2006	Children 6–12 years	437.0
	Peru	2006	Children 7–9 years	259.0
		2012–2013	Pregnant females 12–49 years	250.4
	Uruguay	2004	Children 6–14 years	310.0
	Venezuela	2005	Children 7–14 years	185.0

Source: Prepared by the authors based on information from the surveys listed in Supplementary Material Table 1.

[a] Prevalence established when serum retinol was < 30 µg/dL.
[b] Prevalence established when serum vitamin B12 < 150 pg/mL.
[c] Prevalence established when serum folate was < 3 ng/mL.
[d] Prevalence established when serum folate was < 6 ng/mL.
[e] Prevalence established when red blood cell folate was < 151 ng/mL.
[f] Prevalence established when serum folate was < 4 ng/mL.
[g] Prevalence established when red blood cell folate was < 140 ng/mL.

children under 5 years old and WRA are based on DHS and MICS and/or specific national nutrition and health or micronutrient surveys (e.g., NHS, NMS). In the few countries that report nutrition information on school-age children and adolescents, the data come from NHS and NMS. Based on the available data, between 1985 and 2014, only 19 countries reported information on stunting, wasting, and overweight in children under 5 years old, and only 17 countries reported anemia in WRA. To meet the Global Nutrition Targets 2025 (2), most LAC countries, especially those in the Caribbean subregion, need to strengthen their health information systems to enable monitoring of the appropriate nutrition indicators. Like the research reported here, decision-making on nutrition policy in countries with health information systems that do not collect data for these indicators/biomarkers is based on data from surveys and estimates.

Current trends show that most LAC countries are on track to reduce the number of stunted children under 5 years old by 40% by 2025 (data not shown). The exception is Guatemala, which could see a 20% increase in the total number of stunted children. Brazil has had the greatest achievement in decreasing stunting in children, and this has been attributed to an increase in the average income, better distribution of income, greater access to health care, improved water and sanitation systems, higher food security, more appropriate child care, and a reduction in diarrhea incidence, driven by social protection policies, an increase in primary school enrollment, and improved equity in access to health care, among other factors (16).

Prevalence of low weight for age in children under 5 years old is low for all LAC countries with available data except Guatemala, Guyana, and Haiti, where prevalence is 13.1%, 10.5%, and 11.4% respectively. Wasting prevalence is < 5% in all LAC countries, except Barbados, Guyana, Haiti, Suriname, and Trinidad and Tobago, where the rate of severe wasting (weight for height < –3 SD) is 2.0% (17), 1.1% (18), 1.2% (19), 0.8% (20), and 0.6% (21) respectively. Prevalence of wasting in Haiti might be attributable to the impact of natural disasters and

poverty and has decreased significantly in recent years due to investment and changes made in all sectors (22). In some parts of other subregions, such as the dry corridor in Central America and El Choco in Colombia, seasonal outbreaks of severe wasting occur. Countries with these types of outbreaks need to tailor their nutrition policies, programs, and interventions to prevent or reduce them.

Overweight is an epidemic in school-age children, adolescents, and adults and is expected to affect 9.9% of children globally by 2025 and remain below 8% in the Americas (23). While most countries do not report overweight and obesity, according to the survey data found for this study, both conditions are increasing in children under 5 years old in Brazil, Colombia, Costa Rica, Ecuador, El Salvador, and Mexico, with the highest prevalence in school-age children and adolescents in Mexico. Baseline data are required in order to measure the impact of current or future interventions. Nutrition interventions should be designed according to epidemiological profile and social and environmental conditions, including burden of infectious diseases and dietary intake (24), and considering opportunities to improve nutritional status during puberty, when the reduced prevalence of infectious disease combined with appropriate nutrition interventions can produce some catch-up growth, as suggested by Prentice et al. (24) and Golden (25).

