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National and regional population attributable fractions for anemia risk factors (iron, folate, and vitamin B12) in Belize: potential impact of fortification

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ABSTRACT

Objective. To estimate the national and regional population attributable fraction (PAF) and potential number of preventable anemia cases for three nutritional risk factors (iron, red blood cell folate [RBCF], and vitamin B12 deficiencies) among women of childbearing age in Belize.

Methods. A national probability-based household and micronutrient survey capturing sociodemographic and health information was conducted among 937 nonpregnant Belizean women aged 15–49 years. Blood samples were collected to determine hemoglobin, ferritin, alpha-1-glycoprotein (AGP), RBCF, and vitamin B12 status. All analyses used sample weights and design variables to reflect a complex sample survey. Logistic regression was used to determine adjusted prevalence risk (aPR) ratios, which were then used to estimate national and regional PAF for anemia.

Results. The overall prevalence of anemia (hemoglobin <12 g/dL) was 21.2% (95% CI [18.7, 25.3]). The prevalence of anemia was significantly greater among women with iron deficiency (59.5%, 95% CI [48.7, 69.5]) compared to women without iron deficiency (15.2%, 95% CI [12.2, 18.3]; aPR 3.9, 95% CI [2.9, 5.1]). The three nutritional deficiencies examined contributed to 34.6% (95% CI [22.1, 47.1]) of the anemia cases. If all these nutritional deficiencies could be eliminated, then an estimated 5 953 (95% CI [3 807, 8 114]) anemia cases could be prevented.

Conclusions. This study suggests that among women of child-bearing age in Belize, anemia cases might be reduced by a third if three modifiable nutritional risk factors (iron, RBCF, and vitamin B12 deficiencies) could be eliminated. Fortification is one potential strategy to improve nutritional status and reduce the burden of anemia in this population.

Keywords Anemia; risk factors; women's health; anemia, iron deficiency; folic acid; vitamin B 12 deficiency; Belize.

Anemia is a common public health problem worldwide. The World Health Organization (WHO) estimates nearly 2 billion people across the globe are anemic, and 539 million people with anemia are women of childbearing age (WCBA) (1). Anemia has important health consequences including increased maternal mortality, morbidity, and diminished physical work capacity for WCBA, and impaired cognitive and motor development, impaired growth, low birthweight, and impaired immune function among infants born to anemic mothers (1, 2). While anemia is primarily attributed to iron deficiency, it has a multifactorial etiology. Other contributors to anemia include vitamin A deficiency, folate deficiency, vitamin B12

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deficiency, malaria, inflammation, parasitic infections, and other factors (3, 4).

Maternal anemia is characterized by reductions in hemoglobin concentration, red blood cell (RBC) count, and the inability to meet the oxygen demands of tissues (4). Iron deficiency anemia increases the risk of impaired fetal growth and development (5). A reduction in RBC count might affect the growth of the fetus during the first trimester, and if untreated, there is a higher risk of having a baby with anemia after birth, which could lead to developmental problems. In addition, insufficient folate and vitamin B12 could impair DNA synthesis and cell growth (through the one-carbon metabolism pathway), and increase risk for neural tube defects in infants (6).

To address population nutritional deficiencies, in 2007, Belize established a voluntary wheat flour fortification program as a result of the 2002 Central American Fortification Harmonization Strategy adopted by the ministries of health of Central America (7). The harmonization strategy recommended that wheat flour be fortified with the following nutrients (and amounts): thiamin (6.2 mg/kg), riboflavin (47.2 mg/kg), niacin (55.0 mg/kg), folic acid (1.8 mg/kg), and iron (55.0 mg/kg).

Unlike maize flour and rice, wheat flour is not a Belizean food staple and thus fortification has had limited impact in reducing the burden of micronutrient deficiencies (8). Country-specific data on factors contributing to anemia and how these factors affect population risk are needed to inform health policies. This study estimated the national and regional population attributable fraction (PAF) and potential number of preventable anemia cases for three nutritional risk factors (iron, red blood cell folate [RBCF], and vitamin B12 deficiencies) among WCBA in Belize.

