The Eating Habits of High and Low Vitamin C Users

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Introduction

Earlier reports show that exercisers versus non-exercisers eat differently (Cheraskin et al., 1973) and cigarette users versus non-smokers eat differently (Cheraskin et al., 1975a). This report is intended to analyze the relationship of vitamin C intake to other dietary habits. Are the salutary effects which follow an increase in vitamin C the direct result of the vitamin C consumption? For example, is vitamin C the cause (A) and improvement in disease the effect (B)? Or, does vitamin C act as a cause (A) and so serve to effect a change in some other variable (C) which, in turn, determines B? Or, is the effect (B) really the result of vitamin C consumption (A) and another variable (C)?

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Materials and Methods

Approximately 700 members of the health professions shared in a multiphasic health examination extending over a period of about seven years. Every participant completed the Oral Health Index Questionnaire (OHI, University of Alabama in Birmingham). Additionally, the subjects completed, at each annual examination, a dietary survey (Dietronics, Division of Hanson Research Corporation). The dietary record, a food frequency questionnaire, was submitted to a computer center which provided a readout showing the daily intake of the major foodstuffs and most of the essential nutrients (vitamins, minerals, amino acids, fatty acids).

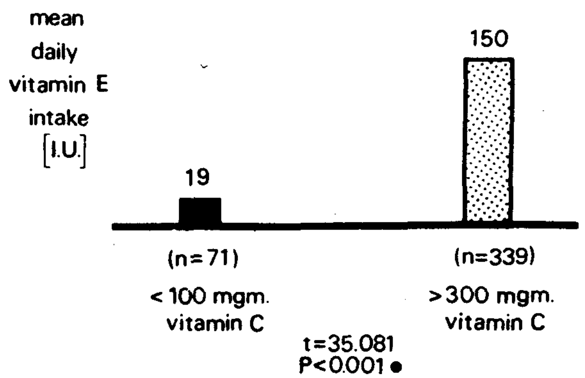
With this information, it was possible to analyze the overall diet in terms of an assessment of daily vitamin C consumption.

Results

Figure 1 shows the mean daily intake of vitamin C as obtained from the food

FIGURE 1

relationship of daily vitamin C and vitamin E consumption [food frequency questionnaire]



• statistically significant difference of the means
June 1975 #

The daily vitamin E intake in International Units is eightfold higher in the subjects consuming >300 mg vitamin C daily than in those consuming <100 mg of C daily.

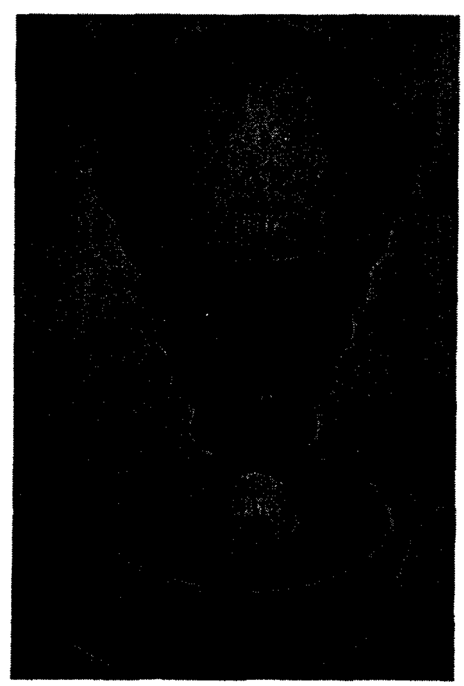
frequency dietary record versus the daily vitamin E consumption also derived from the same survey technique. Subjects with the lower vitamin C intake (< 100 mg daily) also had the lower vitamin E consumption (19 LU. per day); conversely, the subjects consuming the greater amounts of vitamin C (> 300 mg per diem) also consumed the greater amounts of vitamin E (150 I.U.). As a matter of fact, the difference was almost eightfold and very highly significant ($t = 35.081$, $P<0.001$). Thus, it would appear that the relatively low vitamin C user tends also to be a relatively low vitamin E consumer.

Table 1 summarizes the relationship between daily vitamin C consumption and the daily intake of all nutrients as judged by the food frequency questionnaire. Table 1 also lists the vitamin C and other nutrient relationships in decreasing order of statistical significance as judged by the t values and the probabilities. The dietary intake of most of the nutrients was substantially different in low vitamin C consumers compared with high vitamin C consumers (lines 1-28). On the other hand, the high vitamin C consumers displayed a lower percentage of calories from refined carbohydrate foodstuffs (line 29).

