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**VITAMIN E STATUS IN A GROUP OF ELDERLY PEOPLE FROM MADRID**

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**Abstract:** BACKGROUND: Given that vitamin E plays an important role in the prevention of pathological processes frequently observed in older age, it is of special interest to evaluate the nutritional situation of this population with respect to this vitamin. OBJECTIVE: To evaluate the nutritional situation with respect to vitamin E in a group of elderly individuals from Madrid, Spain. DESIGN: The vitamin E status of a group of 120, independently-living elderly people was investigated. All included subjects (i.e., those for whom it was possible to determine vitamin E status) belonged to a sample of 158 elderly volunteers, subjects of a larger nutritional study. A 5-day food record (including a Sunday) was kept in order to monitor food intake. Serum levels of alpha-tocopherol were determined by HPLC. RESULTS: Some 95.2% of subjects showed intakes below those recommended; 86.7% did not even meet 66% of the recommended values. At serum level, subjects showed alpha-tocopherol values of  $8.3 \pm 3.6$  mg/L, with no differences between men and women ( $8.5 \pm 3.6$  mg/l in men and  $8.2 \pm 3.6$  mg/L in women). Some 51.7% (52.4% of men and 51.3% of women) showed levels below 7.8 mg/L; 17.5% (14.3% of men and 19.2% of women) showed values of 5 mg/L. The influence of the diet at the biochemical level can be seen in that those subjects with intakes lower than 50% of the recommended who showed significantly lower serum levels ( $7.8 \pm 3.4$  mg/L) than those with greater intakes ( $9.3 \pm 4.2$  mg/L). This difference was independent of serum triglyceride and cholesterol levels. Subjects with coefficients of vitamin E (mg)/polyunsaturated fatty acids (g) (E/AGP) below the 5 th percentile (0.32) had significantly lower serum alpha-tocopherol levels ( $5.3 \pm 1.1$  mg/L) than did subjects with  $E/AGP \geq 0.32$  ( $8.5 \pm 3.7$  mg/L). CONCLUSION: Given the importance of vitamin E as an antioxidant, and its role in the prevention of a range of pathological processes, insufficient intakes (frequently detected in the group studied) should be corrected.

**Key words:** Vitamin E, elderly, antioxidants, tocopherol, deficiency, intake.

### Introduction

From a nutritional perspective, elderly people are a vulnerable population especially with respect to vitamin and mineral status (1). Factors influencing nutritional status in this population include a decrease in the observed energy intake, an increase in micronutrient requirements, and/or alterations in nutrient absorption and metabolism (2).

Vitamin E intake and status are especially relevant concerns in older persons due to its antioxidant properties and role in the prevention of certain diseases, including cancer, diabetes, cataracts, and cardio- and cerebrovascular disease (3). This vitamin is also involved in maintaining adequate immune function, thus promoting a lower incidence of infections (4). These functions not only demonstrate the importance of vitamin E to general health, but also support efforts to prevent deficiencies in older individuals.

The aim of this study was to evaluate the vitamin E status in a group of non-institutionalized elderly individuals.

### Subjects and Method

A group of 120 non-institutionalized elderly individuals between the ages of 65-91 years participated in the present

study. All subjects resided in Madrid, Spain. The characteristics of the sample are given in Table 1.

**Table 1**  
Personal, anthropometric, dietary and blood data

	Total	Men	Women
<b>Personal and anthropometric data</b>			
Number	120	42	78
Age (years)	$71.0 \pm 6.6$	$71.8 \pm 7.1$	$70.6 \pm 6.3$
Weight (kg)	$67.1 \pm 9.2$	$69.2 \pm 8.8$	$66.0 \pm 9.3$
Height (cm)	$155.7 \pm 8.8$	$164.9 \pm 5.7$	$151.1 \pm 6.0$
Body Mass Index (BMI) (kg/m <sup>2</sup> )	$27.87 \pm 4.1$	$25.6 \pm 3.6$	$29.0 \pm 4.1$
<b>Dietary data</b>			
Vitamin E (mg)	$5.5 \pm 3.5$	$5.4 \pm 3.5$	$5.6 \pm 3.5$
AGP (g)	$8.4 \pm 3.9$	$9.2 \pm 4.4$	$8.0 \pm 3.5$
<b>Blood data</b>			
Alpha-tocopherol (mg/l)	$8.3 \pm 3.6$	$8.5 \pm 3.6$	$8.2 \pm 3.6$

