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Prevalence of anemia in Brazilian adults and elderly

Prevalência de anemia em adultos e idosos brasileiros

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ABSTRACT: ***Objective:*** To verify the prevalence of anemia in Brazilian adults and elderly. ***Methods:*** This is a cross-sectional study consisted of 8,060 subjects aged over 18 years old in all Brazilian states. We used data from laboratory tests of the Brazilian National Health Survey (*Pesquisa Nacional de Saúde* – PNS). The following indicators obtained by erythrogram were used: hemoglobin, mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), and red cell distribution width (RDW). Reference values of the World Health Organization (WHO) were used to determine anemia, which considers hemoglobin levels below 13.0 g/dL for men and less than 12.0 g/dL for women. Sociodemographic information was obtained by interview. ***Results:*** The prevalence of anemia among Brazilian adults and elderly was 9.9%. Higher prevalence of anemia and more severe cases were found among women, elderly, people with low schooling, black skin color and residents of the North and Northeast regions. Normocytic normochromic anemia was the most common type of anemia (56.0%). ***Conclusion:*** The anemia prevalence found in the study was in agreement with the literature. It must be stressed that higher anemia prevalence was found in disadvantaged and older population. Considering the increase of the population over 60 years of age, interventions to prevent and treat anemia among adults and elderly is imperative in the health service network.

Keywords: Anemia. Nutritional anemias. Risk factors. Adult. Aged.

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RESUMO: ***Objetivo:*** Verificar a prevalência de anemia em adultos e idosos brasileiros. ***Métodos:*** Foram utilizados dados provenientes de exames laboratoriais da Pesquisa Nacional de Saúde. Trata-se de um estudo transversal no qual foram incluídos 8.060 indivíduos com idades acima de 18 anos de todos os estados brasileiros. Foram estudados os seguintes indicadores obtidos por meio de eritrograma: dosagem de hemoglobina, volume corpuscular médio (VCM), hemoglobina corpuscular média (HCM) e red cell distribution width (RDW). Utilizaram-se as recomendações da Organização Mundial da Saúde, que consideram anemia o nível de hemoglobina menor que 13,0 g/dL para homens e menor que 12,0 g/dL para mulheres. As informações sociodemográficas foram obtidas por meio de entrevista. ***Resultados:*** A prevalência de anemia entre adultos e idosos brasileiros foi de 9,9%. Maiores prevalências de anemia e casos mais graves foram encontrados entre mulheres, idosos, pessoas de baixa escolaridade e de cor de pele preta e residentes das regiões Norte e Nordeste. Anemia normocítica e normocrômica foi o tipo mais comum (56,0%). ***Conclusão:*** A prevalência de anemia está de acordo com a literatura. Destaca-se que maiores prevalências foram observadas nas populações mais desfavorecidas e entre os idosos. Considerando o crescimento da população acima de 60 anos no país, intervenções para tratar e prevenir a anemia em adultos e idosos se fazem necessárias na rede de serviços de saúde.

Palavras-chave: Anemia. Anemias nutricionais. Fatores de risco. Adulto. Idoso.

INTRODUCTION

Anemia is defined as a reduction in the number of red blood cells or their ability to carry oxygen through hemoglobin to meet physiological needs[1]. Worldwide, according to results from the Global Burden of Disease Study 2017, anemia prevalence was estimated at 27%[2]. The World Health Organization (WHO) estimated a global prevalence of anemia between 1993 and 2005 of 24.8%, ranging from 12.7% in adult men to 47.4% in children aged 0 to 5 years[3].

Anemias are a widely distributed public health problem that increases the risk of morbidity and mortality, especially in children, pregnant women and the elderly[4]. Consequences of morbidity associated with chronic anemia include loss of productivity, cognitive difficulties and increased susceptibility to infections, which also contributes to substantial economic loss[5]. In women, a recent review study found that anemia is also related to premature birth, low birth weight, and infant and maternal mortality[6].