Information on micronutrient deficiencies was available for 25 of the 46 LAC countries/territories, and was mainly limited to 1) anemia in children under 5 years old, and in WRA, and 2) deficiencies in vitamin A and iodine. Information on folate and vitamin B12 was only available for a few countries. Data on micronutrient status were mainly obtained from DHS, NHS, and NMS, which are not conducted systematically. In addition, the age groups that were studied and cutoff points that were used varied across surveys, making comparisons difficult.

Globally, the burden of disease attributable to iron and vitamin A deficiency has decreased in the past 20 years (26). However, in some LAC countries, anemia in young children is still a moderate to severe public health problem. Anemia has several causes, including iron deficiency; malaria; helminth infestation; chronic disease; and combined deficiency of vitamin A, vitamin B12, vitamin B6, riboflavin, and folic acid (8; 27–29). Recent research has shown that obesity-induced inflammation can impair iron absorption and sequester iron in the reticuloendothelial system, leading to anemia (30, 31). Data from Guatemala show that 47.7% of children 6–59 months old have anemia, but only 18.6% are iron-deficient (serum ferritin < 12 µg/dL), whereas in Ecuador 25.7% are anemic, but only 9.9% are iron-deficient. Anemia prevalence is high, but iron deficiency explains less than half of it, suggesting the need for additional valid and sensitive indicators to identify the causal factors and most appropriate interventions, in order to tackle this public health problem.

Several strategies have been implemented to reduce anemia in WRA and young children, including iron and folic acid supplementation, distribution of multiple micronutrient powders, and food fortification of staple foods. However, as shown in the results reported here, anemia is still a severe public health problem in some LAC countries, particularly in certain population groups.

Deficiencies in vitamin B12 and folate are associated with adverse pregnancy outcomes, including low birth weight, neural tube defects, and preterm birth. As shown in the results of this study, folate deficiency is low in most countries with available information. However, the number of countries reporting this information is insufficient for drawing regional conclusions. Furthermore, red blood cell folate has been shown to reflect long-term intake of folate, whereas serum folate—the type most often measured in recent surveys—does not. Therefore, countries should use red blood cell folate for assessing insufficiency in WRA, as recommended by WHO, to prevent neural tube defects (32, 33). In addition, cutoff points and methods for identifying folate deficiency should be standardized to enable comparisons across countries and regions. The highest prevalence of vitamin B12 deficiency was observed in children 6–59 months old in Guatemala (22.5%), and in pregnant women 13–49 years old in Colombia (18.6%). It has been argued that vitamin B12 deficiency may be due to low intake of food products of animal origin, especially in infants and young children. Certain population groups, such as pregnant women and the elderly, may require screening for vitamin B12 deficiency (34, 35).

Great achievements have been made in decreasing vitamin A deficiency, especially in Guatemala, where the latest NMS did not find one case of low serum retinol. However, interventions such as fortification and supplementation with mega doses of vitamin A need to be revised to reduce the risk of vitamin A toxicity. Vitamin A deficiency is still a prevalent problem in Ecuador and Colombia, despite the existence of vitamin A supplementation programs. Some of the data that show higher prevalence of low serum retinol for Antigua & Barbuda, Cuba, Dominica, Guyana, Jamaica, Mexico, and Panama are more than 10 years old, so this situation might have changed in recent years.

Iodine deficiency is not a public health problem in the LAC region, as all LAC countries with available data have a median urinary iodine excretion in school-age children above the recommended threshold. However, Chile, Dominican Republic, Ecuador, Nicaragua, and Peru have an intake above the requirements, and Brazil, Colombia, Costa Rica, Honduras, Paraguay, and Uruguay have an intake that is considered excessive and a risk factor for adverse health consequences. Fortification programs in those countries should be revised to prevent adverse health outcomes.

