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Ascorbic Acid Requirements of Older Adolescents

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FOREWORD

A review of the literature in the field of ascorbic acid requirements showed few data on adolescent subjects. The recommended allowances of the National Reasearch Council for ascorbic acid for adults, children 8 to 12 years, preschool children, and infants were derived from experimental data on those age groups. The allowances for children over 12 years apparently were not based on experimental studies on this age group but were derived from data obtained from studies on adults and younger children.

For that reason a cooperative study on the ascorbic acid requirements of younger adolescent children was initiated in October 1945 by the Oregon Agricultural Experiment Station and the Bureau of Human Nutrition and Home Economics.

Upon the completion of a year's work on that age group the following two years were spent in studying the ascorbic acid requirements of older adolescent children. The methods used and the data obtained have been presented in this bulletin.

SUMMARY

1. The recommended allowance of the National Reasearch Council, 100 mg ascorbic acid for the 18-year-old boys and 80 mg for the 16 to 19-year-old girls, did not maintain mean plasma ascorbic acid values at levels as high as the respective saturation means. For the girls all the mean values were above 0.80 mg per cent (ranging from 0.83 to 1.07). The boys' values ranged from 0.67 to 0.91 mg per cent; two out of the seven values were below 0.80 mg per cent.

2. When the ascorbic acid intake was decreased to 10 mg less than the recommended allowance of the National Research Council, it was found that for six of the eight girls the 70 mg intake of ascorbic acid was as effective as the 80 mg intake in maintaining the ascorbic acid concentration of the plasma, and that for six of the seven boys (JJ's values were excluded) an intake of 90 mg of ascorbic acid was as effective as 100 mg in maintaining the plasma ascorbic acid concentration.

3. The plasma ascorbic acid concentrations of these subjects showed individual variations even when the ascorbic acid intake was considered on the basis of mg of ascorbic acid per kg of body weight.

4. The ten-day experimental periods were more desirable than the periods of one week. This was particularly true for the saturation period when some of the subjects had been on diets low in ascorbic acid prior to the study.

5. The data in this study were analyzed statistically by testing the significance of differences between means and by analysis of variance.

Ascorbic Acid Requirements of Older Adolescents

INTRODUCTION

Little information is available on the ascorbic acid requirements of adolescents. So far as is known, the first controlled study on the vitamin C requirements of adolescents was reported from this laboratory (Storvick et al., 1947). Eight young adolescents, 4 boys and 4 girls who were 12 through 14 years of age, participated in that study in which fasting plasma ascorbic acid determinations were made daily during three one-week periods when the ascorbic acid intake was controlled. For these subjects it was found that the daily allowance of ascorbic acid recommended by the National Research Council (1945) resulted in plasma ascorbic acid values lower than those which they attained during the saturation period but well above 0.6 mg per cent, the quantity considered adequate by Butler (1940).

PLAN OF EXPERIMENT

Description of subjects

The subjects were selected through college elementary nutrition and chemistry classes, as it was felt that these students would have a better understanding of and be more interested in the study than students lacking a science background. All of the subjects were members of the freshman class and were presumably normal, healthy, older adolescents. The description of the subjects as to age, weight, and height is given in Table 1.

The subjects were only moderately active with the exception of JJ who was very active. They carried full class schedules, each including a physical education course, and they participated in various extra-curricular activities.

Prior to the studies the dietary backgrounds of the subjects varied. The girls, PS, MG and RR had eaten at the Memorial Union cafeteria, BR had eaten at a sorority house, NA and BD at a girls' cooperative house, MF at Waldo Hall, a girls' dormitory, and WH with her brother and his family with whom she lived. All of the boys had eaten their meals in the Quonset cafeteria, except WP who had eaten at a private boarding house off campus.

Experimental periods in 1946-47 studies

In the 1946-47 studies, four one-week experimental periods were used for each of the two groups of subjects. During the first week

Table 1. DESCRIPTION OF SUBJECTS.

Subject	Age	Mean weight		Height
1946-47	*Years*	*Pounds*	*Kilograms*	*Inches*
Girls:				
MG	18	119	54	61¼
WH	16	125	57	67
BR	19	130	59	65⅜
PS	18	111	50	59½
Boys:				
JC	18	155	70	71½
VD	18	156	70	69¼
JJ	18	157	71	71
GS	18	170	77	71¼
1947-48				
Girls:				
NA	18	117	53	65½
BD	18	116	53	65
MF	18	145	66	65½
RR	18	153	70	64½
Boys:				
TC	18	186	85	73½
DE	18	182	83	73⅜
WP	18	129	59	66
DR	18	151	69	70½

the subjects ate the regular dormitory diet *ad libitum*, but all the food eaten was weighed and recorded. The second week was the saturation period and during this time the subjects were given 200 mg of crystalline ascorbic acid[1] daily in addition to the regular dormitory diet. During the third and fourth weeks of the study, the ascorbic acid intake from food was restricted to 20 mg or less by substituting foods of lower ascorbic acid content for those foods on the menu which were high in ascorbic acid. Supplements of crystalline ascorbic acid were given during the third period so that the total ascorbic acid intake was equal to the recommended allowances of the National Research Council for the age and sex of the particular subjects. A decrease of 10 mg in the crystalline ascorbic acid supplement was made during the fourth period, thus the total intake was 10 mg less than the recommended allowances of the National Research Council.