Discussion

Man may be viewed as a multi-lamellated sphere (Figure 2, Cheraskin et al., 1975b). The peripheral layer represents the clinical pattern of signs. Beneath this lamella are the prodromal symptoms. Stripping away this area brings into focus the performance layer which suffers before the advent of symptoms and signs. Subjacent is the biochemical pattern which reflects problems before they erupt more peripherally. In order, moving toward the center, are the hormonal and then the enzyme layers. Finally, at the core is the real problem. The core factors are mistakes in living and include such items as drugs, physical activity, light, and diet. For purposes of this discussion, vitamin C is utilized to show that vitamin C intake modifies all of the peripheral lamellae.

FIGURE 2



The sphere of man showing diet as the core problem.

TABLE 1

the vitamin C profile (food frequency questionnaire)

factor	**<100mg vitamin C per day**	**400+ mg vitamin C per day**	**percentage change**	**t**	P
(1) vitamin E (units)	19	150	798	35.081	<0.001*
(2) vitamin B6 (mg)	1.8	7.1	292	34.227	<0.001*
(3) pantothenic acid (mg)	7.5	25.8	243	33.706	<0.001*
(4) vitamin B3 (mg)	16	137	775	31.288	0.001*
(5) vitamin B1 (mg)	1.1	10.3	799	29.847	<0.001*
(6) potassium (mg)	396	3557	798	27.512	<0.001*
(7) vitamin B2 (mg)	2.1	11.4	45	26.078	<0.001*
(8) vitamin B12 (mcg)	4.9	21.8	341	21.105	<0.001*
(9) iodine (mg)	0.38	0.90	135	16.302	0.001*
(10) iron (mg)	13.S	51.9	284	14.940	<0.001*
(11) isoleucine (mg)	4078	6457	58	11.939	<0.001*
(12) magnesium (mg)	195	384	97	11.565	<0.001*
(13) vitamin A (units)	9391	29628	215	10.505	<0.001*
(14) phosphorus (mg)	1073	1860	73	9.799	<0.001*
(15) methionine (mg)	1624	2391	47	6.622	<0.001*
(16) lysine (mg)	5033	7483	49	6.283	<0.001*
(17) valine (mg)	4138	5929	43	6.174	<0.001*
(18) leucine (mg)	5731	8027	41	6.109	<0.001*
(19) total protein (gm)	84	108	29	6.010	<0.001*
(20) phenylalanine (mg)	3173	4491	42	5.823	<0.001*
(21) threonine (mg)	2914	4083	40	5.565	<0.001*
(22) tryptophane (mg)	898	1235	26	5.231	<0.001*
(23) polyunsaturated fatty acids (mg)	10.4	15.3	47	4.462	<0.001*
(24) percentage polyunsaturated to saturated fat	11.6	17.4	50	4.383	<0.001*
(25) total sodium (mg)	2423	2896	20	3.411	<0.001*
(26) ratio Ca/P	0.61	0.74	21	3.023	<0.005*
(27) total carbohydrate (gm)	154	192	24	2.738	<0.010*
(28) calcium (mg)	939	1375	47	2.635	<0.010*
(29) percentage of calories from refined carbohydrates	29	19	34	2.603	<0.010*
(30) total calories	1812	2053	13	1.707	>0.050
(31) calories from refined carbohydrates	473	386	18	1.350	>0.100
(32) refined carbohydrate intake (gm)	81	65	20	1.134	>0.200
(33) fat (gm)	112	109	3	0.572	> 0.500
(34) approximate sugar (tsp)	19	18	8	0.475	>0.500
(35) frequency of eating	3	3	0	0.213	>0.500

