

## The association between anemia and some aspects of functionality in older adults

Vanessa Leite Braz (<https://orcid.org/0000-0001-5582-7935>)<sup>1</sup>

Yeda Aparecida de Oliveira Duarte (<http://orcid.org/0000-0003-3933-2179>)<sup>2</sup>

Ligiana Pires Corona (<https://orcid.org/0000-0001-5298-7714>)<sup>1</sup>

**Abstract** *Aim: To evaluate the association between anemia and some activities of daily living associated with feeding and the difficulty in chewing and swallowing. Methods: Cross-sectional study, which examined 1256 individuals, aged 60 or older who were part of the third collection of the SABE Study (Health, Well-Being and Aging). We classified as anemic men with blood haemoglobin  $\leq 13$  g/dL and women with values  $\leq 12$  g/dL. Results: Prevalence of anemia was higher in individuals who reported reduction in food consumption due to chewing and swallowing complaints, in individuals with difficulty to chew and in individuals who reported difficulty to feed themselves due to chewing and swallowing complaints. Anemia was also more prevalent in those with difficulty to feed themselves and to shop for food. In the analyses, the presence of chewing and swallowing complaints was associated with a chance of anemia almost 2 times greater than for individuals without complaints, and the presence of 2 or 3 chewing and swallowing complaints was associated with a 2.7 chance of anemia. Conclusion: The presence of difficulties in chewing and swallowing were associated with higher prevalence of anemia, even after adjustment for other factors, with a dose-response effect, indicating the importance of a multidisciplinary work with older adults.*

**Key words** *Anemia, Older adults, Functionality*

<sup>1</sup> Faculdade de Ciências Aplicadas, Universidade Estadual de Campinas. R. Pedro Zaccaria 1300, Jardim Santa Luiza. 13484-350 Limeira SP Brasil.

vanessa.leitebraz@gmail.com

<sup>2</sup> Escola de Enfermagem, Universidade de São Paulo. São Paulo SP Brasil.

## Introduction

Anemia is defined as the reduction in the level of hemoglobin circulating in the blood, and it can be triggered by several pathophysiological mechanisms. Values below 12.0 g/dL for women and 13.0 g/dL for men are considered pathologic<sup>1</sup>.

Anemia is common in older adults and its prevalence is greater with the increase in age<sup>2-4</sup>. Previous studies show prevalence varying between 4.5% and 10.2%<sup>4,5</sup>. Anemia can be a misdiagnosed condition in older adults, seeing as the belief that this condition is inherent to the aging of human beings is still very common among health professionals. However, the condition has been associated with reduction in the performance of activities of daily living, and may increase morbidity and mortality<sup>6,7</sup>.

Anemia can have various causes in older adults, as a reflection of an underlying chronic illness, poor diet, blood loss or other possible causes. It is estimated that anemia caused by nutritional deficiency corresponds to one-third of all causes<sup>3,7,8</sup>.

As life expectancy has been increasing in recent years, the evaluation of the functional capacity of older adults is generally carried out through the maintenance of their activities of daily living, which are usually divided into two groups: the basic activities of daily living (BADL) and the instrumental activities of daily living (IADL). The BADL relate to everyday activities associated with the individual's self-care, such as personal hygiene, feeding, bathing and dressing. The IADL are more complex tasks that are often related with the individual's social participation, such as: answering phones, shopping, using means of transport, among others<sup>9</sup>.

In addition, as the individual ages, their chewing habits change. It is known that dental problems, when associated with speech problems, as well as with aging, may be harmful to health<sup>10</sup>. Therefore, these factors can disrupt the individual's routine, because even if the older adult's functional capability is in its normal state, chewing and swallowing affect his/her manner of eating and diet, which may be associated with anemia in these individuals.

Thus, considering all the aforementioned factors, it is necessary that health professionals pay special attention to characteristics associated with anemia in older individuals.

However, the Brazilian literature still has very few studies on the topic. So far, there are no articles that have associated the prevalence of ane-

mia with the oral and food functionality of older adults. Therefore, this article seeks to evaluate the association between the occurrence of anemia and some activities of daily living related to feeding, as well as reports on the difficulty in chewing and swallowing of older adults from the city of São Paulo.