Experimental periods in 1947-48 studies

The 1947-48 studies were divided into three ten-day periods rather than into four one-week periods as in the 1946-47 studies. It was felt that it might be more valuable to omit the orientation period on the unrestricted diet and to have the other three periods extended to ten days rather than have four periods of one week each. This longer experimental period allowed more time for adjustment to a new level of ascorbic acid intake. During the first ten days the sub-

[1]The authors are indebted to Merck and Company, Rahway, New Jersey, for a generous supply of crystalline ascorbic acid.

jects were given 200 mg of crystalline ascorbic acid plus the amount present in the foods on the unrestricted dormitory diet. Again during the second and third periods, the food ascorbic acid was limited to 20 mg or less. During the second period supplements of crystalline ascorbic acid were given in the mornings so that the total ascorbic acid was equal to the recommended allowances of the National Research Council. During the third period the crystalline supplements were decreased by 10 mg, making the total ascorbic acid intake 10 mg less than the recommended allowances of the National Research Council.

EXPERIMENTAL PROCEDURE

General daily procedure

The general procedure for the day was as follows: the subjects reported to the research laboratory at 6:45 AM, weighed themselves and recorded their weights on the chart posted in the laboratory. Next they warmed their hands in running hot water. The blood samples were taken by finger puncture and after the samples were checked to see that there was no hemolysis, the subjects were given their crystalline ascorbic acid supplements, except during the first week of the 1946-47 study, when no additional ascorbic acid was administered. The subjects reported to the dormitory (or cafeteria) at meal times where all their food was weighed for them. No food was eaten between meals, but black coffee was permitted *ad libitum*. After the evening meal of the third and fourth periods of the 1946-47 studies and the second and third periods of the 1947-48 studies, the subjects again reported to the laboratory to receive an additional supplement to make up the difference between the amount of ascorbic acid actually obtained from the food and the 20 mg which were allowed from food each day.

Food service

The studies with the girls were conducted at Snell Hall, a girls' dormitory, conveniently located near the Home Economics Building. This dormitory was selected because the dining hall had table rather than cafeteria style service. A table near the kitchen was selected for the experimental subjects and the research workers. The cold foods were weighed before the dinner bell rang so that full attention could be given to weighing the hot foods at the last minute. Bowls of the different foods were brought to the table where individual portions were weighed for the subjects. As far as was possible, each food was kept separate; for example, cottage cheese, pineapple and lettuce which were to be made into a salad were served in three separate

bowls and each ingredient was weighed as the salad was made. In the same manner, whipped cream or sauces were weighed separately from the foods on which they were served.

The studies with the boys were carried out at the Memorial Union cafeteria. Since all the meal service for boys on the campus is cafeteria service, the Memorial Union was selected because of its convenient location to the Home Economics Building. Cafeteria service brought up different problems but a routine was worked out so that one person went through the serving line just before the serving period started and picked up all the cold foods for the entire group. These were weighed at the table and placed on the individual trays. At the time the subjects arrived, another trip was made through the line to pick up the hot foods.

All the food which the subjects ate was weighed on a Chatillon balance immediately before serving. Milk was weighed directly into glasses. Other food was weighed on small tin pie plates and transferred to individual trays or plates. Standard portions of 100 gm of fruits and vegetables were served except when there was a limited supply available or possible high ascorbic content made it necessary to decrease the size of the portion during the periods when the ascorbic acid from the food was restricted. Larger portions of a few foods (e. g., potatoes) were served during the unrestricted periods if requested by the students.

During the periods when the total ascorbic acid intake was not restricted, fruits with pits or rinds and meat with bone and gristle were weighed intact for each subject. After the meal the inedible portions were weighed back and that amount was subtracted from the original weight of the serving. When identical servings were desired for each subject throughout the periods of limited ascorbic acid intake, the pits or rinds were first removed and then identical servings were weighed. Meat continued to be weighed as in the earlier periods since it was not analyzed and equal servings were not necessarily given to each subject.

The food service in the living units on the campus is supervised by the Department of Dormitories. Menus come from the dormitory office and may be changed by each dining room manager to comply with the facilities for preparation and serving in her own particular food service unit. At Snell Hall, during 1946-47, the manager did not serve citrus fruits at breakfast because she felt that many of the girls did not get up for this meal and would not get an adequate supply of ascorbic acid. The citrus fruits were, therefore, served in salads and desserts at other meals but from our observations the quantity used in this manner was not equivalent to the amount one

would receive in a whole orange or half of a grapefruit. The Memorial Union service, where partitioned trays were used instead of plates, presented difficulties in serving some foods but whole oranges and grapefruit halves could be used conveniently and appeared very frequently as breakfast fruits.

Difficulty in analysis was encountered with several foods. Meats in general were not sampled for analysis but one evening out of curiosity liver was analyzed and found to have a value of 25.68 mg per 100 gm of liver. It was felt that this probably was not wholly ascorbic acid but was due to some interfering reducing substance. Potato chips also gave upon analysis a higher ascorbic acid value than was expected, i. e., 32.42 mg and 24.11 mg per 100 gm. Vegetable soup was another food that caused difficulty. Two analyses of vegetable soup had given low values (0.00 and 2.00 mg per 100 gm) but one day when food ascorbic acid was being restricted to 20 mg, 350 gm of vegetable soup were served to each boy. This particular soup analyzed at 5.13 mg per 100 gm. Considering the other foods already served that day, the 20 mg daily allotment had been exceeded. As a result of these experiences, liver and potato chips were excluded from the diet, and it was decided that vegetable soup should be analyzed before being served.