Anemias have several causes and are often multifactorial. Risk factors for the development of anemia include nutritional aspects, such as vitamin and mineral deficiencies, and non-nutritional ones, such as hemoglobinopathies, acute and chronic blood loss, malaria, infections, chronic kidney disease, and gastrointestinal and gynecological conditions[1]. However, considering the role of iron in oxygen transport and the low availability of this micronutrient in the diet of a large proportion of the world's population, such deficiency is the leading cause of anemia, accounting for more than 50% of cases globally[1,4].

Thus, the prevalence of this condition is especially high in populations of low socioeconomic status, low body weight and pregnant and postpartum women[3,7]. In this context, because of the need to collect biological material for prevalence studies, which increases cost and logistical difficulty, most national and international studies on anemia include a sample composed mainly of children and women of childbearing age[3,7]. Studies that include other life cycles are generally local in scope and target specific populations[8-10].

In Brazil, data from the National Child and Women's Demographic and Health Survey (*Pesquisa Nacional de Demografia e Saúde da Criança e da Mulher – PNDS*) 2006 show that 29.4% of women aged 15 to 49 years had anemia, while the prevalence in children was 20.9%[7]. Studies with the female population of childbearing age reveal anemia prevalence ranging from 18.6% in women in the municipality of Pernambuco[11] to 38.0% in indigenous women[12]. In pregnant women users of Basic Health Units of Maceió, the prevalence was 28.3% in 2014[13].

Among the elderly, a household survey in Porto Alegre, Rio Grande do Sul, showed anemia prevalence of 8.8% in 2012[8]. Among the elderly population using the Unified Health System (SUS) in Campina Grande, the prevalence was 12.5%. % in 2010[14]. In the elderly in long-term care facilities, the prevalence of anemia reached 38.0% in Salvador[15].

Thus, although anemia is a global public health problem, current data on its prevalence in the general Brazilian population are not available. Thus, it is necessary to provide current information on the situation of anemia in the Brazilian adult population and to detect the groups most affected by this condition in order to support public policies.

The objective of the present study was to describe the prevalence of anemia in adults and elderly in Brazil, according to sociodemographic characteristics, using data from the National Health Survey Laboratory (*Pesquisa Nacional de Saúde* – PNS).

METHODS

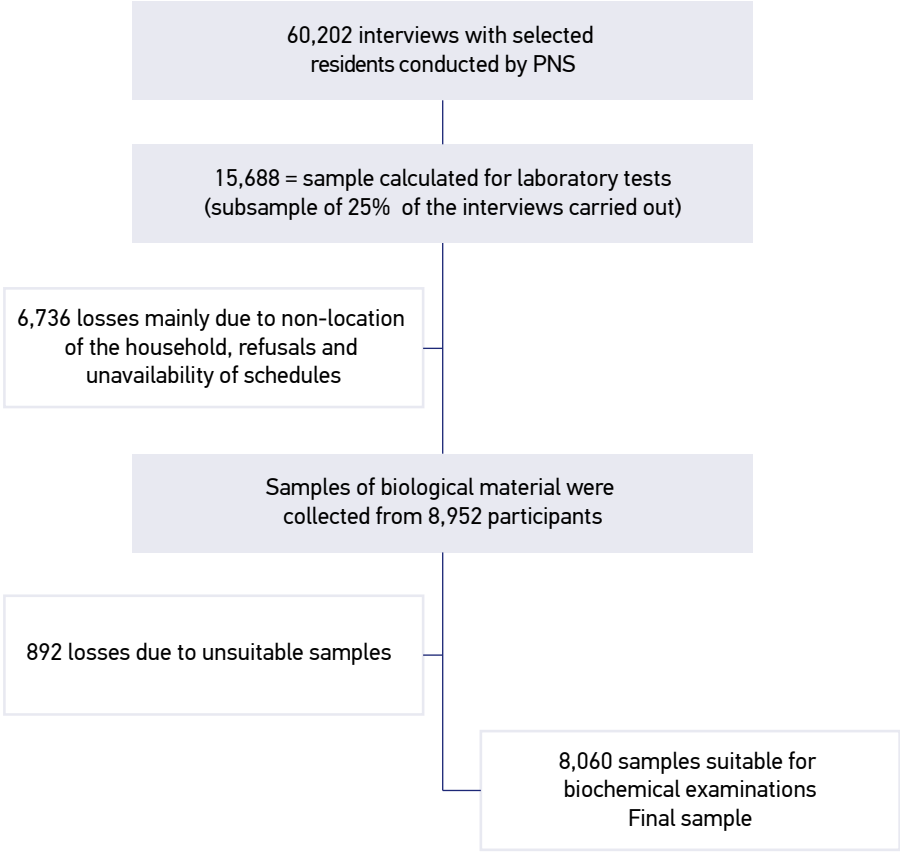
The PNS is a household-based survey conducted in 2013 by the Brazilian Institute of Geography and Statistics (*Instituto Brasileiro de Geografia e Estatística* – IBGE) in partnership with the Ministry of Health. Information was collected from households using a three-stage cluster sampling plan. Primary sampling units (PSU) were the census sectors or set of sectors; the secondary units, the households; and tertiary units, adult residents aged 18 years old or older. Further details on PNS and its sampling procedures can be obtained from previous publications[16].

