Artigo / Article

Hematological and nutritional parameters in apparently healthy elderly individuals

Parâmetros hematológicos e nutricionais em idosos aparentemente saudáveis

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*A non-probabilistic study in an elderly free living community was performed. The first analysis was cross-sectional in design and the additional analysis, a case-control design. In the first analysis, 745 subjects were enrolled. Additional analyses, made in 46 apparently healthy elderly subjects (AHE) and 33 young adults (YA) included: clinical, hematological and biochemical analyses, 24-hours nutritional recall and diet frequency questionnaire. The AHE were selected using the Senieur test protocol. To avoid selection bias in the AHE sample, additional analysis comparing cultural, socioeconomic, and health variables were compared between AHE and non-selected elderly with same dysfunction or morbidity (DE). The prevalence of AHE was 6.17% (n=46) among whom 4.3% were anemic. There were no statistically differences in hematocrit, hemoglobin, leukocytes and vitamin B_{12} levels between AHE and YA groups. Mean values of MCV, RDW, eosinophils, folate and ferritin were higher in the AHE than the YA group. On the other hand, platelets were higher in the YA group. No statistically significant difference occurred between the AHE and DE groups when nutritional indicators were compared. The comparison between nutritional indicators of anemic and non-anemic apparently healthy elderly people showed statistically significant differences in vitamin B_{12} and protein intake, which were lower in the anemic elderly. The results suggest independent biological differences between hematological parameters of elderly and young individuals. Rev. bras. hematol. hemoter. 2007;**29**(2):136-143.*

***Key words**: Healthy aging; hematological aging; nutrition; anemia; healthy elderly.*

Introduction

Aging is related to a progressive decline in the functional reserve of multiple organ systems increasing the probability of dysfunction and disease. Hematopoiesis is maintained by the balance between production and destruction of blood cells. Hematopoietic modulation becomes imbalanced with aging. The reason for this phenomenon is related to the decrease in the bone marrow's ability to respond to stimuli such as bleeding, infection and cytotoxic damage. Studies in this setting suggest a decline in the stem cell population reserve, imbalance in the hematopoietic cytokine production, decreased sensitivity of stem cells and precursor cells to the action of cytokines and alterations in the microenvironment impairing homing.[1]

Anemia, generally mild, is a common problem in the elderly, especially in men. The incidence of anemia increases with age, principally after 60 years old.[2] The frequency of anemia of undetermined etiology in the elderly is high, constituting 14 to 17% of anemias in this age group. This high prevalence raised the hypothesis that lower levels of hemoglobin could be associated with the normal aging process.

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However, controversy continues to surround the significance of unexplained anemia in elderly patients and the extent to which this could be a physiological occurrence.[3] There are opinions in favor and against this statement. Untreated geriatric anemia was associated with higher mortality, increasing the prevalence of comorbidities and functional impairment.[4] In this context, several questions arise such as: what main hematological changes in aging are independently associated to diseases and physiological dysfunction? To contribute to the elucidation of this question, the present study was performed with four general objectives: (1) to identify the prevalence of apparently healthy elderly subjects (HE); (2) to compare the hematological parameters between AHE and a young adult group (YA); (3) to compare nutritional indicators between AHE and elderly people who have some dysfunction or morbidity (HD) and to compare nutritional indicators between anemic and non-anemic HE.

Methods

Type of study

A non-probabilistic and community based study was performed. The first analysis had a cross-sectional design and additional analyses case-control designs. Elderly subjects, who participate in informal social groups in Gravataí, a town in the Porto Alegre Metropolitan Area, Brazil, were recruited by random selection from the Gravatai Health and Social Assistance Service which provides support to the Gravataí Project. They compose the GENESIS-Gravatai Project that investigates gene-environmental interactions in healthy aging and age-related diseases. Methodological details and general sample data about the project are given in Da Cruz *et al.*[5] and Flores *et al.*[6] Data collection was made in the Municipal City Office of Gravataí and Catholic Medicine School, Institute of Biomedical Research and Institute of Geriatrics and Gerontology, Pontificia Universidade Católica in Rio Grande do Sul.