Analytical methods

Determination of Reduced Ascorbic Acid in Foods

The method of Loeffler and Ponting ('42) was used for the analysis of foods. The equipment used for this procedure was as follows:

1. Evelyn photoelectric colorimeter with filter No. 520
2. Waring Blendor units
3. Fast flowing pipette calibrated at 9 ml (or syringe pipette)[1]
4. Stop watch
5. Funnels
6. Evelyn test tubes, checked for uniformity
7. One-ounce glasses
8. One ml quantitative pipettes (or syringe pipettes)[1]

The reagents were prepared in the following manner:

1. 1 per cent metaphosphoric acid (fresh daily).
   It was found convenient to make a 6 per cent solution

[1]During the second year, syringe pipettes were found to be very helpful in the analytical procedure. They are made for syringes of different sizes and are adjustable so that the pipette will rapidly deliver a constant amount of solution. They may be obtained from Mr. H. Ruff, Northern Tool and Instrument Co., 164-21 Northern Blvd., Flushing, New York.

by weighing out 42 gm of HPO_3 and making up to 700 ml with water at night. The acid was dissolved by morning and diluted from this concentrated 6 per cent solution to the 1 per cent solution as needed.

2. Sodium 2,6-dichlorobenzenoneindophenol.
120 mg of dye were dissolved in hot distilled water, cooled, and made up to 1 liter with distilled water. This concentrated dye was made weekly and diluted daily 1:10 for use. When the galvanometer was set at 100, 9 ml of the diluted dye and 1 ml of HPO_3 gave a galvanometer reading of approximately 30.

Any food which was known to contain or thought to contain ascorbic acid was analyzed for reduced ascorbic acid by the method of Loeffler and Ponting ('42). All fruits, vegetables and dairy products except milk were anlyzed each time they appeared on the menu. Milk, delivered once a day at the dining halls, was analyzed each morning. Any mixture made with vitamin C-containing foods was analyzed. Condiments, pickles, and relishes were tested for possible ascorbic acid content.

Samples of liquids to be analyzed were placed in chemically clean one-half pint Mason jars and taken immediately to the laboratory for analysis. A ten gram portion was weighed into a beaker on a trip balance, 70 ml of 1 per cent HPO_3 added and the contents stirred before being filtered through coarse filter paper.

Solid foods were sampled at the dining halls at the time the food for the subjects was weighed. Twenty-five gram portions of food known to contain relatively large amounts of ascorbic acid (e.g., orange sections, tomato, cabbage, and grapefruit) and fifty-gram portions of foods containing smaller amounts of ascorbic acid were weighed directly into one-half pint Mason jars. A 100 ml portion of 1 per cent HPO_3 was added from a graduated cylinder. The samples were taken immediately to the laboratory for analysis.

The contents of each Mason jar were transferred quantitatively into a Waring Blendor unit using 250 ml of 1 per cent HPO_3 to make a total of 350 ml of acid. This is a proportion of seven parts of acid to one part of food for 50-gram samples or 14 parts of acid to 1 part of food for 25-gram samples. Loeffler and Ponting recommend a proportion of not less than 7 parts acid to 1 part food. The mixture was blended for five minutes, allowed to settle a little and filtered through coarse filter paper into one-ounce glasses. The clear filtrate containing the ascorbic acid was analyzed colorimetrically using an Evelyn colorimeter with filter 520 to measure the color intensity. The details of the procedure are as follows:

1. The galvanometer of the instrument was set at 100 with distilled water in a test tube checked for uniformity. One ml of 1 per cent HPO_3 was introduced into 1 of 5 matched test tubes and 9 ml of dye added within 5 seconds from a fast flowing pipette or syringe pipette. The contents were agitated and read in the colorimeter 15 seconds after the beginning of the addition of the dye. This value was recorded as the blank or G_1 value.
2. One ml aliquots of the sample filtrate were placed in each of the four remaining test tubes. Nine ml of water were added to the first tube and the galvanometer set at 100 to correct for color and turbidity of the sample.
3. Nine ml of dye were added to the first of the other three tubes and readings were made at 15 seconds (G_{15}) and 30 seconds (G_{30}) after the beginning of the addition of the dye. The difference between G_{30} and G_{15} representing the reduction of the dye by non-specific reducing substances, was subtracted from the G_{15} value and recorded as G_2. This value represents the dye reduction at zero time. It has been shown by Evelyn ('38) that ascorbic acid is reduced practically instantaneously while interfering substances react with the dye more slowly. Therefore, the G_2 value may be taken to represent the dye reaction due to ascorbic acid alone.
4. The aliquots in the other two tubes were analyzed in the same manner. The G_1 and G_2 values were corrected for galvanometer variation by reference to the chart furnished with the instrument. The average corrected blank (G_1) reading for the determinations of all the foods of a single meal was used in calculating the ascorbic acid content. L_1 and L_2 values corresponding to the corrected G_1 and G_2 values were recorded from the table supplied with the instrument where $L_1 = 2 - \log G_1$ and $L_2 = 2 - \log G_2$. The average L_2 value for each series of three test tube readings was used in calculating the ascorbic acid content of the food.
5. The ascorbic acid content of the food expressed as mg per 100 gm was calculated using the following formula:

$$\text{Mg AA/100 Gm food} = \frac{K(L_1 - L_2)(\text{Weight of acid} + \text{Weight of sample})}{\text{Weight of sample}}$$

K, a constant determined by analyzing standard ascorbic acid solutions, was found to be 10.86 in 1946-47 and 10.85 in 1947-48. The weight of each food sample was taken to represent the weight of water it contained since most of the fruits and vegetables analyzed contain 90 per cent water.