## Methods

This research uses data from the SABE study (Health, Well-Being and Ageing), a longitudinal research conducted with older adults from the city of São Paulo which carried out four rounds of data collection, the first one having been held in 2000, with a probabilistic sample of 2143 older adults ( $\geq 60$  years of age). The older adults were reassessed in 2006 ( $n = 1,115$ ) when a new cohort ( $n = 298$ ), also probabilistic and representative of the urban older population with 60 to 64 years of age from the same municipality, was introduced. Using the same methodology, the third wave of studies was conducted in 2010, within the same location of the 2000 and 2006 cohorts, and including a new cohort, with 60 to 64 years of age ( $n = 355$ ). More details about the design of the study are described in other publications<sup>2,11</sup>.

This study is based on data from the third collection, seeing as the inclusion of biochemical tests occurred on this occasion. Thus, the sample used in this study includes 1256 individuals with 60 years of age or older who had valid data related to blood parameters in 2010.

Our dependent variable was the presence of anemia. Men with blood haemoglobin lower than 13 g/dL and women with values lower than 12 g/dL were considered anemic, based on the classification proposed by the World Health Organization<sup>1</sup>.

The independent variables of interest are a) chewing and swallowing complaints; b) indicative features of daily life activities associated with food.

For the evaluation of the chewing and swallowing complaints that affect the social and psychosocial well-being of older adults, we used some questions that are part of the Geriatric Oral Health Assessment Index (GOHAI), developed especially for the older population and which has been validated by several countries ever since it was first proposed<sup>12</sup>.

The survey applied consists of 12 questions that relate to the influence that chewing and swallowing complaints can have on older adults,

whether physical, psychosocial or related to pain and/or discomfort<sup>12</sup>. The issues that were assessed in this study are: “How many times have you had problems chewing hard foods like meat or apples?”; “How many times were you not able to eat the things you wanted due to problems with your teeth or your dentures?”. The older adults who answered “sometimes”, “rarely” or “never” were considered as having no chewing and swallowing complaints, and the older adults who answered “always” or “often” were considered as having chewing and swallowing complaints. In addition, a question that is part of the questionnaire of the SABE study was used, it being: “Have you been eating less due to digestive problems or have you been experiencing lack of appetite or difficulty chewing or swallowing for the past 3 months?” These questions were condensed to compose the independent variable of the study, named “chewing and swallowing complaints”, with the answers to these questions having been categorized in: no chewing and swallowing complaints; 1 chewing and swallowing complaint; 2 or more chewing and swallowing complaints.

For evaluation of the activities of daily living, the following questions were used: “Do you have trouble eating on your own?”, “Do you have trouble preparing a hot meal?”, and “Do you have trouble purchasing food?” Difficulty was considered when these questions were answered positively.

The control variables used were: gender, age (categorized in: 60 to 69 years old; 70 to 79 years old;  $\geq 80$  years old), education level (categorized in: elementary school; secondary education; higher education), Body Mass Index (BMI) (categorized in: underweight ( $< 23 \text{ kg/m}^2$ ); eutrophy ( $\geq 23$  and  $< 28 \text{ kg/m}^2$ ); overweight ( $\geq 28$  e  $< 30 \text{ kg/m}^2$ ); obesity ( $\geq 30 \text{ kg/m}^2$ )), according to the recommendations of the Pan American Health Organization<sup>13</sup>, number of referred chronic diseases (including systemic arterial hypertension, diabetes mellitus, cancer, chronic obstructive pulmonary disease, cardiovascular disease, stroke, osteoarthritis), which were categorized in: no disease; one disease; two or more diseases.

For the statistical analysis of the study variables, relative frequency distributions, mean values and standard errors for the continuous variables and, for the categorical variables, proportions, were all estimated. The differences between the groups were estimated using Wald’s generalized test of equality between averages and the  $\chi^2$  test with Rao-Scott correction, which take into account sampling weights for the estimates with population weighting.

To analyze the association between functionality, chewing and swallowing and anemia, Poisson’s regression analysis was used, with calculation of the unadjusted and adjusted prevalence ratios (PR), in which the dependent variable was the presence of anemia. We kept control variables when they were associated with anemia and that remained significant in the model, or that adjusted any of the variables of interest in at least 10%.

The variables were included in the model in hierarchical steps, namely: model 1 was adjusted for sociodemographic conditions; in model 2, comorbidities were included as proxy for the health conditions; and in model 3, the ADL were included.

All analyses were performed using the Stata® 13 software, by applying the sampling weights to ensure the representativeness of the population of the city of São Paulo. The critical value used was  $p < 0.05$ .