Subjects were excluded if they had a major underlying illness or were taking medication that might modify the results. Also excluded were those undergoing dietetic treatment in order to lose or gain weight, those who did not provide all the required

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information, and those who were absent at the time of study or who showed a lack of consistency in their answers in the different tests performed. After the presentation of the study protocol, written consent of inclusion was obtained from interested subjects. This study was approved by the Comité de Investigación de la Facultad de Farmacia, Universidad Complutense de Madrid.

- *Dietary survey:* A prospective method making use of a weighed-food-record was followed over 5 consecutive days including a Sunday. All subjects were given kitchen scales for weighing food. When the record was complete, subjects returned their booklets in person. A qualified nutritionist inspected all records to ensure that they were completed and that sufficient detail had been recorded. The energy and nutrient contents of all food ingested were determined by using the Spanish food-composition tables (5). Fatty acid content was determined by using the tables of Moreiras et al (6).

The Tables of Recommended Intakes of Energy and Nutrients for the Spanish Population, issued by the Department of Nutrition (7) were used to calculate the recommended dietary intakes (RDI) for this population group. Comparisons between observed intakes and RDI values were used to assess the adequacy of the diets. Coefficient of vitamin E (mg)/polyunsaturated fatty acids (g) (E/AGP) was calculated.

- *Anthropometric survey:* Weight and height (without shoes) were determined using a digital electronic weighing scale (range: 0.1-150 kg) and a digital stadiometer (range 70-205 cm). These data allowed the calculation of each subject's body mass index (BMI, kg/m<sup>2</sup>). Anthropometric dimensions were taken by trained observers following norms set by the World Health Organization (WHO) (8).

- *Biochemical survey:* To determine serum alpha-tocopherol levels a High Performance Liquid Chromatography (HPLC) method was used, in inverse phase, following a method developed by Cuesta et al. (9). The mobile phase utilized was a mixture of methanol and water (95:5) with a flow rate of 2.0 ml/min. A column ODS-C2 Spherisorb was used with a particular size of 5mm and dimensions of 4 by 125 mm. The determination was carried out in a chromatographer Varian 5000, with a visible ultraviolet detector of variable wave longitude. The detection was carried out at 294nm. The internal standard used was retinil acetate (C.V =2.6%).

The triglycerides were determined by enzymatic hydrolysis (method GPO/PAP) (Merck 19706, C.V=3.2%) (10) and total cholesterol by the same method as the esterase cholesterol (Merck 19705, C.V=2.1%) (11).

- *Statistical analyses:* Means and SDs are shown. The degree of significance of the differences between mean values was calculated using the Student t test. Where the distribution of results was not homogeneous the Mann-Whitney test was used. The results were considered significant if p<0.05. The relationship between serum alpha-tocopherol levels and serum triglyceride and cholesterol levels was investigated using linear regression.

## Results

Within the study population, it was observed that 95.2% had vitamin E intakes below the recommended values. However, when considering the cut off point for adequate ingestion a value above or equal to 66% of the recommendation (2/3), the percentage of individuals demonstrating inadequate vitamin ingestion was reduced to 86.7% (Table 2).

**Table 2**

Percentage of individuals with an energy intake % lower than the daily recommended ingestion (RDI).

	< 100% RDI	< 66 % RDI
Total (%)	95,2	86,7
Men (%)	94,3	88,6
Women (%)	95,7	85,7

With respect to the biochemical data, the mean value of serum alpha-tocopherol among the elderly participants was 8.3±3.6 mg/L; no significant differences were found between sexes (men: 8.5±3.6 mg/L; women: 8.2±3.6 mg/L) (Table 1). Furthermore, 51.7% of the subjects presented alpha-tocopherol levels lower than 7.8 mg/L (men: 52.4%; women: 51.3%), and 17.5 % had levels below 5 mg/L (men: 14.3%; women: 19.2%) (Table 3).