Example:

Food	Weight of sample	HPO_3	G_1	Corrected G_1	G_{15}	G_{30}	G_{15}-G_{30}	G_2	Corrected G_2	L_1	L_2	L_1-L_2	A.A.
	Grams	*Milliliters*											*Milligrams per cent*
Pineapple	50	350	31	31[3]	37 37[2] 37[1]	37[2] 38 37[3]	0[2] 0[2] 0[2]	36[2] 37 36[3]	37[1] 37[3] 37[2]	0.502	0.429 0.423 0.426	0.073 0.079 0.076 *Average* 0.076	6.60

Calculation:

$$C = \frac{K(L_1 - L_2)(\text{Weight of acid} + \text{Weight of sample})}{\text{Weight of sample}}$$

$$C = (10.86)(0.076)\frac{(400)}{50} = 6.60 \text{ mg/100 gm}$$

where C = mg/100 gm.

Determination of Reduced Ascorbic Acid in Plasma

Determinations of fasting plasma ascorbic acid were made daily by the micro-method of Farmer and Abt ('36). The following equipment was used in this procedure:

1. Oxalated blood vials
2. Clean vials for centrifuging deproteinized plasma
3. 0.2 ml pipettes
4. Microburette, (special design of Farmer and Abt, obtained from Sargent & Company, Chicago)
5. Spot plates
6. Lancet
7. Slender glass stirring rods (about 3 inches long) made by drawing out solid glass rod
8. Small corks for vials
9. Pointed glass stirring rods for titrating
10. Clinical centrifuge

The reagents were prepared as follows:

1. Lithium oxalate, 2 per cent solution
2. Mercury
3. 5 per cent metaphosphoric acid (fresh daily)
4. $2\frac{1}{2}$ per cent metaphosphoric acid (fresh daily)
5. Dye: To 0.2 gm of sodium 2,6-dichlorobenzenoneindophenol and 50 ml of 6.8 phosphate buffer was added sufficient hot redistilled water to dissolve the dye. The solution was cooled and made up to 500 ml with redistilled water. Diluted 1:10 for use.

6. Standard ascorbic acid solutions: 40 mg ascorbic acid were placed into a 100-ml volumetric flask. Twenty ml of 2 per cent sulfuric acid containing 2 per cent metaphosphoric acid were added and the solution made up to 100 ml with redistilled water.

   For the standardization, 2 ml of the above solution were diluted to 100 ml with redistilled water. The standard ascorbic acid solutions which were titrated contained 0.008 mg ascorbic acid per ml.

   Dilutions were made from two standard solutions for standardizing the dye. A third standard was prepared if good checks were not obtained with the first two.

7. Blank solution: Twenty ml of 2 per cent sulfuric acid containing 2 per cent metaphosphoric acid were made up to 100 ml with redistilled water. Two ml of this solution were diluted to 100 ml with redistilled water before using.

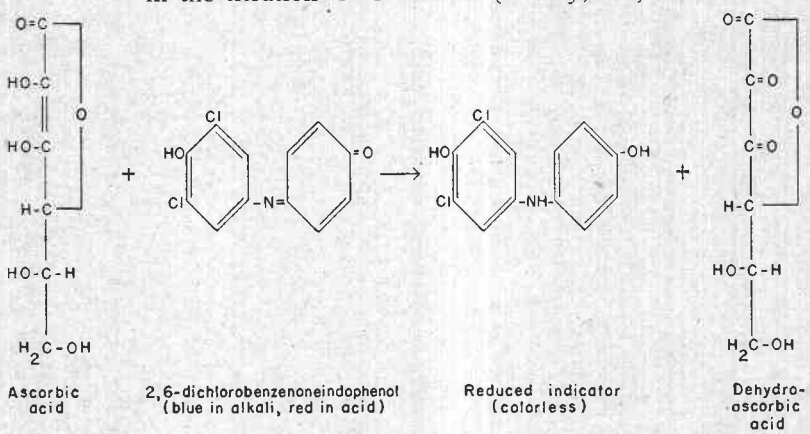
8. Phosphate buffer pH 6.8: Prepared by combining equal volumes of N/15 $Na_2HPO_4 \cdot 2H_2O$ (11.8711 gm per liter) and N/15 KH_2PO_4 (9.0760 gm per liter).

Standardization of the dye:

1. A rubber tube with glass stopper at one end was filled with clean mercury and put on the straight end of the microburette. The microburette was filled with the dye by holding the curved tip in the dye solution and turning the screw of the microburette holder clockwise until a small drop of the mercury was expelled into the dye solution, and then the microburette was filled to the desired point by turning the screw in the reverse direction.