The PNS had 60,202 interviews, and, in one subsample, biological material was collected for biochemical analysis. The subsample was designed to include 25% of the sample of respondents, and for its composition, we considered the municipalities that had the best infrastructure for performing examinations, by means of probability proportional to the

inverse distance from the city where the PSU is located and the nearest municipality with 80 thousand inhabitants or more[17].

The final sample of individuals who had biological material collected consisted of 8,955 individuals. Among the causes of the losses, we highlight not locating the household, participants' refusal to collect biological material, lack of knowledge of the project and objectives, and unavailability of time to attend to the research. No samples were collected from pregnant women. More details about the sample and data collection methods are available in another publication in the same series[17]. From the final sample, 892 participants were excluded, due to their having an inadequate sample to perform laboratory tests. Figure 1 illustrates the flow of losses.

Samples were collected by peripheral venipuncture in vacuum blood collection tubes with ethylenediaminetetraacetic acid (EDTA) and evaluated with an automated cell analyzer. The results of the exams were informed directly to the participant by the hired laboratory. Individuals with altered exams received indications for seeking medical attention.



PNS: National Health Survey.

Figure 1. Sample constitution flowchart.

Cases with results considered critical were immediately identified by the associated laboratory and assistance was provided in the SUS health service network.

In the current study, the following hematimetric indexes were analyzed: hemoglobin; mean corpuscular volume (MCV), which indicates the average volume of red blood cells; mean corpuscular hemoglobin (MCH), which indicates the amount of hemoglobin in the red blood cell; and red cell distribution width (RDW), which evaluates the size variation between red blood cells.

For the definition of anemia, the diagnostic criteria and severity assessment for adults proposed by the WHO were used[18]:

- Men: hemoglobin level lower than 13.0 g/dL indicates that: between 11 and 12.9 g/dL indicates mild anemia; between 8 and 10.9 g/dL moderate anemia; and less than 8 g/dL severe anemia;
- Women: hemoglobin level lower than 12.0 g/dL indicates anemia: that between 11 and 11.9 g/dL mild anemia; between 8 and 10.9 g/dL moderate anemia; and less than 8 g/dL indicates severe anemia.

The MCV and MCH hematimetric indexes were classified according to the reference values proposed by Malvezzi[19], for the Brazilian population, for the definition of hypochromia, normochromia and hyperchromia, microcytosis, normocytosis and macrocytosis. RDW was classified according to the normality limits proposed by Adeli *et al.*[20], as presented:

- MCV concentration: 83.0 to 99.0 fl for males and 82.4 to 96.4 fl for females[19];
- MCH concentration: from 27.9 to 33.9 pg for males and from 27.3 to 32.9 pg for females[19];
- RDW: from 11.4 to 13.5% for both genders[20].

Analyses were stratified by gender, age group (18 to 29, 30 to 44, 45 to 59, 60 to 74, and 75 years old or older), education (uneducated and incomplete elementary education, complete elementary education and incomplete high school education, complete high school education and higher), skin color (white, black, brown, other) and region (North, Northeast, Southeast, South, Midwest). Data were analyzed by Stata v. 14, using the survey command set, which allows analysis of complex sample survey data incorporating post-stratification weights specifically created for the PNS laboratory sample — which included the variables gender, age, skin color, level of education and region — to reduce the bias of non-representation. More information on weighting is available in another publication in this same issue[17]. Pearson's χ^2 test and analysis of 95% confidence intervals (95%CI) were used to identify differences between proportions. The significance level established in the analyses was 5%.

