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Evaluation of Vitamin E Adequacy of a Group of Rural(Amish) People in U. S. A.

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Abstract

In 70 male and female Amish residents of Holmes County, Ohio, USA adequacy of vitamin E was evaluated. Subjects were interviewed three times over a 1.5 year period. Dietary intake of vitamin E was determined from three twenty-four hour recalls with a food composition table. Information on supplements was obtained during the available interviews. From these data, total vitamin E was calculated. Blood samples obtained during interview were analyzed for plasma vitamin E by a colorimetric method. The mean dietary intake of vitamin E was 84% of the RDA(7.4㎎ α-T. E). The mean intake of supplements was 181.4 IU. The mean total vitamin E intake was 188.8 α-T. E. About 67.7% of the total vitamin E intake came from dietary sources, while 32.4% came from supplements. Mean plasma vitamin E concentration was 13.4㎍ /㎖. There was a significant correlation between plasma vitamin E and supplements ($r=0.489$, $p=0.0001$) ; plasma vitamin E was slightly correlated with age($r=0.216$, $p=0.0017$).

Introduction

The increased receptiveness and consciousness of the public in regard to nutrition and health have created an opportunity for food faddism to flourish [1]. A multi-federal agency study on health practices and opinions showed that three-fourths of the general public sampled believed that supplemental vitamins provide energy. One fifth were of the opinion that the causes of diseases such as arthritis and cancer are partly due to vitamin and mineral deficiencies[2].

Vitamin E is a very popular subject for both mythological and sound pragmatic reasons. It attracts many food faddists, who consume large supplements of vitamin E to cure numerous non-deficiency diseases, including diseases of the circulatory, reproductive and nervous systems, to promote physical vigor and to protect against aging and the effects of air pollution[3]. Much of recent popular interest in vitamin E has been generated by the appearance of articles in newspapers, magazines and on T. V., suggesting various medical conditions which may be alleviated by taking vitamin E[4]. On the other hand, the adequacy of vitamin E in the American diet has sometimes been challenged. In one study, the nutritional adequacy of the Thrifty Food Plan formulated by the U. S. Department of Agriculture was evaluated by an analysis of 10-day sample menus. It was found that levels of magnesium, zinc, iron, vitamin E, niacin, vitamin B-6, folacin and pantothenic acid provided were below the Recommended Dietary Allowances [5]. In another study, a computer analysis was performed to assess the nutrient content of published menus from the Basic Four Food Groups. One half of the nutrients analyzed iron, vitamin B-6, vitamin E, magnesium, zinc, thiamin, niacin and folacinfai-

led to meet the Recommended Dietary Allowances and vitamin E, vitamin B-6, magnesium, zinc and iron were below two-third of the Recommended Dietary Allowances[6]. Amish are a minority group of people who have lived in rural areas in the states of Pennsylvaina, Illinois and Ohio in the United states. Being isolated from the modern world, they keep their old way of living which is almost similar to that of their ancestors. Therefore, it seems that their life style and diet are more typical of 19th century America. The objectives of this suudy were : 1) to compare the dietary intake of vitamin E of Amish people, a group known to take nutrient supplements, with the Recommended Dietary Allowances, 2) to determine total vitamin E intake from the diet as well as vitamin E supplement and 3) to assess the relationship between vitamin E intake and plasma vitamin E level.

Materials and Methods

The sample is a subset of that used in a study entitled, "The Selenium Status of Two Ohio Populations", conducted by the Departments of Human Nutrition and Food Management and the Ohio State University and the Ohio Agricultural and Research Development Center[7]. The protocol for this study was approved by the Biomedical Review Committee of the Ohio State University.

The sample used in this study was selected from a group of Old Order Amish residing in Holmes County in the State of Ohio on the basis of two criteria : 1) subjects must have lived in Holmes County for at least two years prior to the onset of this study and must have planned on residing within that county for at least the next calendar year : 2) subjects must have participated in all three interviews. The sample consisted of 70 subjects, 35 male and 35 female. All subjects were volunteers. A public health nurse and a Mennonite minister were contacted to assist in the recruitment of subjects. Signs were posted in offices of local physicians, and short articles were printed in the local newspaper. Other subjects were recruited by asking people who had already volunteered to participate in this study to provide names and addressed of residents whom they thought would be willing to participate. Three twerty-four hour recalls of food intake and information on food supplements were obtained by trained interviewers. The subjects were interviewed personally three times, four to six months apart, in the respondent's home or in a mutually agreed upon location. Each of the three interviews were done during a different season of the year ie, spring, summer and winter and on a different day of the week. One of the three interviews was conducted on a weekend day. When the respondent was not available for interview, a close relative, usually the person responsible for food preparation, was asked to answer for that respondent. At each interview casual blood sample were obtained. Calculation of dietary vitamin E was from the twenty-four hour recalls using a food composition table and food labeling information[8]. Since the values of α-tocopherol in a mixed diet were used, the value in milligrams was multiplied by 1.2 to give an approximation of the total vitamin E activity as milligrams of α-tocopherol equivalents[9]. A colorimetric assay was used to determine plasma vitamin E level[10].