MATERIALS AND METHODS

In 2011, the Belize National Micronutrient Biomarker Survey (BNMBS) was conducted in Belize among a sample of civilian, noninstitutionalized WCBA. Details of the BNMBS survey, laboratory methods, folate and vitamin B12 deficiency results, and population characteristics have been published previously (8). In short, the BNMBS used a complex, multistage probability design for WCBA, with national and regional representation stratified by urban and rural settings. The BNMBS sample included 1 156 eligible households of nonpregnant WCBA. For the households selected, we used a standardized questionnaire, and interviewers collected sociodemographic information, the number of women and children who were household members, primary household language, occupation and educational level of the index woman, total family income, use of health services, and vitamin use. Pregnancy status was determined by self-report. Household interviews were conducted in English, Spanish, or Mayan language by multilingual interviewers. The study protocol was reviewed (at the request of the Belize Ministry of Health) and approved by the U.S. Centers for Disease Control and Prevention (CDC) Institutional Review Board in Atlanta, GA, United States of America.

Biochemical indicators

Blood (non-fasting) was drawn for measurement of nutrition biomarkers. Details of the field management and processing of blood samples were previously reported (8, 9). Anemia was defined using WHO standards for hemoglobin concentrations of <12 g/dL in nonpregnant women (10). RBCF and B12 deficiencies were defined based on the established criteria of <305 nmol/L and <148 pmol/mL for RBCF and B12, respectively (11).

Iron deficiency was measured using serum ferritin that was adjusted for inflammation, as failure to account for inflammation might lead to an underestimation of the prevalence of iron deficiency. The following regression correction was used to adjust for inflammation using α-1 glycoprotein (AGP) as recommended by Biomarkers Reflecting Inflammation and Nutritional Determinants of Anemia (BRINDA) (12, 13):

$$\ln(\text{ferritin}_{adj}) = \ln(\text{ferritin}_{unadj}) - \beta 1[\ln(\text{AGP}_{obs}) - \ln(\text{AGP}_{P10})$$

where AGP_{P10} is the 10th percentile for AGP in the survey population, and where the ferritin level is adjusted only when AGP exceeds its 10th percentile level. Low serum ferritin was then defined as having an adjusted serum ferritin level below 15 µg/dL (12).

Statistical analysis

We summarized the national prevalence and 95% confidence intervals (CI) for anemia, iron deficiency, RBCF deficiency, and B12 deficiency and stratified anemia prevalence by iron, RBCF, and B12 deficiencies and selected demographic factors. Prevalence ratios (PR) were calculated for these three micronutrient deficiencies and the demographic factors (geographic area, ethnicity, age, health services use, and country region). Only significant variables ($p < 0.05$) in the crude analyses were retained in the final multivariable model. All analyses used sample weights and design variables to reflect the complex sample survey and Taylor series approximation to obtain the standard errors of the measurements.

The PAF estimates the proportion of a disease that could be averted from a population if known modifiable risk factors were eliminated. The PAF was calculated using the following formula (14):

$$\text{PAF} = P_d * (\text{PR} - 1) / \text{PR}$$

where P_d = proportion of cases of anemia that are exposed to the specific nutritional risk factor (iron deficiency or RBCF deficiency or vitamin B12 deficiency) and PR = prevalence ratio comparing the prevalence of anemia among exposed and unexposed (without iron deficiency or RBCF deficiency or vitamin B12 deficiency).

The CIs for the proportion and prevalence ratios were calculated using the Bonferroni method (15). Based on these estimates, we determined the number of potentially averted anemia cases by multiplying the PAF percentage by the total population. The PAF models estimated the potential reduction in anemia with different combinations of micronutrients (iron, folate, and vitamin B12). Since anemia prevalence varied by region, we adjusted the overall PAF by region. Additionally, we stratified the analyses by region to make findings more informative from a public health perspective. All statistical analyses using data from the BNMBS were conducted with SAS (version 9.4) and SAS callable SUDAAN (version 11.4).

