

PREVALENCE OF ANEMIA AND ASSOCIATED FACTORS IN ELDERLY PERUVIANS

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ABSTRACT

Objectives. To estimate the prevalence of anemia and associated factors in elderly residing in Peruvian households. **Materials and methods.** The study deals with a cross-sectional design and was conducted in 2011. The sample was probabilistic, stratified and multistage independent in department of Peru. The required sample housing was 5792, we included 2172 elderly. We asked informed consent of all elderly. The anemia was defined as hemoglobin <13.0 g / dL in men and <12.0 g / dL in women, hemoglobin was adjusted for altitude. The anthropometric measurements were performed according to methodology MINSA/INS. The Nutritional status was assessed by body mass index. The classification of nutritional status: underweight (BMI≤23.0) (BMI>23 to <28), overweight (BMI≥28 to <32.0) and obesity (BMI≥32). Statistical analysis was performed using complex samples and adjusted by the weighting factor. We Calculated means, proportions. The chi-square and regression logistic. **Results.** The mean hemoglobin was 13.4 ± 1.6 g / dL. The prevalence of anemia was 23,3% (mild anemia 17.1%, moderate: severe 5,7% and 0,5%). The age 70 to 79 years (OR 1.5; CI 95%:1.1; 2.0), > 80 years (OR 2.1; CI 95%: 1.4; 3.0) and thinness (OR 1.7; CI 95%: 1.2, 2.3) associated with anemia. Ayacucho, Ancash, Lambayeque and Apurimac were the departments with the highest prevalence of anemia. **Conclusions.** Approximately one quarter of elderly were anemic, being more prevalent in the illiterate, rural and poor. Older age and thinness are associated with anemia in elderly Peruvians.

Key words: Elderly; Anemia; Thinness; Overweight; Obesity (source: MeSH, NLM)

INTRODUCTION

Anemia is a frequent health problem among the elderly, and its incidence increases after age 50 ⁽¹⁾. The prevalence of anemia among adults over 65 is 10% among women and 11% among men and increases by 26.1% among men and by 20.1% among women over 85 years old ⁽²⁾. Some studies indicate that the prevalence of anemia among the elderly varies: between 2.9% and 61% among males and between 3.3% and 41.0% among females ⁽³⁾. In Peru, studies on hospitalized senior citizens show the frequency of anemia of 42% ⁽⁴⁾ and 76.4% ⁽⁵⁾.

The prevalence of anemia increases with age ^(6,7) and is associated with lifestyle changes. It also increases the risk of falls and infections and diminishes cognitive status and functional capacity ⁽⁸⁾. Anemia often tends to be misdiagnosed due to comorbidity ⁽⁹⁾. The causes of anemia among the elderly can be classified into three categories: deficiency of iron intake with food, anemia associated with chronic kidney disease, and unexplained anemia ⁽¹⁰⁾. The latter is attributed to a decrease in hemoglobin levels, possibly as an erythropoietic response to the iron deficiency, high levels of proinflammatory cytokines, decreased levels of androgens, and a proliferative and regenerative decrease in the number of

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bone marrow cells, myelodysplasia which is associated with decreased life expectancy⁽¹¹⁾. Anemia among the elderly increases mortality and cardiovascular mortality and morbidity and is associated with such problems as greater cognitive impairment, fragility, decreased quality of life, and a higher risk of domestic injuries^(12,13).

Several studies have been conducted on hospitalized elderly patients; these studies involved small, nonprobabilistic samples. This is the first time that the national prevalence of anemia among the elderly has been estimated in a population-based study of national inference and is expected to show a true picture of anemia as a public health issue among elderly Peruvians.

The aim of this study was to estimate the prevalence of anemia and the associated factors among senior citizens residing in Peruvian households.