Individuals participated voluntarily in the PNS, which was approved by the National Research Ethics Commission (CONEP) of the National Health Council (*Conselho Nacional de Saúde* – CNS) of the Ministry of Health, under Report No. 328.159, of June 26, 2013.

RESULTS

This study had a sample of 8,060 individuals aged between 18 and 101 years old, in which 52.9% of the participants were female. The prevalence of anemia in the study population was 9.9%, 7.2% in men and 12.3% in women. Higher prevalence of anemia was observed among women, elderly, black-skinned population, low level of education and residents of the North and Northeast regions (Table 1).

Important differences were observed between genders. Women had higher prevalence in younger age groups, but from 45 years of age on, there was no difference in the prevalence of anemia between genders. In men, the lowest prevalence was found among those who had complete high school education or higher. Among women, there was no significant difference in relation to education. With regard to skin color, black men exhibited much higher prevalence of anemia than other categories (Table 1).

Regarding the severity of anemia classification, 1.9% presented moderate to severe anemia and 8.0% mild anemia. Higher prevalence of moderate to severe anemia was found in females, elderly, black people and in the North and Northeast regions (Table 2).

Regarding the other hematimetric indexes, 23.2 and 10.2% presented, respectively, reduced and increased MCV; 32.1% showed reduced MCH; and 75.5% increased RDW. In females, there was a higher proportion of individuals with reduced MCV and MCH (Table 3).

Regarding the classification of anemias according to MCV and MCH values, the highest proportion of those considered anemic presented normocytic and normochromic anemia (56.0% in the total population, 58.8% among men and 54.5% among women); followed by hypochromic and microcytic anemia (21.4% in the total population, 16.5% among men and 24.0% among women); and macrocytic normochromics (10.2% in the total population, 14.0% among men and 8.1% among women). Hypochromic and microcytic anemia were more frequent in females, and normochromic and macrocytic anemia in males, although there was an overlap of 95%CI (Graphic 1A). The age group 60 years old or older presented lower frequency of hypochromic and microcytic anemia and higher frequency of normocytic and normochromic anemia (Graphic 1B). Increased RDW was observed in 94.5% of those with homochromic and microcytic anemia and 67.0% of those with normochromic and normocytic anemia (Graphic 1C).

DISCUSSION

Anemia is a public health problem worldwide and varies according to cultural, dietary and morbidity patterns due to infectious diseases and chronic conditions in high, middle and low income countries[4]. Anemia is estimated to reach 27% of the world's population[2], although prevalence may range from 9% in high-income countries to 43% in low-income ones[21].

Table 1. Prevalence of anemia and sociodemographic characteristics in adults, National Health Survey (PNS), Brazil, 2013–2014.

	Total (n = 8,060)				Males (n = 3,353)				Females (n = 4,707)			
	%	95%CI		p	%	95%CI		p	%	95%CI		p
Total	9.86	9.07	10.71		7.18	6.13	8.40		12.25	11.11	13.48	< 0.001
Age range (years)				< 0.001				< 0.001				< 0.001
18 to 29	8.08	6.58	9.89		4.73	3.01	7.36		11.43	9.16	14.17	
30 to 44	9.33	8.03	10.80		4.79	3.50	6.53		13.26	11.22	15.60	
45 to 59	8.64	7.15	10.40		7.85	5.64	10.84		9.35	7.50	11.60	
60 to 74	12.00	10.04	14.29		10.85	8.13	14.34		12.92	10.27	16.13	
75 old or older	24.33	19.50	29.92		26.71	19.10	36.01		22.68	16.76	29.62	
Education				< 0.001				0.001				0.079
Illiterate or incomplete elementary education	11.91	10.67	13.28		9.85	8.19	11.81		13.81	12.05	15.79	
Complete elementary or incomplete high school education	10.18	8.01	12.86		7.64	4.75	12.07		12.72	9.81	16.35	
Complete high school education or higher	8.03	6.95	9.26		4.64	3.39	6.33		10.85	9.25	12.68	
Skin color				< 0.001				< 0.001				0.001
White	8.04	6.96	9.26		5.26	3.99	6.89		10.43	8.83	12.28	
Black	17.13	13.48	21.52		17.03	11.26	24.92		17.21	13.10	22.28	
Brown	10.47	9.40	11.64		7.26	6.01	8.75		13.46	11.83	15.27	
Other	4.19	2.11	8.18		1.39	0.21	8.43		6.08	2.82	12.59	
Region				< 0.001				< 0.001				< 0.001
North	11.59	10.19	13.16		8.33	6.54	10.56		14.64	12.61	16.93	
Northeast	13.62	12.36	14.98		11.21	9.48	13.21		15.73	13.98	17.65	
Southeast	9.09	7.68	10.73		6.10	4.33	8.54		11.73	9.71	14.11	
South	6.80	5.33	8.64		4.35	2.55	7.31		9.01	6.92	11.65	
Midwest	6.40	4.90	8.31		4.79	2.88	7.87		7.87	5.80	10.58	