RESULTS

The prevalence of anemia by selected population characteristics as well as unadjusted and adjusted PRs are presented in Table 1. The prevalence of anemia was greater among women with iron deficiency (59.5%, 95% CI [48.7, 69.5]) compared to women without iron deficiency (15.2%, 95% CI [12.2, 18.3]). The difference remained statistically significant after adjusting for region (aPR 3.9, 95% CI [2.9, 5.1]). No other covariates were significant in the unadjusted analyses. Compared to the West region (14.0%, 95% CI [10.1, 19.2]), both the Central and South regions showed a significantly higher prevalence of anemia, at 28.5% (95% CI [21.1, 36.5]) and 23.4% (95% CI [17.7, 30.2]), respectively. These differences remained significant for both regions after adjusting for iron deficiency: Central aPR 1.8 (95% CI [1.2, 2.6]) and South aPR 1.7 (95% CI [1.1, 2.3]).

Table 2 shows the estimated number of anemia cases in the study, the estimated number of cases in the population, the proportion of anemia cases in the study population that could be attributed (PAF) to iron, RBCF, and B12 deficiencies, and the potential number of cases that could be potentially prevented in the population if these deficiencies were eliminated. Deficiencies were examined independently and in combination (iron and RBCF deficiencies; iron and B12 deficiencies; and iron, RBCF, and B12 deficiencies). The national proportion of anemia that could be attributed to iron deficiency was estimated to be 30.2% (95% CI [20.2, 41.4]). When all three nutritional deficiencies were considered simultaneously, the overall national PAF was 34.6% (95% CI [22.1, 47.1]). The crude PAF showed variation among regions with the North and West regions having the highest proportion of anemia that could be attributed to the three combined deficiencies: North 46.0% (95% CI [14.7, 72.0]) and West 55.8% (95% CI [27.4, 76.5]).

The population of WCBA with anemia in Belize was estimated to be 17 209 (Table 2). Applying the PAF for the combined iron, RBCF, and B12 deficiencies to the national estimated number cases with anemia, we estimated that 5 953 (95% CI [3 807, 8 114]) cases of anemia could be prevented if all three deficiencies were eliminated.

TABLE 1. Anemia prevalence and prevalence ratios (PR), by selected risk factors, Belize

Characteristics	*N* (unweighted)	Anemia prevalence % (95% CI)	Unadjusted PR (95% CI)	Adjusted PR (95% CI) [a]
National [b]	931	21.2 (18.7, 25.3)		
Iron deficiency [b,c] (<15 μg/L)				
Yes	123	59.5 (48.7, 69.5)	**3.9 (3.0, 5.1)****	**3.9 (2.9, 5.1)****
No	802	15.2 (12.2, 18.3)	Reference	
RBCF deficiency [b] (<305 nmol/L)				
Yes	42	25.8 (14.2, 42.3)	1.2 (0.6, 2.2)	
No	889	21.6 (18.4, 25.3)	Reference	
Vitamin B12 deficiency (<148 pmol/L)				
Yes	153	22.9 (14.7, 33.8)	1.1 (0.7, 1.6)	
No	777	21.6 (18.6, 25.1)	Reference	
Area				
Rural	558	22.3 (17.8, 27.4)	1.0 (0.8, 1.4)	
Urban	373	21.4 (17.2, 26.3)	Reference	
Ethnicity				
Mayan	139	22.5 (14.8, 32.6)	1.3 (0.6, 2.9)	
Mestizo	464	17.3 (13.6, 21.7)	1.0 (0.5, 2.1)	
Black (Creole/Garifuna)	256	32.3 (25.7, 39.7)	1.9 (0.9, 3.8)	
Other	72	16.8 (8.4, 30.5)	Reference	
Age (years)				
15–24	292	19.8 (13.6, 26.0)	0.9 (0.6, 1.3)	
25–34	340	22.8 (17.9, 28.6)	1.0 (0.7, 1.4)	
35–49	299	23.2 (18.0, 29.4)	Reference	
Health services use				
Private	123	24.7 (16.5, 35.3)	1.1 (0.7, 1.7)	
Private–Public	100	16.1 (8.7, 27.6)	0.7 (0.4, 1.3)	
Public	631	22.3 (18.4, 26.7)	Reference	
Region				
Central	204	28.5 (21.1, 36.5)	**2.0 (1.3, 3.1)***	**1.8 (1.2, 2.6)***
North	221	19.7 (13.6, 25.7)	1.4 (0.9, 2.2)	1.22 (0.8, 1.7)
South	243	23.4 (17.7, 30.2)	**1.7 (1.1, 2.5)***	**1.7 (1.1, 2.3)***
West	263	14.0 (10.1, 19.2)	Reference	Reference