## Results

Table 1 presents the distribution of older adults according to socioeconomic and health characteristics. The majority of the population was female, aged 60 to 69 years old, with education up to primary school, and with BMI within the normal range. Hypertension was the most prevalent chronic disease (67.56%) and 57.84% of the older adults reported two or more diseases.

Table 2 shows the distribution of anemia in the older adults according to functionality features and chewing and swallowing complaints. The prevalence of anemia was significantly higher in individuals who reported a reduction in food consumption due to chewing and swallowing complaints, as well as in individuals with difficulty to chew and in individuals who reported difficulty to feed themselves due to chewing and swallowing complaints. Anemia was also more prevalent in those with difficulty to feed themselves and to shop for food. However, anemia was less prevalent in individuals with difficulty to prepare a hot meal in relation to those who had no difficulty in doing so.

Figure 1 shows the average hemoglobin in relation to the chewing and swallowing complaints. The average blood concentration of hemoglobin is greater in the older adults who reported having no reduction in food consumption, difficulty chewing and difficulty feeding themselves, when compared with the older adults who did.

**Table 1.** Distribution (%) of older adults according to socioeconomic and health characteristics. SABE Study: São Paulo, Brazil, 2010.

	Percentage (%)
Gender	
Male	35.76
Female	64.24
Age group	
60 to 69 years old	44.39
70 to 79 years old	28.62
≥ 80 years old	26.99
Education level	
Primary school	81.63
High school	11.37
Higher education	7.00
Body Mass Index	
Underweight	15.12
Eutrophy	39.01
Overweight	14.63
Obesity	31.24
Prevalence of self-reported chronic diseases	
Systemic Arterial Hypertension	67.56
Diabetes Mellitus	24.87
Cancer	7.67
Chronic Pulmonary Disease	9.22
Cardiovascular Disease	24.20
Cerebrovascular Accident	8.27
Joint Pain	33.78
Number of chronic diseases	
None	15.99
One disease	26.17
Two or more diseases	57.84

Table 3 presents the results of Poisson's multiple regression analysis. In univariate analyses, the presence of chewing and swallowing complaints was associated with a chance of anemia almost 2 times greater than for individuals without complaints, and the presence of 2 or 3 chewing and swallowing complaints was associated with a 2.7 chance. The presence of difficulties in the ADL associated with feeding was not significant in the gross analysis, but it was maintained to adjust the other variables. In the final model (model 3), the presence of chewing and swallowing complaints remains significant, showing a dose-response effect – association is greater in older adults with two or more complaints when compared to the presence of a single complaint.

## Discussion

The results of this study show that the complaints associated with oral health (chewing and swallowing) have association with the presence of anemia. Oral health has been associated with inadequate nutritional status in older individuals<sup>13-15</sup>. Silva et al.<sup>14</sup> show that the worst indicators of oral health changes were associated with progressive degrees of biological frailty, as well as with significant increase in the GOHAI index. Mesas et al.<sup>15</sup> show that the negative perception of oral health was associated with nutritional deficit. But this seems to be the first Brazilian study with these results.

Oral health is often cited as an indicator of quality of life, since changes such as dental loss and difficulty chewing influence the life of individuals and may affect feeding<sup>16,17</sup>. Ayres et al.<sup>10</sup> mention that the use of removable dental prosthesis leads to instability in chewing, causing insecurity in the user, who will consequently abstain from eating certain foods.

Despite most older adults not acknowledging lack of teeth as a negative factor in relation to chewing ability<sup>18</sup>, the studies show that older people who had less teeth reported their chewing ability negatively, seeing as chewing and speech skills are indicators of quality of life<sup>14,19</sup>.

In addition, the older people who needed to use complete dentures reported a negative impact in relation to the self-perception of their oral health, especially with regard to the chewing function. One explanation is that the symptoms of pain are easily perceived by older adults as interfering with their daily activities<sup>14,20,21</sup>, which is therefore consistent with the results found in this study.

Lamlakar and Parashram<sup>22</sup> showed that the deficiencies of B vitamins, iron and other trace elements derived from nutritional depletion may lead to anemia, which can persist due to improper food intake, becoming a vicious cycle.