95%CI: 95% confidence interval.

Table 2. Classification of anemia in adults and sociodemographic characteristics, National health Survey (PNS), Brazil, 2013–2014.

	Moderate to severe anemia (n = 191)			Mild anemia (n = 714)			Normal (n = 7,155)		
	%	95%CI		%	95%CI		%	95%CI	
Total (n = 8.060)	1.91	1.57	2.31	7.95	7.24	8.74	90.14	89.29	90.93
Gender									
Male	0.88	0.52	1.49	6.31	5.34	7.43	92.82	91.60	93.87
Female	2.76	2.25	3.38	9.38	8.36	10.52	87.86	86.62	89.01
Age range (years)									
18 to 29	2.04	1.32	3.15	6.04	4.77	7.62	91.92	90.11	93.42
30 to 44	1.34	0.96	1.87	7.99	6.76	9.41	90.67	89.20	91.97
45 to 59	1.40	0.86	2.27	7.24	5.87	8.89	91.36	89.60	92.85
60 to 74	2.56	1.70	3.83	9.45	7.71	11.53	88.00	85.71	89.96
75 old or older	5.92	3.74	9.24	18.42	14.10	23.69	75.67	70.08	80.50
Education									
Illiterate and incomplete elementar education	2.22	1.70	2.90	9.69	8.57	10.94	88.09	86.72	89.33
Complete elementar and incomplete high school education	2.04	1.22	3.39	8.14	6.18	10.67	89.82	87.14	91.99
Complete high school and higher	1.59	1.15	2.21	6.44	5.47	7.56	91.97	90.74	93.05
Skin color									
White	1.42	1.05	1.93	6.61	5.62	7.77	91.96	90.74	93.04
Black	3.46	1.94	6.09	13.67	10.39	17.77	82.87	78.48	86.52
Brown	2.15	1.65	2.81	8.31	7.38	9.35	89.53	88.36	90.60
Other	0.30	0.04	2.14	3.89	1.90	7.83	95.81	91.83	97.89
Region									
North	3.36	2.61	4.33	8.23	7.05	9.58	88.41	86.84	89.81
Northeast	2.42	1.91	3.06	11.20	10.04	12.47	86.38	85.02	87.64
Southeast	1.74	1.17	2.59	7.35	6.08	8.86	90.91	89.27	92.32
South	1.53	0.95	2.45	5.27	3.95	6.99	93.20	91.36	94.68
Midwest	0.69	0.33	1.46	5.71	4.29	7.56	93.60	91.69	95.10

95%CI: 95% confidence interval.

In this study, the prevalence of anemia among adults and the elderly in Brazil alone was almost 10%. According to the classification of anemia as a public health problem proposed by the WHO[18] based on the estimated prevalence of hemoglobin blood levels, anemia in Brazil between adults and the elderly can be considered a problem of low expression in relation to the worldwide prevalence; however it should be noted that the present study did not include a sample of children, who are at high risk of having anemia and suffering the most serious consequences of this condition[2], which justifies the lower prevalence compared to other studies involving populations of all age groups.