Patients

To perform the study, 745 elderly subjects (> 60 years old) were recruited from local community groups and registered at the Office for Social Care in Gravataí. This elderly population corresponds both ethnically and socio-economically to the general population of the State of Rio Grande do Sul.[5] The other analyses were made for AHE selected from first analysis and a control group of young adults (YA, n=33).

Method

HE and YA groups were appraised by the SENIEUR 22 protocol that defines rigorous criteria for selecting healthy individuals in immunogerontological studies. Details regarding the selection of the AHE group are described by Luz *et al.* [7] The prevalence of apparently AHE was determined. The AHE group was defined as being free of acute or chronic diseases determined by medical history and physical examination as described in a similar study conducted by Olivares *et al.*[8] and a nutritional assessment. Usual dietary intake was assessed by a 24-hour food record and a food-frequency questionnaire.[9] Additional AHE Group health conditions were checked according to accurate clinical investigations and to hematological and biochemical parameters as well as by anthropometric data. AHE exclusion criteria were presence of infection, chronic or acute inflammation, autoimmune disease, cardiopathy, under-nourishment, clinical depression, neurodegenerative diseases, neoplasias, caregiving subjects, the use of hormones or drugs and refusal to participle of the study.[10] Similar procedures were made to select the YA Group. To avoid selection bias in the AHE sample, additional analysis comparing cultural, socioeconomics, and health variables were compared between AHE and non-selected elderly (DE). These variables included: (1) anthropometric data: body mass index (BMI) was obtained with quantification of weight (kilograms) and height (meters) using mechanical weighing scales (Filizolla, São Paulo). Then, the BMI was calculated by dividing the weight in kilograms by the square of the height in meters (kg/m^2). Smoking status: Smoking was considered for cigarettes and other forms of tobacco. Ingestion of alcoholic beverages was by the number of glasses of alcohol beverages ingested per week. Also, this study investigated: (1) Daily life activities (DLA) constructed in the following four domains: movement; dressing and bathing, eating and urinary continence.[11] (2) life satisfaction: four physical items about life satisfaction were also investigated;[12] (3) nutritional risk: the Nutrition Screening Initiative (NSI) score was used to measure the risk of undernourishment.[13]

Hematological measurements

Fasting blood samples were obtained from each AHE subject by venipuncture. Less than 20 mL of blood was drawn from each subject in three Vacutainers: one containing K_2-EDTA for complete blood counts (CBCs); one containing K_2-EDTA for folate, vitamin B-6 and B-12 status assessment; one dry Vacutainer for other serum measurements. All blood samples were immediately transported in an thermal box to the laboratory. Measurements performed on the blood samples included red blood cell (RBC) count, total lymphocyte (TLC) count, hemoglobin (Hb), hematocrit (Ht), mean corpuscular volume (MCV), mean corpuscular hemoglobin concentration (MCHC), leukocyte count and platelet count. Plasma vitamin B-12 concentrations were measured using the Bio-Rad Quantaphase II assay. Serum ferritin determinations were performed using a two-site enzyme immunoassay. [14] The prevalence of anemia in the AHE and YA groups was also determined. Anemia was defined as Hb

<130 g/dL for women and <120g/dL for men, and macrocytosis as a mean corpuscular volume (MCV) >100 fL.[15] Subsequently, a comparison between the hematological and the nutritional profile between AHE and YA groups was made. Additionally, clinical and nutritional parameters were compared between the AHE group and the other elderly subjects that participated in the Project.

Statistical analysis

The data were analyzed using SPSS Version 9.0.[16] Categorical variables were summarized using frequencies and percentages. Means and standard deviations were calculated for continuous variables and normality was assessed. Variables not normally distributed were log transformed before analysis. To assess differences between AHE and other elderly participants of the Project Genesis – Gravataí, AHE and YA Groups, AHE anemic and non-anemic subgroups, chi-square analysis and Student t-test were performed on categorical variables and continuous variables, respectively. When the continuous variables did not present normal distribution the comparison was performed using the non-parametric Wilcoxon Mann-Whitney test. Forward Wald logistic regression was performed to test intervenient variables in the statistical positive associations. All variables with p-values >0.20 were included in the regression equation.