Following collection, the date were statistically analyzed by the Statistical Analysis System(SAS) at the Ohio State University. Pearson correlation coefficients were used to calculate the correlation between variables. The variables studied were dietary vitamin E intake, supplemental vitamin E intake, plasma vitamin E, and percent of the RDA for vitamin E supplied by food, supplement, and food plus supplement. ANOVA and Duncan's Mul-

tiple range test were used to determine whether there was a significant difference among the three recalls at a selected level($\alpha=0.05$).

Results

Table 1 presents mean values for the different variables food vitamin E. supplemental vitamin E, total vitamin E, percent of vitamin E supplied by food, percent supplements, plasma vitamin E and percent of the RDA supplied by food and total vitamin E intake these value were based on three twenty-four hour recalls available for 70 subjects whose mean age was 38.8 years. Mean value for dietary intake of vitamin E was 7.4 ㎎ α-T. E., equivalent to 84.0% of the RDA, while the mean total vitamin E intake provided 2,081% of the RDA with a S. D. of 6,297. Mean supplementary intake was 181.4 α-T. E. and ranged from 0 to 4571 α-T. E. Total vitamin E intake averaged 188.8 α-T. E. The proportions of the total vitamin E from dietary and supplemental sources were calculated. On the average, dietary sources contributed 67.7% of the total vitamin E intake but supplements furnished 32.4% of the total. Table 1 also shows plasma vitamin E levels. Mean plasma vitamin E concentration was 13.4 ㎍/㎖ with a range of 6.6 to 41.1 ㎍/㎖. Data in Figure 1 show a weak correlation existed between age and supplemental vitamin E($r=0.216$), total vitamin E intake ($r=0.216$), plasma vitamin E ($r=0.216$) and percent of vitamin E provided by supplements ($r=0.274$). These associations were statistically significant. However, percent of vitamin E supplied by food was inversely correlated to age ($r=-0.274$, $p=0.0001$). Figure 2 illustrates the interrelationship between various parameters and plasma vitamin E levels. Plasma vitamin E level was correlated with supplemental vitamin E intake ($r=0.489$), total vitamin E intake ($r=0.489$) and percent of vitamin E provided by supplements ($r=0.574$). However, statistical analysis of the data showed a significant inverse correlation between plasma vitamin E level and percent of vitamin E provided by food ($r=-0.$

Table 1. Mean values of vitamin E intake and plasma vitamin E levels

	Recall 1 (n=70)	Recall 2 (n=70)	Recall 3 (n=69~70)	All (n=209~210)
Variable	mean± SD	mean± SD	mean± SD	mean± SD
Age(years)	38.8± 17.5	38.8± 17.5	38.8± 17.5	38.8± 17.5
Food(㎎ α-T.E.)	8.0± 5.3	7.8± 6.8	6.4± 4.0	7.4± 5.5
Supplements(IU)	179.4± 608.7	173.4± 607.2	191.5± 610.1	181.4± 605.8
Total(㎎ α-T.E.)	187.4± 608.8	181.2± 606.6	197.9± 610.1	188.8± 605.6
% food	68.8± 44.3	70.0± 43.9	64.1± 45.9	67.7± 44.6
% supplements	31.2± 44.3	30.0± 43.9	35.9± 45.9	32.4± 44.6
Plasma(㎍/㎖)	13.6± 5.4	13.5± 5.0	13.2± 6.03	13.4± 5.5
1% RDA_1*	91.8± 65.8	87.1± 73.6	73.1± 44.0	84.0± 62.6
2% RDA_2**	2048.7± 6314.5	200.3± 6306.9	2192.2± 6359.3	2081.3± 6297.1