Limitations

This study had some limitations. First, the results reported here were obtained as a result of Internet searches and requests for information sent to PAHO country offices. Additional information on nutritional status in LAC countries might be available to the public through other search methods. The second limitation was related to variations in the period covered and frequency of the surveys that were used as data sources. For example, while it is recommended that DHS and MICS are carried out every five years, the study timeframe varies across countries, and the NHS and NMS that provided the data on vitamin A and iodine status were not conducted according to a set schedule in any particular country but were carried out only as part of specific studies. Finally, some of the countries included in the review (other than Colombia and Mexico) have only

recently included folate and vitamin B12 intake in their national nutrition and/or micronutrient surveys.

Conclusions

LAC countries have weak surveillance systems for monitoring nutritional status indicators and thus need to increase their efforts to strengthen them, including their capacity to monitor micronutrient status to help researchers 1) identify the causal factors of anemia and 2) evaluate the effects of iodine and vitamin A fortification programs. Stunting, anemia, and vitamin A deficiency are still a public health problem in some LAC countries and overweight and obesity are an epidemic and growing problem. Solving these nutrition-related health problems require the development and implementation of comprehensive inter-sectoral policies that address the immediate, intermediate, and underlying determinants of malnutrition across the life course.

Acknowledgments. The authors thank the Micronutrient Initiative (Ottawa, Ontario, Canada) for the financial support for this research.

Conflicts of interest. None.

Funding. The Micronutrient Initiative provided financial support for the research and authorship of this article. The Pan American Health Organization (PAHO) provided financial support for editorial production.

Disclaimer. Authors hold sole responsibility for the views expressed in the manuscript, which may not necessarily reflect the opinion or policy of the *RPSP/PAJPH* or PAHO.