Ethics

The Ethics Committee of the Pontifical Catholic University of Rio Grande do Sul approved the study protocol. Informed consent was prospectively obtained from all individuals whose information was collected.

Results

The prevalence of apparently healthy elderly (HE) was 6, 17% (n=46). The AHE group was composed of 32.6 (n=15) male and 67.4% (n=31) female individuals. In the DE group, 31% (n=217) were male and 69% (n=484) female. There were no statistical differences in gender proportions of both groups (p=0.847). Mean ages were also similar in both groups: AHE group was 66.3 ± 5.0 years and DE group was 66.9 ± 7.4 (p=0.591).

The comparison of health indicators between the AHE and DE groups is demonstrated in Table 1. The analysis showed no statistically significant differences between both groups for the investigated parameters. The entire results indicated no selection bias associated with the AHE group.

Table 1. Global health indicators comparison between apparently healthy elderly (HE) and the other elderly participating in Projeto Gravataí (DE)

Variables	Specification	Apparently healthy elderly (HE)	Elderly with previous disease (DE)	*p*
Social economic and Cultural	Income Status (US$)/ month	%	%	
	No income	5.6	5.9	*0.395*
	50 a 139	64.2	66.8	
	140 a 279	20.0	20.5	
	280 a 359	10.2	4.2	
	> 360		2.9	
	Education background			*0.456*
	illiterate	14.6	17.50	
	< 3 years	9.0	11.0	
	≥2 ≤ 8 years	74.2	67.2	
	≥8 ≤ 12 years	4.2	3.6	
	>12 years	0.0	0.7	
	Marital Status			*0.408*
	Married	30.6	33.3	
	Widowed	50.0	51.3	
	Single	6.2	5.9	
	Divorced	13.2	9.4	
	Functional status (retirement)	87.7	74.1	*0.229*
Sanitary conditions				
	Immunizations (/year)	63.0	58.0	*0.457*
	Physician evaluation/year	85.7	80.3	*0.546*
	Regular medicine consumption	0.0	63.8	*0.001*
Nutritional Risk (NSI)				
	Low	38.1	35.10	*0.171*
	Moderate	47.6	30.70	
	High	14.3	34.20	
	Smoking status	70.6	80.5	*0.518*
	Males	30.1	34.42	
	Females		15.68	
Daily Living Activities (DLA)				
	Independence	86.7	82.9	*0.687*
	Wash and dress		95.9	
	Eating	98.5	97.40	
	Movement		94.80	
	Urinary continence	75.7	79.81	*0.586*

Table 1 - Global health indicators comparison between apparently healthy elderly (HE) and the other elderly participating in Projeto Gravataí (DE)

Variables	Specification	Apparently healthy elderly (HE)	Elderly with previous disease (DE)	p
Physical life satisfaction	Self-perception			
	Health			
	Excellent or good	42.80	44.90	0.217
	Regular	33.3	44.30	
	Bad	23.9	10.70	
	Vision			
	Excellent or good	19.0	28.7	0.434
	Regular	57.1	41.7	
	Bad	26.9	29.60	
	Hearing			
	Excellent or good	51.3	52.07	0.614
	Regular	33.3	31.30	
	Bad	15.4	15.90	
Morbidities Metabolic				
	Diabetes mellitus	0	12.00	-
	Obesity	0	21.70	-
	Osteoporosis (Females)	0	20.21	-
	Dyslipidemia	0	37.21	-
Cardiovascular Diseases				
	Hypertension	0	65.80	-
	Angina pectoris	0	25.78	-
	Acute myocardial infarction	0	13.32	-
	Stroke	0	7.43	-
	Venous thrombosis	0	5.58	-
	Claudication	0	14.32	-
Neurological diseases	Major depression	0	42.56	-
	Cognitive dysfunction	0	41.23	-
Neoplasia	All types	0	3.01	-
Other diseases	Gastrointestinal	0	65.04	-
	Respiratory diseases (asthma, emphysema, etc.)	0	48.04	-
	Osteomuscular diseases	0	35.06	-
	Allergies	0	32.01	-