*1 % $RDA_1 = \frac{\text{dietary intake of vitamin E}}{\text{RDA}} \times 100$

**2 % $RDA_2 = \frac{\text{Total(dietary + supplements) vitamin E intake}}{\text{RDA}} \times 100$

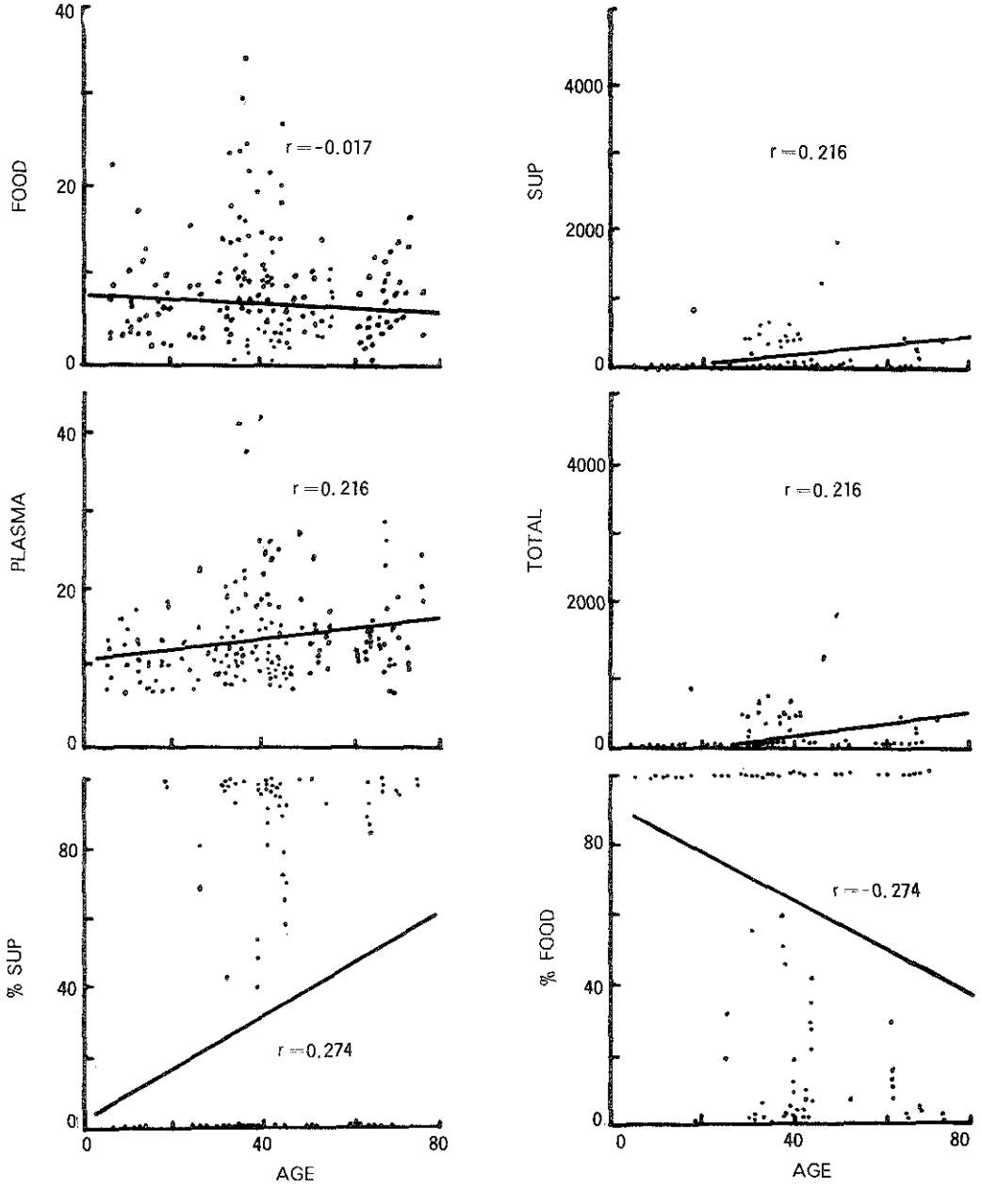

Fig. 1. Relationship between parameters and age (n=209~210).