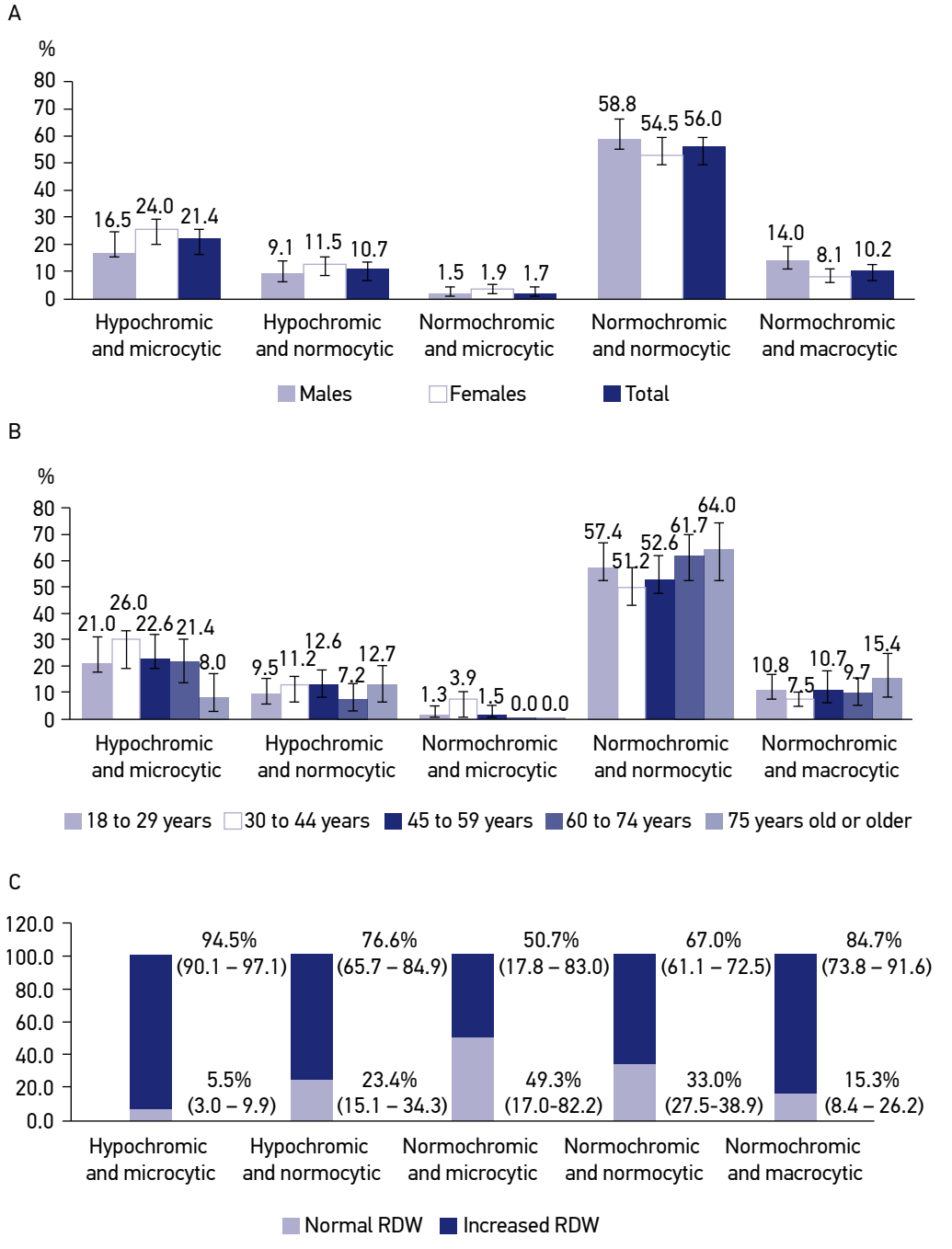
Anemia was more prevalent and presented more severe levels among women and among the elderly, individuals with low education and black skin color and residents of the North and Northeast regions. The identification of these risk groups is consistent with previous studies regarding gender[22], race[23], education/socioeconomic status[9] and elderly[22-24]. In women, those of reproductive age also exhibited high prevalence of anemia, in agreement with previous literature[23].