p = significance measured by chi-square. 1 US$ (dollar) = R$2.8

Mean age of the young adult group was 27.4 ± 6.7. In the young group 45, 5% (15) were men and 54.5% (18) women. No significant differences were seen in gender frequencies between both groups (p=0.246) or other variables with the exception of the ingestion of medicines and previous morbidities as expected.

The comparison of biological and lifestyle variables between the AHE and YA Groups are described in Table 2. The AHE group presented with a higher BMI than the YA Group, and shorter stature. The YA Group reported they occasionally drank alcohol, while the majority of AHE subjects reported no alcohol intake. There were no statistically significant differences in smoking between groups.

The hematological profile showed statistically significant differences between AHE and YA Groups. Mean values of VCM, RDW, eosinophils, ferritin and folic acid were higher in the older group, while mean values of CHCM and platelets were higher in the young group (Table 3).

The nutritional profile was statistically similar between the AHE and DE Groups (Table 4). However, unbalanced nutrition ingestion was observed in the two groups of elderly subjects (HE and DE). Lower mean values to those recommended by WHO were detected in the ingestion of the following nutrients: calories, carbohydrates, folic acid, vitamin D, vitamin B_6, calcium and vitamin E. On the other hand, the mean values of ingestion of vitamin B_{12}, vitamin A, vitamin C, iron and protein were higher than those recommended by WHO.

Prevalence of anemia in the AHE group was 4.3%. Even considering the low number of anemic subjects, hematological and nutritional parameters of the anemic and non-anemic elderly were compared. The results are summarized in Table 5. Mean values of serum vitamin B_{12} and mean values of protein ingestion were significantly lower in the anemic group than in the non-anemic apparently healthy subjects.

Discussion

The present study describes the prevalence of apparently healthy elderly individuals. Additionally, we analyzed the hematological profile of aged subjects selected for being healthy, comparing them with a group of young adults also without known morbidities. The study shows a very low frequency of apparently healthy elderly, no major nutritional influence on the hematological parameters investigated and a very low prevalence of anemia in the AHE Group.

Since the apparently healthy elderly were selected from a relatively big group of aged people it could be questioned whether general health indicators of these individuals would be different from non-healthy elderly, thereby identifying a possible selection bias favorable to the healthy state. Because of this, general health indicators were compared between both groups without any significant differences being observed between them. Consequently, the possibly that other variables may be involved in maintaining the health of these individuals was suggested.

In this study there were no significant differences between hematocrit and hemoglobin levels in the elderly and young adults. This finding agrees with other reports investigating aged people and implies the adequacy of the WHO diagnostic criteria for anemia, which use the same reference values as young adults. However, it must be remembered that this is a cross-sectional study limiting this kind of conclusion. The establishment of normal hematocrit and hemoglobin values for the aged is complex, because of the heterogeneity of this population and the great diversity of studies on this issue. Longitudinal investigations would be better to evaluate this, but they are scarce and difficult to execute.

Some authors, such as Yamada *et al.* state that there is a physiological reduction in normal hematologic values as age increases. In this study a group of Japanese individuals was followed up for a forty-year period, measuring hemoglobin levels every two years, with adjustments for gender, birth cohort, cigarette smoking and anemia related diseases. This group was used as a control group for other subjects submitted to atom bomb irradiation, accompanied during the same period of time. A tendency for the hemoglobin rate to diminish with age was identified; thus the authors postulated that aging per se may be the cause of anemia. Also, cohort effects and consequences of cigarette smoking were observed.