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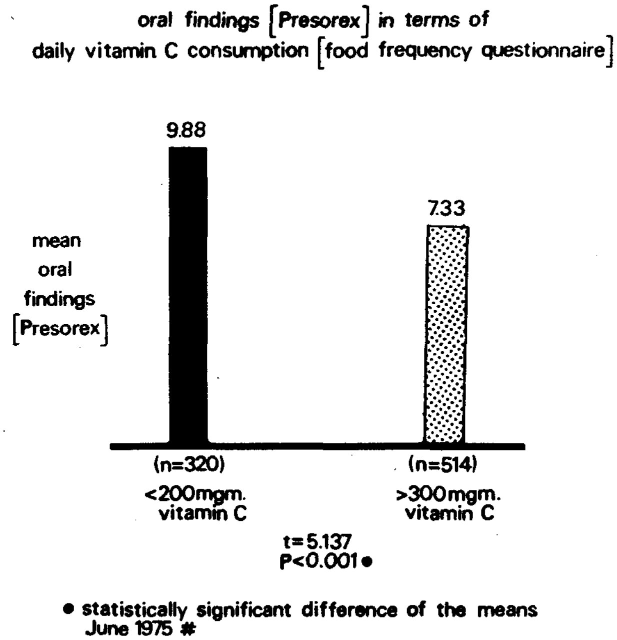
However, as noted in Table 1, those consuming the greater amount of vitamin C tend to consume more of all the other essential nutrients. Hence, changes in the peripheral areas may be the result of the (1) vitamin C intake, or (2) the diet which is different in the vitamin C user, or (3) both.

For example, Figure 3 outlines the relationship between vitamin C intake (the core in Figure 2) and the mean number of oral symptoms and signs designated as the Presorex (in the most peripheral layers in Figure 2). The 320 subjects consuming < 200 mg vitamin C daily have, on an average, 9.88 oral symptoms and signs. The 514 subjects with a mean intake of > 300 mg vitamin C per day have a Presorex of 7.33. This 26 percent difference is quite significant (t = 5.137; P<0.001).

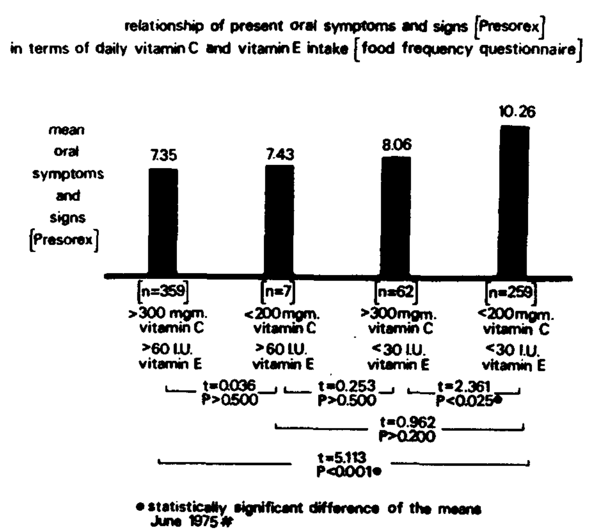
Since the possibility prevails that vitamin C may not be the only variable, Figure 4 pictorially portrays the relation-

FIGURE 3



Oral symptoms and signs are significantly less in subjects consuming greater than 300 mg vitamin C daily versus subjects consuming less than 200 mg daily.

FIGURE 4



Oral symptoms and signs are greater when the intake of vitamins C and E is poorer. Oral complaints are less when C and E intake is generous.

ship of vitamin C and vitamin E in terms of oral symptoms and signs. The greatest number of oral findings (10.26 per individual) is associated with the group characterized by the lesser amounts of both vitamin C and vitamin E. The fewest oral findings (7.35 per person) are noted in the group with the highest vitamin C and vitamin E intake. The other two possibilities occupy intermediate positions in terms of present oral findings.

There seems to be no question but that low and high vitamin C users eat differently. What is not so clear is why this should be. There is some clinical evidence in the literature to suggest that vitamin C users are more health conscious and, therefore, are more careful of their other eating habits (Cheraskin and Ringsdorf, 1973).

One point which appears unquestioned is that there is a relationship between vitamin C consumption (as judged by the food frequency questionnaire) and health and disease (as judged by oral symptoms and signs) utilizing the sphere as the experimental model (Figure 2). It is also clear that the relationship between vitamin C intake and oral health and disease becomes more sharply delineated when viewed additionally in terms of other eating habits, in this instance vitamin E. Since all nutrients are interrelated in their metabolic functions (Harte and Chow, 1964), it is likely that each essential vitamin, mineral, amino acid, and fatty acid plays a role in vitamin C's impact on health and disease.

Summary

Dietary intake in terms of vitamin C consumption was assessed in approximately 700 members of the health profession. It was found that, in most instances, those consuming relatively large amounts of vitamin C also consumed significantly more ($P < 0.001$-0.010) of most of the vitamins, minerals, and amino acids. The most notable exception was the fact that the percentage of calories derived from refined carbohydrate foods was significantly lower ($P < 0.010$) in the high vitamin C

users. This same pattern prevailed, though not statistically significant, with other measures of refined carbohydrate intake.

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