REFERENCES

1. International Food Policy Research Institute. Global nutrition report 2014: actions and accountability to accelerate the world's progress on nutrition. Washington: IFPRI; 2014.
2. World Health Organization. Global Nutrition Targets 2025: policy brief series. Geneva: WHO; 2014. (WHO/NMH/NHD/14.2).
3. Stevens GA, Finucane MM, Paciorek CJ, Flaxman SR, White RA, Donner AJ, et al. Trends in mild, moderate, and severe stunting and underweight, and progress towards MDG 1 in 141 developing countries: a systematic analysis of population representative data. Lancet. 2012; 380(9844):824–34.
4. Rivera JA, de Cossío TG, Pedraza LS, Aburto TC, Sánchez TG, Martorell R. Childhood and adolescent overweight and obesity in Latin America: a systematic review. Lancet Diabetes Endocrinol. 2014;2(4):321–32.
5. Jaacks LM, Slining MM, Popkin BM. Recent trends in the prevalence of under- and overweight among adolescent girls in low- and middle-income countries. Pediatr Obes. 2015;10(6):428–35.
6. Yang H, de Onis M. Algorithms for converting estimates of child malnutrition based on the NCHS reference into estimates based on the WHO Child Growth Standards. BMC Pediatr. 2008; 8:19.
7. de Onis M, Onyango AW, Borghi E, Siyam A, Nishida C, Siekmann J. Development of a WHO growth reference for school-aged children and adolescents. Bull World Health Organ. 2007;85(9):660–7.
8. World Health Organization. Iron deficiency anaemia assessment, prevention and control: a guide for programme managers. Geneva: WHO; 2001. (WHO/NHD/01.3).
9. World Health Organization. Serum retinol concentrations for determining the prevalence of vitamin A in populations. Geneva: WHO; 2011. (WHO/NMH/NHD/MNM/11.3).
10. World Health Organization. Urinary iodine concentrations for determining iodine status deficiency in populations. Geneva: WHO; 2013. (WHO/NMH/NHD/EPG/13.1).
11. Pan American Health Organization. Health situation in the Americas: basic indicators 2014. Washington: PAHO; 2014.
12. Corsi DJ, Neuma M, Finlay JE, Subramanian SV. Demographic and health surveys: a profile. Int J Epidemiol. 2012; 41(6):1602–13.
13. World Health Organization. Physical status: the use and interpretation of anthropometry. Report of a WHO Expert Committee. Technical report series no. 854. Geneva: WHO; 1995.
14. Ministerio de Salud Pública y Asistencia Social; Instituto Nacional de Estadística (GT). II Encuesta Nacional de Micronutrientes 2009–2010 (ENMICRON 2009–2010). Guatemala: MSPAS/ INE; 2010.
15. World Health Organization. World health statistics 2010. Geneva: WHO; 2010. Available from: http://www.who.int/whosis/whostat/2010/en/
16. Monteiro CA, Benicio MH, Conde WL, Konno S, Lovadino AL, Barros A, et al. Narrowing socioeconomic inequality in child stunting: the Brazilian experience, 1974–2007. Bull World Health Organ. 2010;88(4):305–11.
17. Barbados Statistical Service. Barbados Multiple Indicator Cluster Survey 2012: final report. Bridgetown: BSS; 2014.
18. Ministry of Health; Bureau of Statistics; ICF Macro. Guyana Demographic and Health Survey 2009. Georgetown: MOH / BOS / ICF Macro; 2010.
19. Cayemittes M, Fatuma M, Bizimana JdD, Barrère B, Sévère B, Cayemittes V, et al. Enquête mortalité, morbidité et utilisation des services Haïti, 2012. Calverton, MD: Ministère de la Santé Publique et de la Population/ Institut Haïtien de l'Enfance/ ICF International; 2013.
20. Ministry of Social Affairs and Housing; General Bureau of Statistics (SR). Suriname Multiple Indicator Cluster Survey 2010: final report. Paramaribo: MSAH/GBS; 2013.
21. Central Statistical Office, Ministry of Community Empowerment, Sports and Consumer Affairs (TT). Trinidad and Tobago Multiple Indicator Cluster Survey 2000. Port of Spain: CSO/MCESCA.
22. Ayoya MA, Heidkamp R, Ngnie-Teta I, Pierre JM, Stoltzfus RJ. Child malnutrition in Haiti: progress despite disasters. Glob Health Sci Pract. 2013;1(3):389–96.
23. Black RE, Victora CG, Walker SP, Bhutta ZA, Christian P, de Onis M, et al. Maternal and child undernutrition and overweight in low-income and middle-income countries. Lancet. 2013;382(9890):427–51.
24. Prentice AM, Ward KA, Goldberg GR, Jarjou LM, Moore SE, Fulford AJ, et al. Critical windows for nutritional interventions against stunting. Am J Clin Nutr. 2013;97(5):911–8.
25. Golden MH. Is complete catch-up possible for stunted malnourished children? Eur J Clin Nutr. 1994;48 Suppl 1:S58–70; discussion S71.
26. Lim SS, Vos T, Flaxman AD, Danaei G, Shibuya K, Adair-Rohani H, et al. A comparative risk assessment of burden of disease and injury attributable to 67 risk factors and risk factor clusters in 21 regions, 1990–2010: a systematic analysis for the Global Burden of Disease Study 2010. Lancet. 2012;380(9859):2224–60.
27. Olivares M, Walter T, Hertrampf E, Pizarro F. Anemia and iron deficiency disease in children. Br Med Bull. 1999;55(3):534–43.
28. Asobayire FS, Adou P, Davidsson L, Cook JD, Hurrell RF. Prevalence of iron deficiency with and without concurrent anemia in population groups with high prevalences of malaria and other infections: a study in Côte d'Ivoire. Am J Clin Nutr. 2001;74(6):776–82.
29. Allen LH, Rosado JL, Casterline JE, López P, Muñoz E, García OP, et al. Lack of hemoglobin response to iron supplementation in anemic Mexican preschoolers with multiple micronutrient deficiencies. Am J Clin Nutr. 2000;71(6):1485–94.