RBCF: red blood cell folate; * $p < 0.01$; ** $p < 0.0001$.
Notes:
[a] Adjusted for variables that were significant (ferritin deficiency and region).
[c] Serum ferritin (<15 μg/L) = iron deficiency.
[b] Serum ferritin, plasma vitamin B12, and hemoglobin missing 12, 7, and 6 blood samples, respectively.
Source: Prepared by the authors based on the study data.

TABLE 2. National and regional population attributable fractions for iron, red blood cell folate (RBCF), and vitamin B12 deficiencies, and the estimated numbers of anemia cases potentially prevented with the elimination of iron, RBCF, and vitamin B12 deficiency among women of childbearing age, Belize

	National	Central	North	South	West
Anemia cases observed (unweighted) and estimated cases of anemia in the population (weighted)	191 (17 209)	57 (7 207)	40 (4 097)	51 (3 298)	43 (2 608)
Iron deficiency					
Proportion (%) of anemia cases among WCBA with iron deficiency (95% CI)	40.8 (32.3, 49.8)	34.8 (22.4, 49.7)	61.0 (41.2, 77.8)	29.1 (16.0, 47.1)	39.9 (26.5, 55.0)
aPR (95% CI)	3.9 (2.9, 5.1)	2.5 (1.6, 3.8)	6.9 (3.8, 12.5)	3.6 (2.2, 6.0)	5.4 (3.2, 9.1)
PAF % (95% CI)	30.2 (20.2, 41.4)	20.7 (0.0, 39.2)	52.2 (27.5, 73.9)	21.2 (7.6, 42.1)	32.5 (16.4, 51.3)
Estimated number of potentially preventable anemia cases in the population	5 202 (3 474, 7 129)	1 493 (496, 2 828)	2 140 (1 125, 3 029)	700 (251, 1 390)	847 (429, 1 339)
RBCF deficiency					
Proportion (%) of anemia cases among WCBA with RBCF deficiency (95% CI)	5.4 (2.9, 9.7)	0.8 (0.0, 5.7)	2.4 (0.1, 10.0)	6.3 (1.4, 2.5)	21.6 (10.9, 38.4)
aPR (95% CI)	1.2 (0.6, 2.4)	0.1 (0.0, 1.2)	2.4 (1.0, 6.1)	1.3 (0.3, 4.4)	3.6 (1.8, 7.1)
PAF % (95% CI)	0.9 (0.2, 1.6)	--	1.4 (0.0, 10.4)	1.2 (0.0, 24.9)	15.5 (3.8, 35.9)
Estimated number of potentially preventable anemia cases in the population	162 (0.0, 1 116)	--	59 (0.0, 427)	39 (0.0, 789)	405 (98, 936)
Vitamin B12 deficiency					
Proportion (%) of anemia cases among WCBA with B12 deficiency (95% CI)	17.0 (11.0, 25.3)	19.1 (9.5, 34.9)	40.5 (12.3, 33.2)	15.5 (4.9, 39.3)	25.6 (13.1, 44.0)
aPR (95% CI)	1.2 (0.8, 1.7)	1.9 (1.2, 3.1)	0.4 (0.1, 1.3)	1.3 (0.5, 3.4)	1.2 (0.5, 2.8)
PAF % (95% CI)	2.3 (0.0, 12.1)	9.1 (0.0, 26.3)	--	3.5 (0.0, 32.4)	4.0 (0.0, 32.0)
Estimated number of potentially preventable anemia cases in the population	394 (0.0, 2 090)	658 (57, 1 892)	--	116 (0.0, 1 070)	105 (0.0, 836)
Iron and RBCF deficiencies					
Proportion (%) of anemia cases among WCBA with iron and RBCF deficiencies (95% CI)	44.3 (35.6, 53.3)	34.8 (22.4, 49.7)	62.6 (42.7, 79.0)	34.9 (20.8, 52.4)	53.3 (35.5, 70.3)