MATERIALS AND METHODS

STUDY DESIGN AND POPULATION

An observational and cross-sectional study was conducted. We included senior citizens living in Peruvian households who agreed voluntarily to participate in the study and excluded senior citizens with physical limitations (congenital malformations or accentuated scoliosis) that would make anthropometric measurements difficult. The data were collected in 2011. Sampling was probabilistic, stratified, in multiple stages, and independent in each Peruvian region. The size of the sample was calculated to estimate the characteristics of the home, characteristics of household members, education, health, employment, income, and household expenses. The following metrics were considered: the confidence level of 95%, precision of 5%, all households in Peru, nonresponse rate, and the design effect corresponding to the previous reports of the National Household Survey (Spanish acronym ENAHO) of 2011. The required sample was 5,792 households (3,384 in urban areas and 2,408 in rural areas). Six households were selected randomly from each urban conglomerate, and eight households from rural conglomerates⁽¹⁴⁾. The study was conducted within the framework of the agreement between the National Institute of Statistics and Information (INEI, Spanish acronym) and the National Health Institute (INS, Spanish acronym), via which the INEI provides the sample and maps, and the INS (through the National Food and Nutrition Center; CENAN, Spanish acronym) performed the anthropometric and biochemical evaluations on the population included in the sample. 2,172 senior citizens (60 years old or older) were included at the national level.

METHODS AND INSTRUMENTS

Anemia was defined as the concentration of hemoglobin (Hb) of <13.0 g/dL in males and <12.0 g/dL in females. We considered mild ($12.0 \text{ g/dL} \leq \text{Hb} \leq 12.9 \text{ g/dL}$), moderate ($9.0 \text{ g/dL} \leq \text{Hb} \leq 11.9 \text{ g/dL}$), and severe anemia ($\text{Hb} < 9.0 \text{ g/dL}$) among males. We also considered mild anemia ($10.0 \text{ g/dL} \leq \text{Hb} \leq 11.9 \text{ g/dL}$), moderate ($7.0 \text{ g/dL} \leq \text{Hb} \leq 9.9 \text{ g/dL}$), and severe anemia ($\text{Hb} < 7.0 \text{ g/dL}$) among females⁽¹⁵⁾. Concentrations of Hb were quantified in capillary blood samples with a portable Hb meter. Hb data were adjusted for altitude above the sea level, according to the following formula: $\text{Adjustment} = 0.022 \times ([\text{altitude}/1000] \times 3.3 \times [\text{altitude}/1000] \times 3.3) - (0.032 \times ([\text{altitude}/1000] \times 3.3))$.

Anthropometric measurements were carried out according to the MINS/INS methodology. We used a calibrated digital scale with the capacity of 150 kg and precision of $\pm 100 \text{ g}$ as well as mobile wooden measuring boards. The personnel who did the weight and height measurements were trained and certified by the INS's National Food and Nutrition Center. Nutritional status was evaluated by means of the body mass index (BMI) according to the Ministry of Health's classification of nutritional status for the elderly: underweight ($\text{BMI} \leq 23.0$), normal ($23 < \text{BMI} < 28$), overweight ($28 \leq \text{BMI} < 32.0$), and obese ($\text{BMI} \geq 32$)⁽¹⁶⁾.

Poverty was measured by the monetary approach (poor household, extremely poor household, and not poor), and the following definitions were used: "poor households" were homes where only food was provided, but they could not afford to fulfill other needs such as goods and services, education, health care, shoes, transportation, or housing. "Extremely poor households" were homes that could not cover their food expenses or other expenses related to goods and services such as transportation, clothing, housing, education, and health care. Finally, "not poor households" were homes that could fulfill the nutritional needs of the family members as well as other needs such as transportation, clothing, housing, education, and health care⁽¹⁷⁾.

DATA ANALYSIS

The data were analyzed in the SPSS software v. 22 for complex samples and adjusted by the weighting factor. Means were calculated with proportions within a confidence interval of 95%. We calculated chi squared and the logistical regression to evaluate the association between the covariables and anemia.