30. Becker C, Orozco M, Solomons NW, Schümann K. Iron metabolism in obesity: how interaction between homoeostatic mechanisms can interfere with their original purpose. Part I: Underlying homoeostatic mechanisms of energy storage and iron metabolisms and their interaction. J Trace Elem Med Biol. 2015;30:195–201.
31. Becker C, Orozco M, Solomons NW, Schümann K. Iron metabolism in obesity: how interactions between homoeostatic mechanisms can interfere with their original purpose. Part II: Epidemiological and historic aspects of the iron/obesity interaction. J Trace Elem Med Biol. 2015;30:202–6.
32. World Health Organization. Optimal serum and red blood cell folate concentrations in women of reproductive age for prevention of neural tube defects. Guideline. Geneva: WHO; 2015.
33. Crider KS, Devine O, Hao L, Dowling NF, Li S, Molloy AM, et al. Population red blood cell folate concentrations for prevention of neural tube defects: Bayesian model. BMJ. 2014;349:g4554.
34. Barnabé A, Aléssio AC, Bittar LF, de Moraes Mazetto B, Bicudo AM, de Paula EV, et al. Folate, vitamin B12 and Homocysteine status in the post-folic acid fortification era in different subgroups of the Brazilian population attended to a public health care center. Nutr J. 2015;14(1):19.
35. Wong CW. Vitamin B12 deficiency in the elderly: is it worth screening? Hong Kong Med J. 2015;21(2):155–64.

Manuscript received on 11 August 2015. Revised version accepted for publication on 24 November 2015.

RESUMEN

Situación nutricional en América Latina y el Caribe: panorama actual, tendencias y brechas en la información

Objetivo. Determinar la situación actual de las carencias nutricionales en América Latina y el Caribe (ALC) e identificar las deficiencias en los datos y el curso actual de la vigilancia en materia de nutrición.

Métodos. Se realizó una búsqueda sistemática de la internet para encontrar fuentes oficiales dedicadas a observar la evolución de la situación nutricional de los países de América Latina y el Caribe, incluidos los avances en relación con las metas mundiales de nutrición fijadas por la Asamblea Mundial de la Salud para el 2025. Se recopilaron y compaginaron los informes de diferentes sistemas de vigilancia nutricional nacionales y de encuestas representativas de alcance nacional con el fin de: (1) analizar la situación nutricional con respecto a indicadores antropométricos y marcadores biológicos para todas las etapas de la vida y (2) detectar brechas en la disponibilidad de datos y observar la evolución de las carencias nutricionales. También se recopiló y compaginó información relativa a la carencia de hierro, vitamina A, yodo, folato y vitamina B12.

Resultados. Veintidós países de América Latina y el Caribe (48%) contaban con información acerca de la desnutrición (retraso del crecimiento, peso inferior al normal y emaciación) en niños menores de 5 años de edad, niños en edad escolar, adolescentes y mujeres en edad fecunda (MEF). Diecisiete países (38%) tenían información sobre la anemia en niños menores de 5 años; 12 (27%) la tenían sobre la anemia en MEF. Aunque la situación nutricional en general ha mejorado en los últimos decenios en todos los países de la Región, algunos países de América Latina y el Caribe siguen teniendo una alta prevalencia de retraso del crecimiento y anemia en niños y MEF. El sobrepeso afectaba a por lo menos 50% de las MEF en nueve de los países que poseían datos y estaba aumentando en los niños. En la Región hay pocos datos relativos a los niños en edad escolar, los adolescentes, los hombres adultos y las personas de edad.

Conclusiones. La situación nutricional en general ha mejorado en los países de América Latina y el Caribe para los cuales se cuenta con información, pero hay que tomar más medidas para incrementar las intervenciones relacionadas de manera tangencial o directa con la nutrición a fin de combatir la desnutrición en todas sus manifestaciones, habida cuenta de que el retraso del crecimiento, la anemia y la carencia de vitamina A siguen siendo problemas de salud pública en muchos países y que el sobrepeso constituye una epidemia. Los sistemas de información nutricional de la Región son pobres y los países tienen que fortalecer su capacidad para vigilar los indicadores de la situación nutricional.

Palabras clave Estado nutricional; anemia; micronutrientes, deficiencia; América Latina; Región del Caribe.