aPR (95% CI)	3.3 (2.5, 4.4)	1.8 (1.1, 2.8)	7.1 (3.9, 13.1)	2.9 (1.8, 5.0)	5.7 (2.9, 10.9)
PAF % (95% CI)	30.9 (19.9, 42.8)	15.6 (1.5, 34.9)	53.9 (28.7, 75.2)	23.2 (7.5, 44.8)	43.9 (20.8, 66.4)
Estimated number of potentially preventable anemia cases in the population	5 322 (3 424, 7 374)	1 123 (110, 2 512)	2 207 (1 176, 3 083)	767 (247, 1 479)	1 145 (542, 1 731)
Iron and vitamin B12 deficiencies					
Proportion (%) of anemia cases among WCBA with iron and B12 deficiencies (95% CI)	52.1 (43.3, 60.7)	50.2 (36.3, 64.0)	62.8 (42.5, 79.4)	35.8 (19.7, 55.9)	60.8 (45.6, 74.1)
aPR (95% CI)	2.8 (2.2, 3.6)	2.7 (1.9, 3.9)	3.3 (1.6, 6.7)	2.3 (1.2, 4.1)	3.2 (1.9, 5.4)
PAF % (95% CI)	33.5 (21.9, 45.6)	31.7 (15.3, 49.8)	43.9 (13.1, 70.3)	19.9 (2.2, 45.7)	41.6 (18.3, 62.7)
Estimated number of potentially preventable anemia cases in the population	5 773 (3 772, 7 840)	2 283 (1 101, 3 589)	1 799 (537, 2 880)	659 (72, 1 507)	1 085 (479, 1 636)
Iron, RBCF, and vitamin B12 deficiencies					
Proportion (%) of anemia cases among WCBA with iron, RBCF, and B12 deficiencies (95% CI)	55.2 (46.4, 63.8)	50.2 (36.3, 64.0)	64.4 (44.1, 80.5)	41.5 (24.1, 61.4)	72.2 (55.8, 84.3)
aPR (95% CI)	2.7 (2.0, 3.5)	2.2 (1.2, 4.1)	4.4 (2.3, 8.5)	3.5 (1.7, 7.1)	2.1 (1.5, 3.1)
PAF % (95% CI)	34.6 (22.1, 47.1)	26.7 (9.9, 45.6)	46.0 (14.7, 72.0)	23.1 (2.4, 50.0)	55.8 (27.4, 76.5)
Estimated number of potentially preventable anemia cases in the population	5 953 (3 807, 8 114)	1 922 (711, 3 288)	1 886 (603, 2 948)	762 (79, 1 648)	1 455 (714, 1 886)

aPR, adjusted prevalence ratio; PAF, population attributable fraction; WCBA, women of child-bearing age.
Source: Prepared by the authors based on the study data.

DISCUSSION

Belize's first national and regional fortification survey provided an opportunity to assess the modifiable nutritional deficiencies (iron, RBCF, B12) for anemia and the potential for prevention of anemia cases among nonpregnant WCBA. This study showed that in Belize about a third of anemia cases among WCBA in the population might be attributed to iron, RBCF, and vitamin B12 deficiencies.

The prevalence of anemia in Belize was higher than that observed in other countries in the region, such as Chile (5.1%), El Salvador (10.0%), Costa Rica (10.2%), Mexico (15.5%), and Nicaragua (11.2%) (16, 17). The low prevalence estimates reported for Chile and Costa Rica are likely due to sustained mandatory nutrient fortification interventions on staple foods that reach most of these countries' populations (18–20).