Blood hemoglobin (Hb) has, in a number of studies, been reported to decline in the elderly, more so among men than among women.[17] No consensus has been reached on age-related Hb patterns in healthy elderly persons, which may be due, in part, to the study designs used.[18]

Table 2. Anthropometric and life style variables comparison between apparently healthy elderly (HE) and young adults (YA).

Variables		YA group	HE group	*p*
		n (%)	n (%)	
BMI (Kg/m^2)		23.2±3.4	27.3±4.2	*0.001*
Weight (Kg)		67.1±12.2	69.1±10.8	*0.471*
Height (m)		1.70±0.08	1.58±0.09	*0.001*
Alcohol consumption (%)	No drink	6 (18.8)	27 (58.7)	*0.001*
	1 glass/week	1 (3.1)	11 (23.9)	
	3 glass/week	1 (3.1)	3 (6.5)	
	6 glass/week	0 (0)	5 (10.9)	
	Occasionally	24 (75.0)	0 (0)	
Smoking status (%)	Non smoker	25 (78.1)	27 (58.7)	*0.138*
	Ex-smoker > 1 year	0 (0)	3 (6.5)	
	Ex-smoker > 2 years	4 (12.5)	13 (28.3)	
	Smoker	3 (9.4)	3 (6.5)	

p= significant value using Student t test.

Table 3. Hematological indicators comparison between apparently health elderly and young adult groups

Variables	YA group		HE group		*p*
	Mean ± sd	Median	Mean ± sd	Median	
HT	41,66 ± 3,74	43	42,31 ± 3,53	42	0,489
HB (g/dl)	14,13 ± 1,50	14,7	14,06 ± 1,29	13,9	0,841
RCC (x 10^{12} / l)	4,75 ± 0,43	4.7	4,64 ± 0,37	4.6	0,295
MCV (-fl)	87,14 ± 3,89	87	90,89 ± 4,19	91	0,001
MCHC	33,42 ± 0,75	34	32,80 ± 0,98	33	0,015
RDW (%)	13,15 ± 0,59	13,1	13,53 ± 0,60	13,5	0,042
WBC (x 10^9 / l)	6595,93 ± 1965,57	6,600	6788,89 ± 1370,84	6,900	0,642
Neutrophils (x 10^9 / l)	3954,77 ± 1105,08	3755	3843,91 ± 1029,38	3708	0,687
Basophils (x 10^9 / l)	28,73 ± 21,08	28	31,91 ± 25,11	30	0,610
Eosinophils* (x 10^9 / l)	169,50 ± 120,60	120	267,80 ± 258,47	241	0,038
Monocytes (x 10^9 / l)	552,73 ± 194,62	441	579,38 ± 173,30	588	0,572
Lymphocytes (x 10^9 / l)	2329,73 ± 632,21	2122	2035,16 ± 603,80	2126	0,069
Platelets (x 10^9 / l)	253.666,67 ± 61.429,01	249000	210.000,00 ± 55.893,44	206000	0,024
B12 serum* (ng / l)	495000 ± 269640	369000	516870 ± 201640	486000	0,687
Folate serum (µg / l	5,02 ± 2,63	3,8	7,00 ± 2,99	6,0	0,003
Serum ferritin (µg / l)	112,30 ± 95,40	82,7	179,67 ± 144,77	110	0,022

p= significant value; sd= standart desviation; variables with normal distribution were compared using Student t test; variables with no normal distribution were compared by Wilcoxon-Mann-Whitney test (*)

We observed anemia even in the apparently healthy elderly group. A similar study performed by Olivares *et al.* was conducted in Chile. These authors analyzed 275 apparently healthy individuals older than 60 and found a prevalence of 4% of anemia in men and 4% in women. This was similar to our results indicating that even in aged people without detectable disease, anemia may occur. These findings are corroborated in longitudinal studies. Similar results were found in the Seneca study, a multicentric longitudinal study,[19,20] that described 6% of anemia in men and 5% for women, at the beginning and at the end of a five-year observation period. Izaks *et al.*[21] also found an increase in mortality risk following anemic elderly individuals for five years. Based on the results obtained here we believe that preventive hematological testing is important in old people, as anemia may represent a signal for disease, even in asymptomatic people.