**Table 3**

Percentage of individuals with serum alpha-tocopherol levels lower than 7,8 mg/l and 5 mg/l.

	< 7.8 mg/l	< 5 mg/l
Total (%)	51,7	17,5
Men (%)	52,4	14,3
Women (%)	51,3	19,2

Subjects with vitamin E intakes lower than 50% of the recommended had significantly lower serum levels (7.8±3.4 mg/L) in comparison to those with superior intake values (9.3±4.2 mg/L) (Table 4). These differences were independent of serum triglyceride and cholesterol levels.

**Table 4**

Serum levels of alpha-tocopherol as a function of the vitamin E/AGP relation and dietary vitamin E intake.

	Alpha-tocopherol (mg/l)
Vit E/AGP < per 5 (0,32)	5.1±11*
Vit E/AGP > per 5 (0,32)	8,5±3,7*
Vitamin E < 50% RDI	7,8±3,4*
Vitamin E > 50% RDI	9,3±4,2*

\*Significat difference between those with less-than and greater-than 50% RDI and per 5 (0.32).

However, it was observed among certain elderly participants with a coefficient of vitamin E (mg)/polyunsaturated fatty acid (g) (E/AGP) lower than 0.32 (Percentile 5), had serum alpha-tocopherol levels significantly lower ( $5.3 \pm 1.1$  mg/L) than those with a greater coefficient of E/AGP ( $\geq 0.32$ ) ( $8.5 \pm 3.7$  mg/L) (Table 4).

### Discussion

In this study group, an elevated percentage of elderly individuals were encountered with vitamin E intakes below current recommendations (Table 1). This percentage is similar to data presented in other studies of populations with similar characteristics (12, 13, 14).

A systematic review of nutritional studies, published in 1990-99 and realized by metaanalysis, relates a nutritional epidemiological profile of the Spanish population and includes data on vitamin intakes and results from biochemical measurements. In the majority of cases reviewed, a mean vitamin E intake well below the recommended was revealed as well as a percentage of individuals with insufficient intakes 54-95.4% (14).

The biochemical data indicate that even though the majority of the study population did not exhibit a vitamin E deficiency, some 17.5 % of individuals had serum values below 5 mg/L, which is considered the normal limit for this vitamin. Similar results were observed in other studies, which also found percentage variables of people, between 1,6 and 32,6%, with values below the normal limit (14).

Regarding the diet/blood relationship, no significant relationship was found ( $r=0,1517$ ) between vitamin E intake and serum alpha-tocopherol levels. Similar results have been obtained in other investigations. Specifically, in a study involving hospitalized patients, it was observed that 95% had vitamin E intakes that corresponded with 2/3 of the recommended value, and only 0.6% presented inadequate serum levels (15). This data may demonstrate that adipose tissue contributes to a balancing of alpha-tocopherol levels despite a low dietary vitamin E intake. Thus, when dividing the elderly individuals according to whether dietary ingestion was greater or less than 50% of the recommended dietary intake (RDI), it was observed individuals with a low dietary vitamin E intake (<50% RDI) presented significantly lower serum alpha-tocopherol levels than those with intakes greater than 50% of the RDI, even though none of the participants reached risk values.

Furthermore, it was found that participants with a lower coefficient of (E/AGP) had lower serum alpha-tocopherol levels, which supports the claim that excess consumption of polyunsaturated fats increases vitamin E requirements (16).

### Conclusion

A vitamin E intake level below the current recommendation was observed in this elderly population. However, this does not translate into a vitamin deficiency in the majority of cases, but indicates that suboptimal intake may represent a serious risk for individuals with increasing requirements for this vitamin.

Despite the information presented in the Food Composition Tables, which are typically utilized, they do not offer complete information regarding the vitamin E content of foods and may lead to the devaluation of intakes for this vitamin. Overall, it is important to monitor the risks of inadequate intakes of this antioxidant vitamin especially with respect to the diets of the aging population..

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