ETHICAL CONSIDERATIONS

We requested written consent from every participant; this consent was confirmed by means of a signature or

a fingerprint (from illiterate participants). This procedure was performed in the presence of a witness. The study was conducted within the framework of the Supervision of Nutritional Indicators carried out by the Executive Directorate of Food and Nutritional Supervision of the National Institute of Health in agreement with the National Institute of Statistics and Information and was recorded and approved in the Institutional Operational Plan of the National Institute of Health and therefore was not evaluated by the INS Ethics Committee.

RESULTS

We included 2,172 senior citizens, 60.6% of whom were married or living with someone; 77.7% had primary, secondary, or higher education; most had some type of health insurance; and 21.3% were poor (extreme poverty or poverty; Table 1).

The Hb level was 13.4 ± 1.6 g/dL (mean \pm SD) and was higher in males (13.8 ± 1.8 g/dL) than in females (12.9 ± 1.4 g/dL). The average Hb level was the highest in obese subjects (14.1 g/dL), followed by overweight people (13.6 g/dL), and people of normal weight (13.4 g/dL) and was the lowest was in those who were underweight (12.9 g/dL). The prevalence of anemia was 23.3% (95% CI 21.1–25.7%), where 17.1% (95% CI 15.2–19.3%) were mild cases of anemia, 5.7% (95% CI 4.6–7.0%) were moderate cases, and 0.5% (95% CI 0.2–1.1%) were severe cases (Table 2).

The regions with the highest prevalence were Ayacucho (57.6%), Ancash (40.1%), Lambayeque (37.7%), and Apurímac (36.9%). Cajamarca (9.5%) and Arequipa (8.8%) showed the lowest prevalence of anemia at the national level (Figure 1).

DISCUSSION

The population of the world is aging gradually⁽¹⁸⁾, both in developed and developing countries. Nevertheless, preparation or the way this period is dealt with differs among the elderly depending on where they live. Most studies on the elderly were conducted in hospital environments. There are few population-based studies on anemia in the elderly.

Approximately one in every four senior citizens suffers from anemia; our results are lower than those reported by Reyes (42%) and Ortiz *et al.* (76.4%) in Peru^(4,5) and well below those reported in Chile (40.1%)⁽¹⁹⁾ and New Zealand (33.3%)⁽²⁰⁾ but above those reported by

Table 1. Characteristics of Peruvian senior citizens, 2011

Characteristics	n	%	(IC 95%)
Age			
60-69	1060	47.6	(44.4-50.8)
70-79	754	35.5	(32.7-38.4)
>80	358	16.9	(14.8-19.2)
Gender			
Male	1040	49.1	(46.9-51.4)
Female	1132	50.9	(48.6-53.1)
Marital status			
Cohabitant	221	9.6	(7.7-12.1)
Married	1134	51.0	(47.9-54.1)
Widowed	719	34.4	(31.7-37.2)
Divorced/Separated/Single	98	5.0	(3.7-6.6)
Educational level			
Illiterate	592	22.3	(20.1-24.7)
Elementary	1077	46.3	(43.1-49.6)
Secondary	345	20.5	(18.1-23.1)
Higher education	157	10.9	(8.4-14.1)
Health insurance			
No	635	30.3	(27.2-33.6)
Yes	1536	69.7	(66.4-72.8)
Area			
Urban	1198	70.8	(67.3-74.2)
Rural	974	29.2	(25.8-32.7)
Type of geographical area			
Metropolitan Lima	235	30.8	(27.1-34.7)
Coast	643	24.3	(21.6-27.3)
Mountains	900	33.6	(30.5-36.8)
Jungle	394	11.3	(9.6-13.3)
Poverty level			
Extreme poverty	193	6.1	(4.9-7.5)
Nonextreme poverty	407	15.2	(13.0-17.7)
Not poverty	1572	78.7	(75.8-81.3)