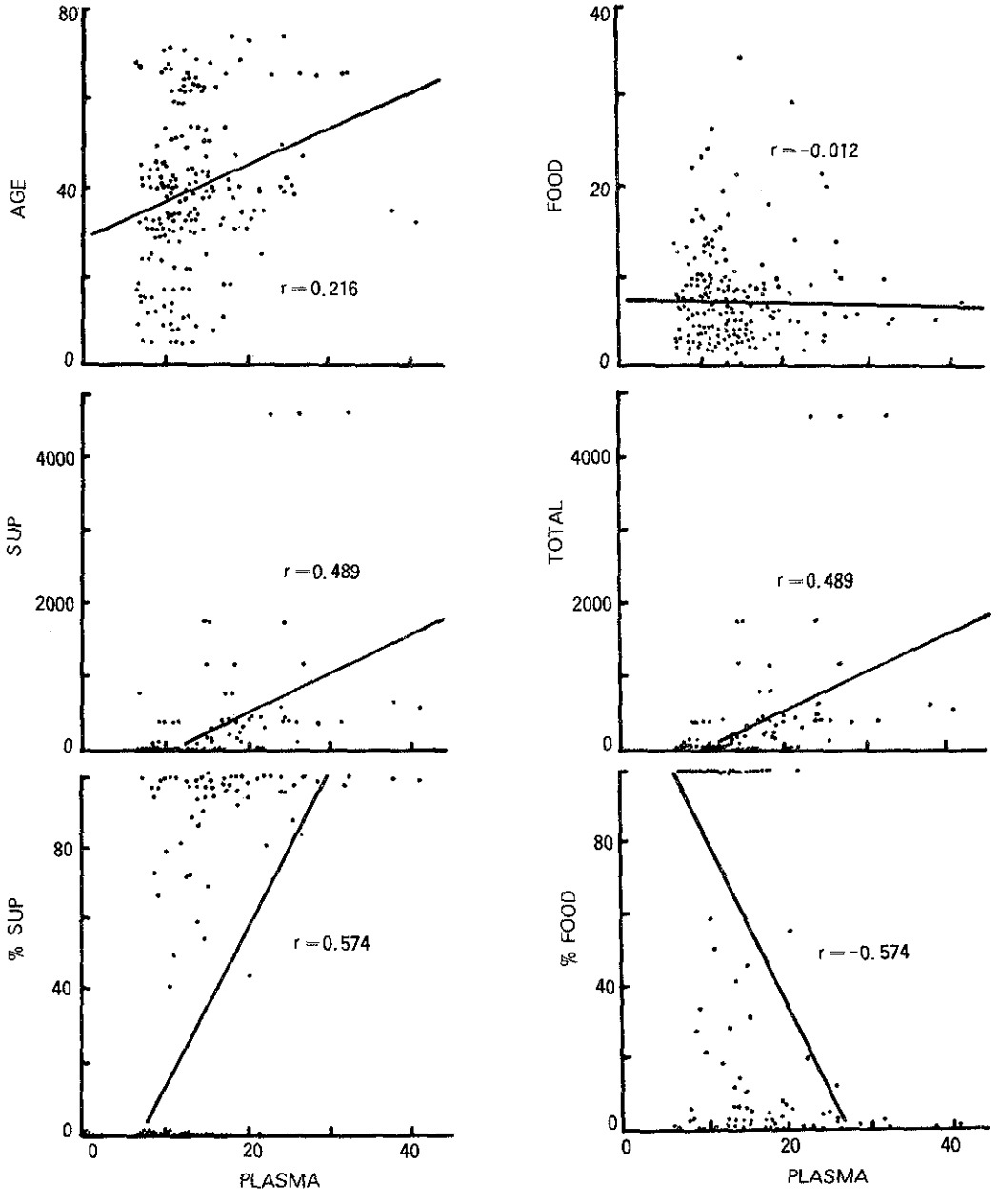

Fig. 2. Relationship between plasma vitamin E level and various parameters (n=209~210).

Table 2. Differences of vitamin E among three 24-hour dietary recalls

	Dietary intake (mg α tocopheral equivatent)	
Recall 1(spring)	8.0± 5.3*	a**
Recall 2(summer)	7.8± 6.8	a
Recall 3(winter)	6.4± 4.0	a

*Mean± SD

**Values within a column not followed by the same letter are significantly different at $\alpha=0.05$ level by Duncan's multiple ranges test.

574). There was no correlation between food and plasma vitamin E levels and a weak one between plasma vitamin E level and age ($r=0.216$).

Three twenty-four hour recalls were compared to obtain information on how dietary intake varies with the season. There was no significant difference in food vitamin E intake among these recalls ($p>0.05$).