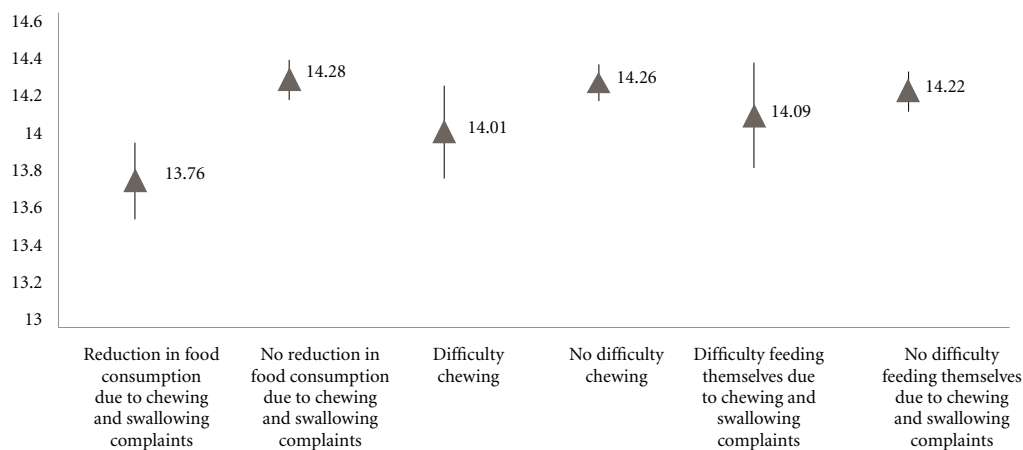
The association between anemia and oral health can also reside in the fact that iron, which is the nutrient responsible for great part of nutritional anemias<sup>8,23</sup>, has red meats as major sources, which require great chewing and swallowing efforts. Thus, an individual who has difficulty with these functionalities can begin restricting firmer foods, preferring those with softer consistency, thus compromising the nutritional quality of their meals.

Red meats, in addition to being more fibrous, are more expensive and therefore less accessible,

**Table 2.** Average Hemoglobin (Hb) concentration and Prevalence (%) of anemia in older adults according to chewing and swallowing complaints and some activities of daily living. SABE Study: São Paulo, Brazil, 2010.

	Average concentration of Hb (g/dL)	Non-Anemic (%)	Anemic (%)	P value*
<b>Indicators of chewing and swallowing</b>				
Reduction in food consumption due to chewing and swallowing complaints				0.001
With reduction	13.76	87.50	12.50	
Without reduction	14.28	93.39	6.61	
Difficulty in chewing				0.002
With difficulty	14.01	88.22	11.78	
Without difficulty	14.26	93.77	6.23	
Feeding in association with chewing and swallowing complaints				0.012
With difficulty	14.09	85.81	14.19	
Without difficulty	14.22	93.21	6.79	
<b>Activities of Daily Living</b>				
Feeding themselves				0.015
With difficulty	13.49	81.29	18.71	
Without difficulty	14.20	92.65	7.35	
Shopping for food				<0.001
With difficulty	13.70	83.48	16.52	
Without difficulty	14.26	93.71	6.29	
Preparing a hot meal				0.044
With difficulty	14.12	93.06	6.94	
Without difficulty	14.52	89.05	10.95	

\*P value relative to differences between anemic and non-anemic individuals.

**Figure 1.** Average hemoglobin (g/dL) in relation to chewing and swallowing complaints. SABE Study: São Paulo, Brazil, 2010.

having their consumption limited in older adults with poor socio-economic conditions<sup>24</sup>. In the

same way, access to health and dental services can be compromised in less-favored populations<sup>25</sup>,

**Table 3.** Results of Poisson's regression analysis for the association between the presence of anemia, chewing and swallowing complaints and activities of daily living. SABE Study: São Paulo, Brazil, 2010.

	Gross PR**	Model 1 PR** – Sociodemographic Block	Model 2 PR** – Health Block	Model 3 PR** – ADL Block
Chewing and swallowing complaints				
No complaints	1.00	1.00	1.00	1.00
One complaint	1.93*	1.71*	1.65*	1.66*
Two or more complaints	2.70*	2.11*	1.79*	1.77*
Age	1.06*	1.06	1.06*	1.05*
Gender				
Male	1.00	1.00	1.00	1.00
Female	1.09	0.89	0.83	1.05*
Education level				
Primary school	1.00	1.00	1.00	1.00
High school	0.91	1.27	1.32	1.32
Higher education	0.22*	0.34	0.43	0.44
Body Mass Index	0.96	-	0.99	0.98
Number of chronic diseases				
None	1.00	1.00	1.00	1.00
One disease	1.55	-	1.44	1.44
Two or more diseases	2.18*	-	1.79	1.79
Difficulty in one or more ADL***	1.07	-	-	1.26

Note: \*p < 0.05; \*\*RP = prevalence ratio; \*\*\*Difficulty in performing one or more of the following ADL: feeding themselves; shopping for food; preparing a hot meal.

which could be an aggravating factor in this association. This is due to the fact that older adults do not see the need for oral treatment, a lower education level being associated with lower frequency of use of dental health services<sup>25,26</sup>.