In the present study, mean values of MCV and RDW were higher in the elderly than in the young, while MCHC mean values were lower. A tendency of higher values of MCV was shown in other reports. Blain *et al.* analyzed hematological values of normal young adults and independent, asymptomatic elderly individuals that did not take medicine. They found a tendency of higher levels of MCV and MCHC in the old individuals and did not see differences in the RDW values. Another study comparing hematological indexes between adults and elderly individuals

Table 4. Nutritional indicators comparison between apparently health elderly (HE) and another elderly (DE) participant of Projet Gravataí

Nutrients	Groups	Mean	±sd	Minimun	Maximun	*p*	WHO
Calories (Kg)	HE	1467,4	428,6	852,0	2425,4	*0,584*	Lower
	DE	1531,8	538,6	212,0	3383,7		Lower
	Total	1527,5	531,5	212,0	3383,7		Lower
Carbohydrates %	HE	52,4	9,5	36,7	71,0	*0,718*	Lower
	DE	53,3	10,4	23,4	86,4		Lower
	Total	53,2	10,3	23,4	86,4		Lower
Proteins %	HE	20,9	4,6	11,6	31,7	*0,186*	Higher
	DE	19,3	5,6	6,9	43,9		Higher
	Total	19,4	5,5	6,9	43,9		Higher
Lipids %	HE	25,7	7,5	11,7	36,1	*0,597*	Recommend
	DE	26,6	8,3	2,7	54,1		Recommend
	Total	26,6	8,3	2,7	54,1		Recommend
Vitamin C (mg)	HE	130,0	116,7	2,2	398,7	*0,520*	Higher
	DE	115,5	101,4	0,0	548,1		Higher
	Total	116,4	102,4	0,0	548,1		Higher
Folate (µg)	HE	256,2	145,8	35,7	561,3	*0,630*	Lower
	DE	284,5	272,2	10,1	4112,9		Lower
	Total	282,6	265,5	10,1	4112,9		Lower
Vitamin B_{12} (µg)	HE	10,1	30,5	0,8	146,2	*0,334*	Higher
	DE	5,5	20,4	0,1	287,8		Higher
	Total	5,8	21,2	0,1	287,8		Higher
Vitamin D (µg)	HE	2,3	2,0	0,0	8,7	*0,671*	Lower
	DE	2,5	2,0	0,0	18,1		Lower
	Total	2,5	2,0	0,0	18,1		Lower
Vitamin B6 (mg)	HE	1,4	0,8	0,3	3,0	*0,903*	Lower
	DE	1,4	0,8	0,1	6,2		Lower
	Total	1,4	0,8	0,1	6,2		Lowerr
Vitamin A (µg)	HE	1285,4	3456,2	30,9	16576,7	*0,457*	Higher
	DE	863,0	2493,2	3,6	32521,9		Higher
	Total	891,5	2564,8	3,6	32521,9		Higher
Vitamin E (mg)	HE	6,0	3,4	1,8	14,1	*0,063*	Lower
	DE	9,6	9,2	0,4	42,9		Lower
	Total	9,4	8,9	0,4	42,9		Lowerr
Calcium (mg)	HE	593,0	313,6	154,1	1351,3	*0,684*	Lower
		563,0	334,3	60,8	2910,5		Lower
		565,0	332,5	60,8	2910,5		Lower
Iron (mg)	HE	12,4	5,7	2,1	25,7	0,859	Higher
		12,6	6,1	1,2	43,3		Higher
		12,6	6,1	1,2	43,3		Higher

sd=Standard deviation; p= significance value obtained by Student t test compassion. WHO= World Health Organization

showed significant differences in MCV, MCHC and RDW, with MCV and RDW being higher in the aged. Nilsson-Ehle *et al.*[17] also found a tendency towards higher mean values of CMV with increasing age in a longitudinal study. The fact that MCV values did not vary significantly between the anemic and non-anemic elderly supports the hypothesis that this is related to aging per se.