According to the PNDS conducted in 2006, the prevalence of anemia in women of childbearing age was 29.4%[7]. In the present study, the prevalence of anemia in women aged 18 to 29 and 30 to 44 years old was less than half of that found in 2006, using the same diagnostic criteria. This difference may be due to the great effort of the Brazilian government,

Table 3. Hematimetric rates in anemic adults, National Health Survey (PNS), Brazil, 2013–2014.

Hematimetric rates	Reduced			Normal			Increased		
	%	95%CI		%	95%CI		%	95%CI	
Total (n = 905)									
MCV	23.17	19.49	27.32	66.63	62.35	70.66	10.19	8.12	12.71
MCH	32.13	28.18	36.37	65.61	61.30	69.68	2.26	1.12	4.50
RDW	0.00	0.00	0.00	24.53	20.87	28.59	75.47	71.41	79.13
Male (n = 279)									
MCV	18.00	12.01	26.09	67.91	59.79	75.07	14.09	9.89	19.70
MCH	25.74	19.05	33.79	71.20	62.89	78.30	3.06	0.94	9.49
RDW	0.00	0.00	0.00	22.03	16.04	29.46	77.97	70.54	83.96
Female (n = 626)									
MCV	25.88	21.46	30.85	65.97	60.92	70.68	8.15	6.08	10.85
MCH	35.48	30.75	40.51	62.69	57.61	67.50	1.83	0.81	4.12
RDW	0.00	0.00	0.00	25.83	21.42	30.80	74.17	69.20	78.58

95%CI: 95% confidence interval; MCV: mean corpuscular volume; MCH: mean corpuscular hemoglobin; RDW: red cell distribution width.



*Values close to 0.

Graphic 1. Classification of anemias according to the hematimetric indexes mean corpuscular volume and mean corpuscular hemoglobin rates in anemic adults by (A) gender, (B) age group and (C) red cell distribution width. National Health Survey (PNS), Brazil, 2013–2014.

aligned with international recommendations, to minimize anemia among the public health problems of the Brazilian population, especially with the Wheat Flour, Corn and By-Products Fortification Program, to all purposes, with iron and folic acid, whose effective implementation took place in 2004[25]. It is also noteworthy that, in 2005, the National Iron Supplementation Program was implemented, which consists of the prophylactic supplementation of this micronutrient for children from 6 to 24 months of age, pregnant and postpartum women, and supplementation of pregnant women with folic acid. In addition to these programs, it is also the attribution of primary health care, within the scope of SUS, the promotion of adequate and healthy diet to increase the consumption of iron source foods to prevent anemia[26].

Anemia in the elderly is a common problem, with an increase in its prevalence every decade of life, from 70 years old[24]. In the current study, the age group 75 years old or older had the highest proportion of anemia and moderate to severe anemia. These high rates are noteworthy, since anemia in the elderly is associated with disabilities, worse cognitive function and increased morbidity and mortality[23,27]. In addition, chronic conditions that greatly affect the elderly population, such as cancer and chronic kidney disease, may result in anemia and lead to a worse prognosis[23]. Thus, anemia in older individuals requires greater public health attention, not only for its high prevalence, but also for its potential health consequences.

Regarding age, it is noteworthy that differences were observed between the genders. Among men, the prevalence of anemia was lower in the 18 to 44 years age group, while for women it was less common in the 45 to 59 years age group. The increased proportion of age-associated anemia was also more marked in men, to the point of becoming more common in individuals over 75 years of age. The same pattern was observed in an American study[24]. Brazilian investigations with the elderly also found higher prevalence of anemia in the males compared to the femals[8,9,14]. The effect that men are more likely to have anemia in older age groups may be related to the reduction in testosterone production, which has a significant impact on lowering hemoglobin levels in the body[28].

Regarding the differences between regions and educational levels, it is important to emphasize the importance of nutritional factors, which are the ones that most contribute to the occurrence of anemia in both genders[1]. A population-based study in Brazil with children and women of childbearing age also found higher prevalence of anemia in the Northeast Region[7], indicating a relationship between anemia and socioeconomic and cultural conditions. Studies have also shown that people with poorer socioeconomic status and lower education are more likely to have anemia because of poor access to adequate and varied food[10,11,29].