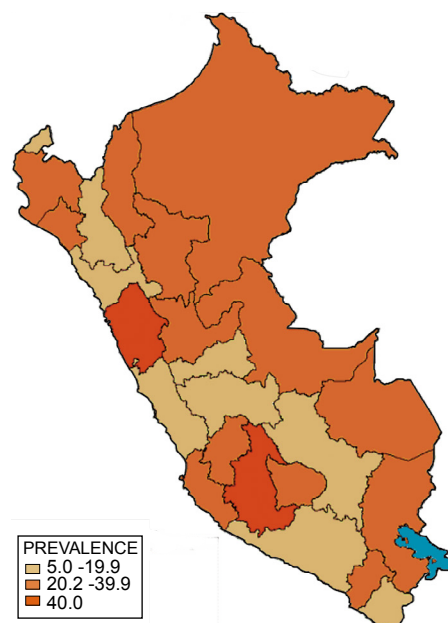


Figure 1. Distribution of anemia among senior citizens (Peru; 2011)

Table 2. Characteristics of Peruvian senior citizens by anemia (2011)

Variables	With anemia		Without anemia		OR	(95% CI)	p value
	n	(%)	n	(%)			
Age							
60-69	193	(17.0)	862	(83.0)	1.0		<0.001
70-79	217	(25.9)	537	(74.1)	1.5	(1.1-2.0)	
>80	141	(35.7)	216	(64.3)	2.1	(1.4-3.0)	
Gender							
Male	277	(25.5)	758	(74.5)	1.0		0.048
Female	274	(21.2)	857	(78.8)	0.8	(0.6-1.0)	
In a relationship							
Yes	341	(23.4)	1008	(76.6)	1.0		0.885
No	210	(23.1)	607	(76.9)	0.9	(0.7-1.2)	
Educational level							
Higher education	18	(12.9)	138	(87.1)	1.0		0.002
Secondary	55	(17.0)	287	(83.0)	1.3	(0.6-2.7)	
Elementary	304	(26.4)	771	(73.6)	2.0	(0.9-4.1)	
Illiterate	174	(27.9)	418	(72.1)	1.9	(0.9-4.0)	
Health insurance							
Yes	391	(23.2)	1141	(76.8)	1.0		0.886
No	160	(23.6)	473	(76.4)	1.0	(0.7-1.4)	
Weight							
Normal	209	(22.3)	658	(77.7)	1.0		<0.001
Underweight	240	(35.0)	431	(65.0)	1.7	(1.2-2.3)	
Overweight	53	(13.5)	328	(86.5)	0.6	(0.4-1.0)	
Obese	19	(10.1)	151	(89.9)	0.4	(0.3-0.8)	
Area							
Urban	274	(20.9)	918	(79.1)	1.0		0.001
Rural	277	(29.2)	697	(70.8)	1.1	(0.8-1.5)	
Type of geographical area							
Metropolitan Lima	49	(18.7)	186	(81.3)	1.0		0.057
Coast	170	(26.9)	473	(73.1)	1.5	(1.0-2.4)	
Mountains	239	(24.8)	661	(75.2)	0.9	(0.6-1.5)	
Jungle	93	(23.9)	295	(76.1)	1.0	(0.6-1.6)	
Poverty level							
Not poverty	351	(21.2)	1215	(78.8)	1.0		<0.001
Nonextreme poverty	128	(29.7)	279	(70.3)	1.2	(0.9-1.7)	
Extreme poverty	72	(35.2)	121	(64.8)	1.3	(0.8-1.9)	

Yavuz *et al.* (10.3%) in Turkey ⁽²¹⁾. All these studies were performed on hospitalized senior citizens and on urban senior citizens in Korea ⁽²²⁾.

A probable explanation for these differences is that most published studies are focused on explaining the prevalence of anemia among hospitalized senior citizens, whereas our results are based on the general population; this situation allows us to estimate the prevalence of

anemia among senior citizens at the national level thus overcoming the underdiagnosis that often occurs in hospitals where anemia is underdiagnosed because only the main disease is reported. Although our study does not specify the type of anemia, it is known that iron deficiency anemia is the most common type among the elderly ⁽²³⁾ and is associated with daily small losses that decrease iron deposits in the body. Its origin can be nasal or digestive (e.g., epistaxis, esophageal

varices, hiatal hernia, intestinal diverticula, vascular malformations, or hemorrhoids), micro- or macroscopic losses via the urinary tract (benign or malignant tumors), blood loss that originates in the lungs, or uncontrolled use of nonsteroidal anti-inflammatory drugs (NSAIDs), which cause chronic gastrointestinal bleeding due to secondary gastritis⁽²⁴⁾.