2. Three 0.2 ml aliquots of each of the standard ascorbic acid solutions were transferred to depressions of the spot plate and were titrated with 2,6-dichlorobenzenoneindophenol using the Farmer and Abt microburette. The dye was added until a faint pink color appeared. In an adjacent depression in the spot plate 0.2 ml of $2\frac{1}{2}$ per cent metaphosphoric acid was titrated with the dye until the faint pink color matched the titrated ascorbic acid sample.

The equation for the chemical reaction which occurs in the titration is as follows (Bessey, '39):



3. Calculations:

$$\frac{\text{AA in aliquot}}{\text{ml dye used for aliquot} - \text{ml dye used for blank}} = \text{dye equivalent}$$

Example:

Standard solution	Sample	Titre with dye		Sample minus blank	Dye equivalent
		Sample	Blank		
	Milliliters	*Milliliters*	*Milliliters*	*Milliliters*	
I	0.2	0.0840	0.0035	0.0805	0.0199

$$\frac{0.0016}{0.0840 - 0.0035} = 0.0199$$

Titration of the plasma:

1. Blood was collected by finger prick into an oxalated vial, stirred with a slender glass rod, stoppered, and centrifuged for 3 to 5 minutes.
2. Into a conical tip vial 0.1 ml of plasma and 0.1 ml of redistilled water were pipetted with the same pipette. Then 0.2 ml of 5 per cent metaphosphoric acid was added and mixed thoroughly by tapping the vial against the palm of the hand. The coagulated protein was centrifuged down (about 5 minutes).

3. Two 0.2 ml aliquots of deproteinized plasma were transferred to each of two depressions in the spot plate and titrated with a solution of sodium 2,6-dichlorobenzenone-indophenol until a faint pink color appeared. In an adjacent depression of the spot plate 0.2 ml of $2\frac{1}{2}$ per cent metaphosphoric acid was titrated with the dye until the faint pink color matched the color of the titrated plasma sample.

Calculation:

(ml dye used for AA in plasma — ml dye used for blank) (dye equivalent) (2,000) = mg AA per 100 ml blood plasma

Example:

Subject	Sample	Titre with dye		Sample minus blank	Dye equivalent	Plasma ascorbic acid
		Sample	Blank			
	Milliliters	*Milliliters*	*Milliliters*	*Milliliters*		*Milligrams per cent*
Mary Smith	0.2	0.0145	0.0045	0.0100	0.0199	0.398*

* (0.0145 — 0.0045) (0.0199) (2,000) = 0.398 mg per cent.

RESULTS AND DISCUSSION

Results and Discussion of Food Analysis:

The various foods analyzed, the number of times they were served, and average mg of reduced ascorbic acid per 100 gm of food are shown in Tables 4 and 5 in the Appendix. The number of times each food was served refers to the times they were served to our subjects and not necessarily the frequency with which they appeared on the dormitory menus. During the third and fourth periods of the 1946-47 studies and the second and third periods of the 1947-48 studies the foods of high ascorbic acid content were replaced in the diet by foods low in ascorbic acid. Thus, for example, our records show that peaches were served more frequently and that oranges and grapefruit appeared fewer times for our subjects than on the regular dormitory menu. It was necessary to make these substitutions in order to keep the ascorbic acid content of the diet low, i.e., 20 mg or less, so that the larger part of the ascorbic acid intake could be given as crystalline ascorbic acid which was accurately weighed on an analytical balance.

In the foods as served, no consistent differences could be observed between those served at Snell Hall and the Memorial Union. At both the dormitory and the Memorial Union there were variations in the ascorbic acid content of any particular food at the different

times it was served. Ascorbic acid values obtained for the individual analyses of the foods may be found in Table 4 in the Appendix.

The greatest differences as far as food intake was concerned were found in the quantities of food eaten by the subjects. The boys ate much larger quantities of food, especially such food as bread, potatoes, and sweet rolls. The girls, on the other hand, were conscious of their weights and they wanted to eat a minimum of those foods which they thought were fattening. All of the subjects were very cooperative about eating the foods served to them, which was as expected since the routine and requirements of the study had been carefully explained to them before they agreed to participate in it.

Results and Discussion of Plasma Analysis:

The daily fasting plasma ascorbic acid values for each subject, their total daily ascorbic acid intake and their respective means are given in Tables 6, 7, 8, and 9 in the Appendix. Deviations from the means and the average mean deviations are also given. During the 1946-47 studies, the plasma values for all of the days in the first, or orientation, period of each study were considered in the calculations since no attempt was made to control the ascorbic acid intake for this period (Tables 6 and 8 in the Appendix). For the second, third, and fourth periods, the plasma values were averaged for the last five days, thus allowing two days for the subjects to adjust to the new levels of intake. In the 1947-48 studies the mean values have been calculated both on the basis of the last eight days and on the last five days, which means in the first instance that two days have been allowed for adjustment to the new levels of intake and in the latter case five days have been allowed for this adjustment. The purpose of these two sets of calculations was to show whether the longer experimental periods were really necessary (Tables 7 and 9 in the Appendix). All of the daily ascorbic acid intake values were averaged in every experimental period. Table 2 presents a summary of the data for each subject including mean ascorbic acid intake, mean plasma ascorbic acid values and their ranges during each experimental period. The ascorbic acid intakes during the last two periods of the studies of both years are also expressed in mg of ascorbic acid per kg of body weight. The significance of the difference between the means has been tested statistically. The difference was considered significant if it was twice as large as the standard deviation of the differences (Table 10 in the Appendix).