We found no difference between total and differential counts of white blood cells of young adults and apparently healthy elderly individuals. Statistically the eosinophil count was different but this did not have clinical significance and so it was not identified as an aging-related hematological abnormality. Corberand *et al.*[22] stated that differences in white blood cell counts described in some reports may be attributed to the individual selection criteria used. If criteria used to select healthy elderly are rigorous (like in the Senieur protocol), these differences disappear.

Serum measurements of vitamin B_{12} in young adults and apparently healthy elderly subjects were not statistically different. Some considerations must be made:

1. pernicious anemia has a genetic predisposition and is more prevalent in European and North American people. Since the population studied is ethnically mixed all samples present with Caucasian phenotypes. For this reason we can not study genetic predisposition.

2. the rigorous criteria used for selection certainly contributed to excluding this pathology.

3. the elderly included in the study participate in a socially active group, automatically excluding individuals with possible B_{12} related neurological disease.

4. as we assessed vitamin B_{12} by the immunological assay Elisa, which has well-known limitations, a normal result does not exclude the possibility of a real deficit.

Serum levels of B_{12} diminish with aging, while serum concentrations of methylmalonic acid increase. Subnormal concentrations were detected in old people in 3% to 40%, depending on the diagnostic criteria used. Probably the lower reference values used to define B_{12} deficiency are in fact too low, underestimating the real frequency of this deficiency in the old population. It was seen that in 40% of elderly individuals with normal but near lower reference values of B_{12}, methyl-malonic acid was elevated.

We found higher mean serum levels of folic acid in apparently healthy elderly than in the young adult group. This was somewhat expected, since the studied group was composed of socially active individuals without symptomatic disease. In general, folic acid deficiency in the aged is associated with institutionalization, disease, alcoholism and feeding difficulties. The majority of the literature reviewed reported similar findings.

We found significantly higher mean values of serum ferritin in apparently healthy elderly in comparison to the young adult group. Some factors influencing ferritin levels are the presence of chronic disease (inflammation, infection, neoplasia), hepatic disease and genetic predisposition (hemochromatosis). In our study the exclusion of these factors was only clinical, without laboratory testing. The low incidence of iron deficiency could be attributed to the good nutritional status of the subjects and/or to the adequate selection of healthy elderly. A tendency to store iron with aging may be possible.

Table 5. Comparison of hematological and nutritional indications between apparently health elderly with anemia and without anemia

Nutritional variables	Groups	Mean	± dp	*p*
Hematological				
B_{12} values	Anemia	1,50	0,71	*0,000*
	Normal	1,98	0,12	
Folate	Anemia	8,85	3,75	*0,218*
	Normal	6,17	2,99	
Ferritin	Anemia	264,0	207,9	*0,231*
	Normal	147,6	132,6	
VCM	Anemia	87,50	2,121	*0,489*
	Normal	89,7	4,49	
Leucocytes	Anemia	8000,00	8485,280	*0,249*
	Normal	6.686,31	1.582,613	
Diet				
Calories (Kg)	Anemia	1.730,0000	0,00000	*0,638*
	Normal	1.407,5839	949,93717	
Carbohydrates (%)	Anemia	46,8800	0,00000	*0,764*
	Normal	111,5989	298,55744	
Protein (%)	Anemia	13,2800	0,00000	*0,000*
	Normal	22,3078	11,86670	
Lipids (%)	Anemia	39,8400	0,00000	*0,685*
	Normal	57,0353	58,75962	
Vitamin B_{12} (g)	Anemia	1,8900	0,00000	*0,769*
	Normal	29,1828	128,74656	
Iron (mg)	Anemia	8,9900	0,00000	*0,903*
	Normal	9,4311	5,03356	
Folate (µg)	Anemia	272,0400	0,00000	*0,659*
	Normal	388,2811	364,97801	