Our results show that with aging, the prevalence of anemia increases, in agreement with the trend observed among Korean senior citizens (although those results are much lower and deal only with an urban population)⁽²⁵⁾. We also found that age is associated with anemia. Seniors over 80 years old are 1.4-fold more likely to have anemia than seniors between 60 and 69 years of age; and seniors between 70 and 79 years of age are 1.5-fold more likely to have anemia than citizens between 60 and 69 years of age. This situation is a cause for concern because anemia is related to the deterioration of physical and cognitive functions in senior citizens. Anemia represents transition to chronic diseases and is a predictor of mortality due to the correlation between the severity of the anemia and the risk of death^(11,25).

One in every four men and one in every five women were found to have anemia; our analysis showed a link between the male gender and anemia although the multivariate analysis did not show a significant correlation. These results differ from those reported by Bang *et al.*⁽²²⁾, who showed that women have higher prevalence of anemia than men do.

The educational level was not associated with anemia despite the influence of knowing about iron-rich foods or foods that promote or inhibit absorption of iron. On the other hand, it is likely that the better purchasing power of retirees and having some kind of health insurance favored the timely attention to and treatment of chronic diseases in the elderly.

One of every ten obese senior citizens was found to have anemia, and one in every three underweight senior citizens have anemia. This finding is similar to the results reported by Samper-Terment *et al.*⁽²⁶⁾, who found that 10% of Mexican senior citizens are obese and have anemia.

On the other hand, we observed a trend for a positive relation between the level of poverty and anemia. It is worrisome that one in every three extremely poor subjects or poor subjects have anemia. This situation may be related to the low purchasing power of poor households

in relation to iron-rich foods and supplements such as ferrous sulfate and multimicronutrient supplements. Therefore, it would be useful to broaden the study to specify deficiency etiologies and the presence of iron absorption alterations due to the presence of parasites that are frequent in areas of poverty and extreme poverty.

The regions with the highest prevalence of anemia are those still considered extremely poor⁽¹⁷⁾. In this regard, it is known that economic status is a social determinant of health. Therefore, in this sense, it could also cause the poor intake of iron-rich foods, lower the access to health care, and result in possible abandonment of senior citizens. On the other hand, regions with the lowest national prevalence of anemia are characterized by mining, ranching, and agriculture as the main economic activities. It is possible that this situation contributes to improved availability of food and access to and consumption of iron-rich foods.

One of limitations of this study is that it was conducted nationally in Peruvian homes; therefore, our results may underestimate the real prevalence of anemia because they do not reflect the medical condition of hospitalized senior citizens. Nevertheless, taking into account the size and representativeness of the sample, we can say that this study can provide approximation of the prevalence of anemia among elderly Peruvians. On the other hand, the study does not specify the underlying disease or the type of anemia. According to Reyes⁽⁴⁾ the most common type of anemia among Peruvian senior citizens is anemia due to a chronic disease, followed by the megaloblastic type and then the iron deficiency type.

In conclusion, a quarter of senior citizens have anemia, most of whom are illiterate, come from rural areas, and are poor or extremely poor. There is a positive relation with age. Older age and being underweight are associated with anemia among elderly Peruvians. We suggest that health authorities provide iron supplements or multivitamins to senior citizens, especially to those in rural areas, poor elderly, and abandoned elderly. Similarly, we recommend specialized treatment in the case of malnourished (underweight or overweight) seniors with anemia because of the increased risk of mortality. We also suggest broadening the coverage of the Comprehensive Health Insurance (Spanish: Seguro Integral de Salud [SIS]) to all senior citizens in order to improve access to health care as well as the implementation of shelters, especially for seniors in rural or poor areas or seniors who may be abandoned; the goal is to improve quality of life in this vulnerable group.

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