Girls

In the first, or orientation, period of the girls' study in 1946-47, three of the four girls showed near-saturation values according to

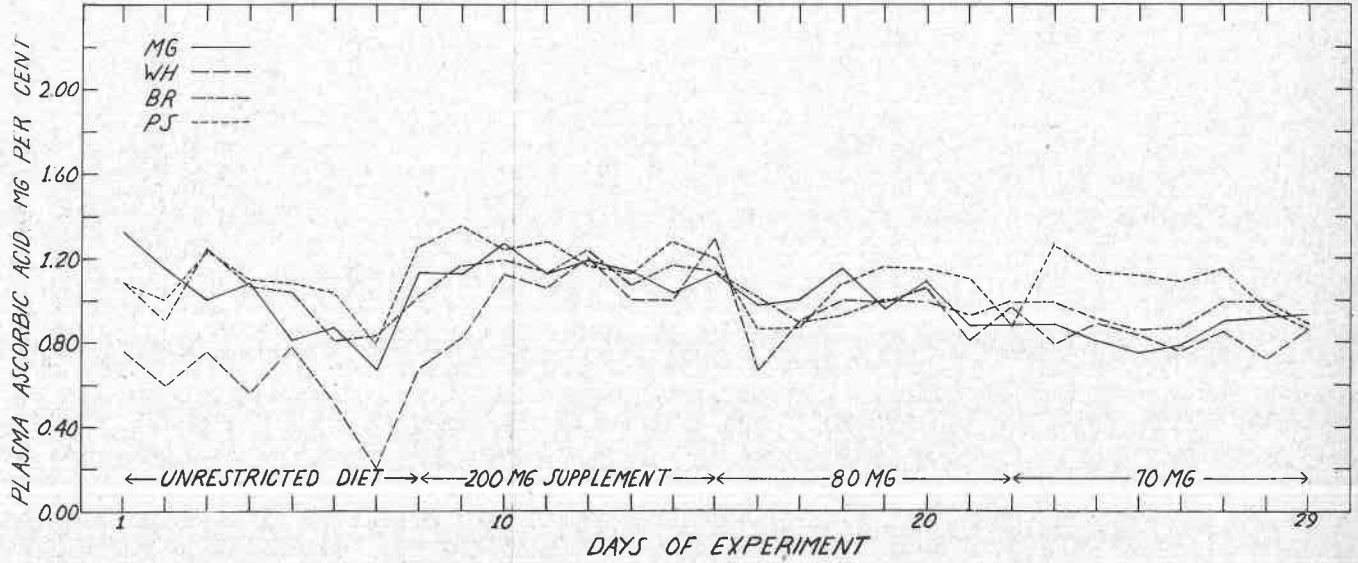


FIGURE 1. DAILY PLASMA ASCORBIC ACID VALUES OF THE GIRLS, 1946-47.

the results of fasting plasma ascorbic acid determinations (Figure 1 and Table 2). The mean fasting plasma ascorbic acid values were 1.00 mg per cent or higher for three of the subjects during this period. WH's value (0.61 mg per cent) was considerably lower than those of the other girls. This lower value was probably due to a previous diet which was low in citrus fruits and other sources of ascorbic acid. She was living with her brother and his family, while her brother was attending school under the G.I. Bill; food expenditures necessarily were kept at a minimum. The mean daily intake for the group was 73 mg of ascorbic acid, ranging from 64 to 78 mg for the individual subjects. The steady decrease in plasma ascorbic acid shown by MG during the early part of this first period may be explained by the fact that prior to the study she was probably in a state of saturation due to the high intake of fruits. The day before the study began she had eaten six oranges.

A rise in plasma ascorbic acid values was observed in all cases with the ingestion of saturation levels of ascorbic acid during the second period. WH showed a rapid rise until her value was in the same range as the other subjects. Although the other three subjects appeared to be saturated, WH possibly may not have been since on the last day of the saturation period her plasma value was the highest she had shown. There is a question, therefore, as to whether a further increase would have been shown if the period had been extended.

There was a significant (Table 10 in the Appendix) decrease in the plasma ascorbic acid concentration in all subjects when the mean level of ascorbic acid intake was decreased for the third period of 82 mg[1] which is slightly higher than the 80 mg recommended allowance of the National Research Council. During the previous week the mean intake had been 219 mg, so that 82 mg is a decrease of 137 mg from the previous intake. The mean plasma values during this period were very similar to the mean plasma values of each subject during the first period with the exception of WH, whose value remained 0.35 mg per cent higher than her mean value for the first period. WH's mean plasma value was, however, very similar to those of the other subjects during the third period.

A further significant (Table 10 in the Appendix) decrease in plasma ascorbic acid values was shown by two subjects (MG and WH) during the fourth period when the mean ascorbic acid intake was 71 mg, or 11 mg less than during the third period. A decrease in mean plasma ascorbic acid content of 0.13 and 0.16 mg per cent was shown by MG and WH respectively, between the third and

[1]A mean intake of 80 mg of ascorbic acid had been the aim for this period, and this had been achieved except for the last day of the period when a high value for liver was obtained.

fourth periods, while the values of BR and PS showed respective decreases of only 0.05 and 0.03 mg per cent. PS was the only subject whose plasma value did not "level off" at this particular intake. WH had a mean plasma value of 0.80 mg per cent, which was lower than the other subjects. She was the youngest subject, 16 years of age, and it may be that she had a higher requirement.