Fleming *et al*.[23] analyzed iron deposits in a group of elderly with ages between 67 and 96 years old, survivors of the original Framingham study cohort, with emphasis on the differential diagnosis of anemia in chronic diseases. They measured reactive protein C (to exclude inflammatory disease), alkaline phosphatase and transaminases (to exclude hepatic disorders), white blood cell count and differential (to exclude infection) and clinical analysis to discard neoplasia. They interpreted high levels of transferring saturation, ferritin and total serum iron as possible associations with hemochromatosis genes, but confirmatory exams were not performed. The results of this study were: low frequency of iron deficiency and a higher prevalence of high iron deposits rather than deficiency. The causes were ignored, but the role of diet must be better investigated for possible subclinical inflammatory conditions.

There are a few studies about iron deposits in the old, showing similar results. Until now, the real situation of iron status in the elderly is difficult to determine due to the high prevalence of chronic diseases. In our study the quantities of iron, protein and vitamin B_{12} ingestion by apparently healthy elderly subjects were higher than those recommended by World Health Organization, results that are similar to other reports on the aged. There are questions about the necessity of increasing the quantity considered adequate for old people, since the catabolism rate increases in this group.

A comparison of anemic and non-anemic apparently healthy elderly showed a significantly lower level of vitamin B12 in the first group. This finding agrees with the high prevalence of subclinical deficiency of this vitamin reported in the literature.

The comparison of nutritional indicators between the apparently healthy elderly and the other elderly did not show differences, suggesting that the diet did not play an important role in determining health status in this setting.

We found in both groups, ingestion below the recommended quantities for several macro and micro nutrients. A previous study described the nutritional characteristics of these elderly and compared them with similar studies in diverse countries. The analysis suggested similar ingestion of B_{12}, folate and iron as elderly living in Bangkok,[24] Atlanta,[25] Costa Rica,[26] Germany[27] and France.[28] The low ingestion of calories, high ingestion of proteins and adequate ingestion of lipids were also reported in other studies. Since the elderly investigated were of a lower education level, this could be related to a lack of information.

Although the study described here presents some limitations, the data obtained suggest that there are some differential hematological parameters in elderly individuals that may be biological aging associated. Whether these modifications are clinical consequences need to be tested in future studies.

Resumo

Foi realizado um estudo não probabilístico em idosos que vivem na comunidade. A primeira análise teve um delineamento transversal e análises adicionais um delineamento caso-controle. Na primeira análise foram incluídos 745 indivíduos. Análises adicionais foram feitas em 46 idosos saudáveis (HE) e em 33 adultos jovens (YA) incluindo: análises clínicas, hematológicas e bioquímicas, recordatório nutricional de 24 horas e questionário de freqüência dietética. Os idosos saudáveis foram selecionados através do uso do protocolo Seniour. Para evitar viés de seleção na amostra HE, uma análise adicional comparando variáveis culturais, socioeconômicas e saúde com a dos idosos não selecionados (DE). A prevalência de HE foi de 17% (n=46) sendo que, entre estes, 4,3% estavam anêmicos. Não ocorreram diferenças estatísticas de hematócrito, hemoglobina, leucócitos, neutrófilos e vitamina B_{12} entre os grupos AHEe YA. Níveis médios de MCV, RDW, eosinofilos folato and ferritina foram mais altos no grupo AHE do que no YA. Ao contrário, as plaquetas foram mais altas no grupo YA. Não ocorreram diferenças significativas entre os grupos AHE e DE quando os indicadores nutricionais foram comparados. A comparação entre indicadore nutricionais de idosos anêmicos e não-anêmicos em idosos aparentemente saudáveis mostrou diferenças significativas na ingestão de vitamina B_{12} e de proteína, que foi mais baixa nos idosos anêmicos. Os resultados sugerem diferenças biológicas independentes entre

*os parâmetros hematológicos de idosos e jovens. Rev. bras. hematol. hemoter. 2007;**29**(2):136-143.*

***Palavras-chave:** Envelhecimento saudável; envelhecimento hematológico; nutrição; anemia; idoso saudável.*

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