Discussion

Results of this study indicate that our subjects have an adequate dietary intake of vitamin E. Mean intake of this vitamin from dietary sources was 84% of the current RDA. When dietary Recall 1, Recall 2 and Recall 3 were compared to find out if dietary intake varies with the season, no significant differences were found among these recalls. Since the number of data was relatively small it might be premature to draw any conclusions from these finding. The interpretation of data obtained for vitamin E from the twenty-four hour recalls was complicated by the many limitations of the study. Although the twenty-four recall method is adequate for estimating mean dietary intake of population groups, accuracy of estimating vitamin E values was dependent on the skill of the interviewer and the memory and cooperativeness of the subjects. Since recipes and food composition varies, nutrient analyses of the raw data were subject to error.

According to Eckstein[11], vitamin A is distributed irregularly in foods. Rich sources are ingested irregularly, in contrast to protein, fat and carbohydrate which are ingested regularly. Vitamin E is ingested irregularly, also, as we can see in the case of salad dressing, one of the best dietary sources of vitamin E in this study. Because of the wide daily variation of dietary vitamin E intake, it is suggested that estimation of intake should be averaged over seven day or monthly intervals[12].

It was found in this study that a considerable number of Amish people took large doses of supplements in an attempt to cure non deficiency diseases. It was interesting to note one subject who took 4,571 IU per day had heart problems. Vitamin E is fat soluble and accumulates in the body, especially in liver and pancreas. Thus, cumulative untoward effects are hypothetically possible[13]. This vitamin is particularly susceptible to distortions by food faddists. To offset the false propaganda of food faddists, effective nutrition education for this group is important.

In addition to dietary intake, vitamin E status in estimated from the plasma concentrations of vitamin E. Several investigators reported that in the U. S. adult populations, the range of total plasma tocopherol in 0.5~1.2mg/100mℓ[9,12,14]. The data in this research showed a mean plasma vitamin E of 1.34± 0.55mg/100mℓ, which was higher than those reported in other studies. The plasma vitamin E level in this study ranged from 0.66~4.11mg/100mℓ(Table 1). It was obvious that this group was sufficient in plasma vitamin E.

As we expected, plasma vitamin E levels were significantly correlated with supplementary intake. This finding is consistent with that of Farrell and Bieri, who used 100~800 IU oral supplements[15]. The average intake of supplements in the Amish group was 181.4 IU but the variation was wide

(SD=605.8). The positive correlation between plasma vitamin E level and age has been reported in other studies[16, 17, 18]. The result of this study showed a positive weak correlation between age and plasma vitamin E level. In this study, the dietary intake of vitamin E was not correlated with plasma vitamin E level. From the results of this study, it is clear that vitamin E status of Amish people is satisfactory. For the considerable number of people taking megavitamin E. effective nutrition education is needed to distinguish difference between facts and fads.

Other researchers have reported that the plasma concentration of vitamin E correlates highly with the plasma concentration of total lipids[18]. Since in this research, only plasma vitamin E was studied, it might be suggested the effects of plasma lipid associated with plasma vitamin E be examined.

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미국 농촌에 살고 있는 Amish집단의 비타민 E 영양 상태에 대한 평가

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요 약

Amish집단(미국 오하이오주 홈스카운터 거주)의 vitamin E 영양상태를 24시간 회상법, 영양보충제의 사용량 조사, colorimetric법에 의한 혈장 vitamin E의 분석으로 평가하였다. 평균식이 섭취 vitamin E는 7.4㎎ α-tocopherol equivalent였으며 평균 181.4 IU는 영양 보충제로 섭취했다. 전체 vitamin E의 67.7%는 식이를 통해 섭취했으며 32.4%는 영양 보충제를 복용함으로 섭취했다. 평균 혈장 vitamin E 농도는 13.4㎍/㎖였다. 혈장 vitamin E와 영양제로 복용한 vitamin E 사이에는 유의적인 상관관계가 ($r=0.489$, $p=0.0001$)를 보여주었고 혈장 vitamin E와 연령과도 상관관계($r=0.216$, $p=0.0017$)가 있었다. Amish 집단의 vitamin E 영양상태는 충분했으며 이 집단 중의 어떤 자들은 고단위의 다량의 vitamin E 영양제를 복용하고 있어 vitamin E에 대한 올바른 정보를 알려주고 효율적인 영양교육을 시킬 필요성이 요청되었다.