In our study, the main factor associated with anemia is iron deficiency. Although folic acid and vitamin B12 deficiencies had a more limited impact on the prevalence of anemia, ensuring that WCBA are adequately covered with all three nutrients before and during pregnancy can address additional poor pregnancy outcomes such as neural tube defects, impaired development (cognitive and motor), impaired growth, low birthweight, and impaired immune function among infants; and increased maternal mortality, morbidity, and diminished physical work capacity among mothers – which suggests that addressing these deficiencies could have significant benefits to the population beyond the prevention of anemia (21–23).

These findings suggest that it is possible, at least in principle, to prevent an appreciable proportion of anemia cases by addressing deficiencies of these three nutrients. Increasing the availability and access to fortified staple foods for the population is one strategy that could potentially yield improved micronutrient status and address population-level anemia.

This study shows that some regions might benefit more than others if nutritional deficiencies were addressed, in particular iron deficiency. While risk factors for anemia go beyond those explored in this study, our summary PAF estimates suggest that fortification of maize and rice with iron, folic acid, and vitamin B12 might help address the burden of anemia in the Belizean WCBA population. This impact would be dependent upon the population having easy access to fortified foods of commonly consumed staples.

This study has several strengths. Population-level data such as those presented here are important pieces of information when considering health priorities. The BNMBS utilized rigorous laboratory methods to conduct biochemical analyses on blood samples. It was designed and implemented using strict standardized population-based sampling to reduce biases in the selection of households and individuals using standardized field and laboratory methodologies to ensure proper handling of biological samples. We adjusted ferritin by inflammation by measuring AGP as recommended by BRINDA.

Study limitations include a lack of health status, additional micronutrient biomarkers that might impact anemia, and a lack of data regarding dietary intake, which are important factors for nutrient status assessments. This study was cross-sectional; therefore, causality cannot be determined. Because we assessed prevalence instead of incidence, we do not know if factors assessed were associated with having iron deficiency or a function of the length of time living with iron deficiency. The PAF estimates presented might not account for all relevant factors associated with anemia and inadequate micronutrient status, and therefore might not be reflective of the true potential impact that fortification might have. Finally, while there has been a lag time between data collection and dissemination, the country has seen no changes to its fortification policies since this study was conducted.

Conclusion

Anemia remains a public health problem in Belize. Iron deficiency was the factor most strongly associated with anemia. This study suggests that a combination of three modifiable nutritional risk factors is associated with about a third of anemia cases among WCBA in Belize. Fortification of staple foods combined with high population coverage is one potential option for reducing the population burden of anemia associated with iron and other micronutrient deficiencies.

Author contributions. JR designed the study, carried out the analysis, interpretation and drafted the manuscript. NL-B assisted in the design of the study, field work, interpretation, and manuscript drafting. LBB and GPAK designed and implemented the folate and vitamin B12 laboratory processing and analysis and assisted in interpretation and manuscript drafting. CJA assisted in data analysis, interpretation, and manuscript drafting. JLW assisted in interpretation and manuscript drafting. JJS, MD, and KB assisted in drafting the manuscript. All authors read and approved the final manuscript as submitted.

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Fracciones atribuibles poblacionales nacionales y regionales de factores de riesgo de anemia (hierro, folato y vitamina B_{12}) en Belice: posible impacto del enriquecimiento de los alimentos con suplementos

RESUMEN

Objetivo. Calcular la fracción atribuible poblacional a nivel nacional y regional y el número de casos de anemia que podrían prevenirse para tres factores de riesgo nutricional (deficiencia de hierro, folato eritrocitario y vitamina B_{12}) en las mujeres en edad reproductiva en Belice.

Metodología. Se llevó a cabo una encuesta probabilística nacional sobre características de los hogares y micronutrientes en la que se recopiló información sociodemográfica y de salud de 937 mujeres beliceñas no embarazadas de entre 15 y 49 años. Se extrajeron muestras de sangre para determinar los niveles de hemoglobina, ferritina, alfa–1–glucoproteína, folato eritrocitario y vitamina B_{12}. En todos los análisis se emplearon ponderaciones muestrales y variables calculadas para tener en cuenta que se trataba de una encuesta con una muestra compleja. Se estimaron mediante regresión logística las razones de riesgos de prevalencia ajustados, que posteriormente se utilizaron para calcular la fracción atribuible poblacional con respecto a la anemia a nivel nacional y regional.