Just like the human body, the swallowing mechanism also experiences a normal aging process. This occurs due to the deterioration of the nerve function and to the decrease in the muscle mass of the brain-dependent region, which affects the swallowing mechanism negatively. It is clear that age is a factor that affects this mechanism over time<sup>27</sup>.

Characterized as a condition of difficulty in swallowing food, dysphagia, from the Greek *dys* (difficulty) and *phagia* (to eat), is the feeling that food cannot be moved from the mouth to the stomach. However, despite the physiological changes in the mechanism of swallowing caused by the aging process, dysphagia should not be attributed in an isolated manner to normal aging, and its presence suggests that there should be an investigation to identify potentially treatable causes<sup>27</sup>.

Among these causes, it is possible to list some diseases, such as stroke, amyotrophic lateral sclerosis, Parkinson's disease, among others – all of them feature an increase in prevalence with aging<sup>27,28</sup>. With the rapid growth of population aging, dysphagia is increasingly recognized as an important national health issue, being associated with high costs to health<sup>27</sup>.

Another factor that can cause dysphagia is the use of some medications. It is known that with the individual's aging, his/her health problems tend to increase, thereby increasing the intake of medicines throughout the day.<sup>27,27</sup> Drugs can interfere with the swallowing function in different ways, damaging the transit of food through the esophagus, increasing the incidence and severity of dysphagia. In addition, drugs that cause xerostomia may affect the ability to chew food, interfering with the swallowing process. Finally, some drugs have an increased risk of mouth infections, causing the patients to develop difficulty in retaining their dentures, interfering in food chewing and swallowing<sup>27</sup>.

In our study, the prevalence of anemia was higher in older adults with older age and in those with low education level. Bianchi<sup>23</sup> noted, in his study, an association between the prevalence of anemia in relation to gender and older ages, that is, 85 years or older. Older age and lower education level may also be associated with the increased reports of chewing and swallowing complaints, as described by Cardoso et al.<sup>29</sup>. Therefore, these two groups seem to have higher chances for both conditions — anemia and oral problems.

This study shows higher prevalence of anemia in older people with difficulties in some activities of daily living, however, this association did not remain significant in the regression analysis. Milagres et al.<sup>7</sup> also report having found no significant association between functional capacity and anemia. On the other hand, Bosco et al.<sup>30</sup> reported significant association between the presence of anemia and reduced functional capacity. The authors also concluded that older adults who live alone have greater functional capacity in relation to those who live with family members. This is due to the fact that older adults with low functional capacity need third-party assistance in their daily activities.

The results of this research should be interpreted with caution, since this is a cross-section-

nal study, that is, a cause-and-effect relationship between chewing and swallowing complaints and anemia cannot be established. The use of hemoglobin levels as an indicator of anemia can also be indicated as limitation, since the literature has studies that show natural reduction in hemoglobin levels as inherent to the ageing process<sup>31,32</sup>. On the other hand, there are few longitudinal studies that deal with this subject, thus, there are no consolidated opinions about this aspect of aging<sup>32</sup>, and, in addition, the World Health Organization's definition of hemoglobin-based anemia is currently still in force.

This study also has strong points, such as the fact of it including a large probabilistic sample originated from the largest Brazilian city, and therefore, the results presented here should be taken into consideration in subsequent studies, as they may guide the actions in health and nutrition for the older population.

In conclusion, the importance of a multidisciplinary work with older adults, involving nutritionists, dentists and audiologists, becomes clear, due to the association between anemia and chewing and swallowing problems, to support the process of recovery from anemia of these individuals, as well as improve their quality of life and diet.

## Collaborations

VL Braz worked on data analysis and manuscript writing, YAO Duarte in coordinating manuscript research and review, LP Corona on study design, analysis plan, and final manuscript writing.

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