Skin color was a poorly evaluated factor in studies available in the literature. A study with the North-American population found that anemia was three times higher in black than in white/Caucasian people, and only part of this racial difference was due to differences in risk factors for anemia[30]. In the current study, the same was observed among men. Such differences need to be better studied in order to investigate the need to establish different hemoglobin reference values according to gender and skin color.

Hypochromic microcytic anemia with high RDW is characteristic of iron deficiency and may be due to nutritional deficiency, iron absorption deficiency due to gastrointestinal changes and chronic loss of this micronutrient. Moreover, it is more frequent in women of childbearing age[31]. In the present study, 95% of individuals with hypochromic and microcytic anemia had high RDW, which represented 20% of anemic individuals and 2% of the population studied. These findings show the magnitude of iron deficiency and reinforce the importance of continuing and strengthening drug supplementation and food fortification programs.

Microcytic and hypochromic anemia with normal RDW and enlarged red blood cells is suggestive of thalassemia hemoglobinopathy, to be confirmed by hemoglobin electrophoresis, capillary electrophoresis, or high performance liquid chromatography (HPLC)[20,32].

Macrocytic anemia is commonly associated with gastrointestinal changes with deficiency in absorption or loss of vitamin B12 (cyanocobalamin) and folate[20,32]. This anemia may also be associated with consumptive and even neoplastic states[20,32]. Macrocytosis is also a very common condition in alcoholism with or without cirrhosis, due to several factors: marked hemolysis of red blood cells, folate deficiency and direct alcohol toxicity on the marrow[20]. This condition was present in one tenth of the population, reaching a prevalence of 15% among the elderly. Therefore, the magnitude of chronic diseases and nutritional deficiencies in this population is highlighted.

Another form of anemia common in the elderly population is the normocytic and normochromic with normal RDW, which can be found in acute bleeding and anemia of chronic diseases. This anemia may be associated with thyroid alterations, rheumatological, autoimmune and neoplastic diseases, among other chronic pathologies[20,32]. Such anemia was present in 18.5% of the anemic identified here and in 1.7% of the total population.

Due to its high prevalence and health consequences, coping with anemia is one of the priorities in public health, finding political support in Brazil's commitment to reduce iron deficiency anemia not only nationally but also internationally. In 2016, the United Nations General Assembly proclaimed the United Nations Decade of Action on Nutrition (2016–2025). Led by WHO and the United Nations Food and Agriculture Organization (FAO), the resolution is a milestone for making commitments, tracking progress and ensuring mutual accountability in line with the global nutrition goals of eradicating hunger and avoiding all forms of malnutrition around the world[33]. The 2030 Agenda for Sustainable Development also includes the goal of,

> by 2030, end all forms of malnutrition, including by meeting the internationally agreed targets for chronic malnutrition and malnutrition in children under five by 2025, and addressing the nutritional needs of adolescent girls, pregnant and lactating women and elderly people[34].

For the country to reach the agreed goals, it is necessary to intensify actions in the field of food and nutrition security, with special attention to the most vulnerable groups

This study contains some limitations. First, the sample size made it possible to accurately estimate the prevalence of anemia and its forms according to hematimetric values in the

total population; however, in some age and skin color groups, estimates with wide confidence intervals were observed and should be interpreted with caution. The research showed higher prevalence of anemia in the elderly and individuals with low education. Considering that the elderly have lower education in Brazil, it is recommended in future analyzes that age be controlled to know the effect of schooling in isolation.

CONCLUSION

The prevalence of anemia was higher among women, elderly, low-educated, and black people, and residents of the North and Northeast. Because anemia is associated with increased morbidity and mortality in older adults, given the increasing elderly population, and because higher prevalence and more severe forms of the condition are found in the most vulnerable populations, interventions to treat and prevent anemia in order to reduce iniquities are necessary.

The results presented here provide an overview of anemia in the population over 18 years of age in Brazil. It is noteworthy that surveillance systems for anemia with blood samples from a representative sample of the population are essential for decision-making in public health and for monitoring the control program, allowing the monitoring of the goals established in national and international agreements.

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