The ten-day saturation period during the 1947-48 study seems to have been sufficiently long for the plasma to become saturated in all four girls as indicated by a "leveling off" at plasma values above 1.00 mg per cent (Figure 2 and Table 2). The mean plasma values for the last five days of the period were 1.02, 1.19, 1.26, and 1.27 mg per cent for NA, BD, MF, and RR respectively.

A significant (Table 10 in the Appendix) decrease in plasma ascorbic acid between the saturation period and the second period when the ascorbic acid intake was 80 mg per day was shown by all subjects, regardless of whether the plasma values of the last eight days or only the last five days of the period were considered. Considering the last five days of each period, the decrease was 0.19, 0.29, 0.28, and 0.25 mg per cent for the different subjects. The mean plasma values for the last five days remained above 0.80 mg per cent in all cases.

With these four subjects, a 10 mg decrease in the level of ascorbic acid intake (to a mean of 70 mg per day) resulted in no significant (Table 10 in the Appendix) decrease in the plasma ascorbic acid values when calculated on the basis of the last five days, and in only one case was there a significant decrease when calculated on the last eight days of the period.

In the 1946-47 study with the girls the recommended allowance of the National Research Council of 80 mg of ascorbic acid per day appeared to maintain the plasma ascorbic acid at a concentration near 1.00 mg per cent for at least one week following a period of saturation. During the 1947-48 study the same level of intake maintained mean plasma values for the last five days of 0.83, 0.90, 0.98, and 1.02 mg per cent in a ten-day period following saturation. For all the girls in both studies the mean fasting plasma values on the 80 mg level of ascorbic acid intake were all significantly lower than the mean plasma ascorbic acid values during saturation, but in no case was the mean below 0.80 mg per cent. With six of the eight subjects, the 70 mg intake of ascorbic acid appeared, under the conditions of these studies, to be equally as effective as was the 80 mg intake in maintaining the concentration of ascorbic acid in the plasma.

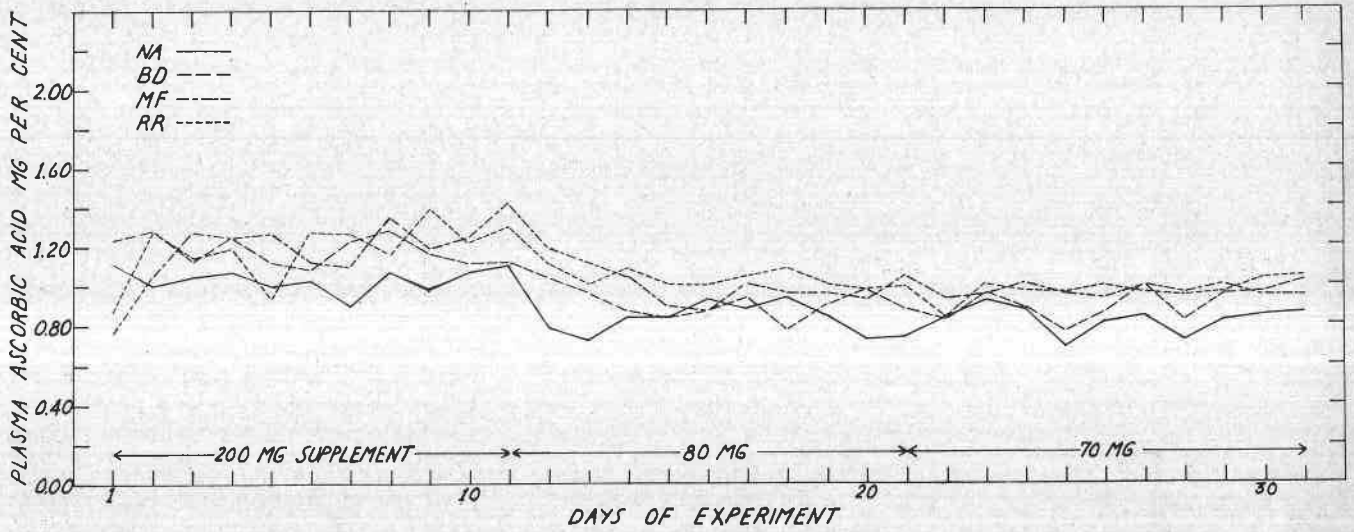


FIGURE 2. DAILY PLASMA ASCORBIC ACID VALUES OF THE GIRLS, 1947-48.

Table 2. Summary of Mean Reduced Ascorbic Acid Intake, Mean Plasma Ascorbic Acid, and Their Respective Ranges for Each Subject.