Resultados. La prevalencia global de la anemia (hemoglobina <12 g/dl) fue del 21,2% (IC del 95%: 18,7–25,3). La prevalencia de la anemia fue significativamente mayor en las mujeres con ferropenia (59,5%, IC del 95%: 48,7–69,5) que en las que no tenían ferropenia (15,2%, IC del 95%: 12,2, 18,3); razón de riesgos de prevalencia ajustados = 3.9, IC del 95%; 2,9–5,1). Las tres deficiencias nutricionales examinadas explicaban al 34,6% (IC del 95%: 22,1–47,1) de los casos de anemia. Se estima que si pudieran eliminarse todas estas deficiencias nutricionales, se prevendrían unos 5953 (IC del 95%: 3807–8114) casos de anemia.

Conclusiones. Los resultados de este estudio sugieren que los casos de anemia en las mujeres en edad reproductiva de Belice podrían reducirse en un tercio si se pudieran eliminar tres factores de riesgo nutricionales modificables (deficiencias de hierro, folato eritrocitario y vitamina B_{12}). Una posible estrategia para mejorar el estado nutricional y reducir la carga de la anemia en este grupo poblacional es en el enriquecimiento de los alimentos con suplementos.

Palabras clave Anemia; factores de riesgo; salud de la mujer; anemia ferropénica; ácido fólico; deficiencia de vitamina B 12; Belice.

Frações atribuíveis populacionais nacionais e regionais de fatores de risco para anemia (ferro, ácido fólico e vitamina B12) em Belize: potencial impacto da fortificação

RESUMO

Objetivo. Estimar a fração atribuível populacional (FAP) nacional e regional e o potencial número de casos preveníveis de anemia para três fatores de risco nutricionais (deficiência de ferro, ácido fólico eritrocitário e vitamina B12) entre mulheres em idade fértil em Belize.

Métodos. Realizou-se um inquérito probabilístico domiciliar nacional sobre micronutrientes, que coletou informações sociodemográficas e de saúde de 937 mulheres belizenhas não grávidas com idade entre 15 e 49 anos. Coletaram-se amostras de sangue para dosagem de hemoglobina, ferritina, alfa-1-glicoproteína (AGP), ácido fólico eritrocitário e vitamina B12. Todas as análises usaram variáveis de delineamento e ponderações amostrais para refletir um inquérito amostral complexo. Aplicou-se regressão logística para determinar razões ajustadas de risco de prevalência (RPa), que foram usadas para estimar a FAP nacional e regional para anemia.

Resultados. A prevalência geral de anemia (hemoglobina <12 g/dL) foi de 21,2% (IC 95% [18,7–25,3]). A prevalência de anemia foi significativamente maior em mulheres com deficiência de ferro (59,5%, IC 95% [48,7–69,5]) que em mulheres sem deficiência de ferro (15,2%, IC 95% [12,2–18,3]); RPa 3,9, IC 95% [2,9–5,1]). As três deficiências nutricionais analisadas contribuíram para 34,6% (IC 95% [22,1–47,1]) dos casos de anemia. Caso se eliminassem todas essas deficiências nutricionais, seria possível evitar cerca de 5.953 (IC 95% [3.807–8.114]) casos de anemia.

Conclusões. Este estudo sugere que, nas mulheres belizenhas em idade fértil, os casos de anemia poderiam ser reduzidos em um terço caso fosse possível eliminar três fatores de risco nutricionais modificáveis (deficiência de ferro, ácido fólico eritrocitário e vitamina B12). A fortificação é uma possível estratégia para melhorar o estado nutricional e reduzir a carga de anemia nessa população.

Palavras-chave Anemia; fatores de risco; saúde da mulher; anemia ferropriva; ácido fólico; deficiência de vitamina B 12; Belize.