Subject	Unrestricted diet period		Saturation period		
				Mean ascorbic acid in plasma	
	Mean ascorbic acid intake per day	Mean ascorbic acid in plasma all days of period	Mean ascorbic acid intake	Last 8 days of period	Last 5 days of period
	Milligrams	*Milligrams per cent*	*Milligrams per day*	*Milligrams per cent*	*Milligrams per cent*
Adolescent girls					
1946-47					
MG	64[1]±24[2] (17–112)[3]	1.01±0.17 (0.67–1.33)	219± 4 (210–226)	.....	1.13±0.03 (1.04–1.19)
WH	76±33 (28–175)	0.61±0.14 (0.20–0.78)	219± 4 (210–226)	.....	1.11±0.11 (1.00–1.30)
BR	78±35 (30–200)	1.00±0.12 (0.81–1.25)	219± 4 (210–226)	.....	1.15±0.04 (1.07–1.24)
PS	75±36 (16–187)	1.08±0.10 (0.79–1.26)	219± 4 (210–226)	.....	1.21±0.06 (1.13–1.29)
1947-48					
NA	.....	.....	261±11 (243–289)	1.03±0.05 (0.90–1.10)	1.02±0.07 (0.90–1.10)
BD	.....	.....	261±11 (243–289)	1.18±0.07 (1.09–1.29)	1.19±0.06 (1.12–1.29)
MF	.....	.....	261±11 (243–289)	1.25±0.12 (1.10–1.42)	1.26±0.10 (1.10–1.42)
RR	.....	.....	261±11 (243–289)	1.22±0.12 (0.94–1.40)	1.27±0.06 (1.17–1.40)
Adolescent boys					
1946-47					
JC	116±31 (22–159)	0.78±0.07 (0.66–0.92)	319±45 (260–413)	.....	1.07±0.10 (0.93–1.24)
VD	130±54 (21–296)	0.39±0.11 (0.18–0.66)	357±69 (264–486)	.....	1.01±0.09 (0.89–1.22)
JJ	102±32 (24–164)	0.39±0.04 (0.33–0.45)	327±47 (266–421)	.....	0.90±0.11 (0.68–1.12)
GS	130±40 (21–198)	0.61±0.13 (0.39–0.89)	324±47 (263–424)	.....	1.07±0.03 (1.00–1.13)
1947-48					
TC	.....	.....	272±25 (243–311)	0.80±0.44 (0.39–1.31)	0.99±0.20 (0.63–1.31)
DE	.....	.....	270±29 (240–320)	0.71±0.32 (0.38–1.06)	0.88±0.10 (0.63–1.06)
WP	.....	.....	270±27 (243–318)	1.11±0.11 (0.99–1.32)	1.12±0.09 (0.99–1.32)
DR	.....	.....	265±21 (243–298)	1.04±0.17 (0.87–1.18)	1.09±0.06 (0.94–1.18)

Table 2 (*Continued*). Summary of Mean Reduced Ascorbic Acid Intake, Mean Plasma Ascorbic Acid, and Their Respective Ranges for Each Subject.

Subject	National Research Council recommended allowance				10 milligrams less than National Research Council recommended allowance			
	Mean ascorbic acid intake		Mean ascorbic acid in plasma		Mean ascorbic acid intake		Mean ascorbic acid in plasma	
			Last 8 days of period	Last 5 days of period			Last 8 days of period	Last 5 days of period
	Milligrams per day	*Milligrams per kilogram*	*Milligrams per cent*	*Milligrams per cent*	*Milligrams per day*	*Milligrams per kilogram*	*Milligrams per cent*	*Milligrams per cent*
Adolescent girls								
1946-47								
MG	82±4 (78–99)	1.5	.....	0.99±0.10 (0.88–1.15)	71±2 (70–74)	1.3	.....	0.86±0.07 (0.75–0.93)
WH	83±5 (78–101)	1.5	.....	0.96±0.07 (0.80–1.06)	71±2 (70–74)	1.2	.....	0.80±0.05 (0.72–0.86)
BR	82±4 (78–95)	1.4	.....	0.97±0.03 (0.93–1.00)	71±2 (70–74)	1.2	.....	0.92±0.06 (0.86–0.99)
PS	80±1 (78–82)	1.6	.....	1.07±0.08 (0.87–1.16)	71±2 (70–74)	1.4	.....	1.04±0.10 (0.86–1.15)
1947-48								
NA	80±0.4 (78–81)	1.5	0.85±0.07 (0.73–0.94)	0.83±0.08 (0.73–0.94)	70±0.3 (69–72)	1.3	0.81±0.05 (0.69–0.87)	0.82±0.04 (0.72–0.86)
BD	80±0.4 (78–81)	1.5	0.88±0.06 (0.78–0.98)	0.90±0.05 (0.78–0.98)	70±0.3 (69–72)	1.3	0.91±0.07 (0.77–1.02)	0.95±0.06 (0.82–1.02)
MF	80±0.4 (78–81)	1.2	0.97±0.08 (0.87–1.05)	0.98±0.04 (0.93–1.04)	70±0.3 (69–72)	1.1	0.96±0.02 (0.93–1.01)	0.96±0.02 (0.94–0.99)
RR	80±0.4 (78–81)	1.1	1.03±0.04 (0.98–1.09)	1.02±0.04 (0.98–1.09)	70±0.3 (69–72)	1.0	0.98±0.04 (0.94–1.04)	0.99±0.04 (0.94–1.04)
Adolescent boys								
1946-47								
JC	100±0 (100–102)	1.4	.....	0.91±0.06 (0.82–0.99)	92±3 (90–105)	1.3	.....	0.79±0.07 (0.63–0.86)
VD	100±0 (100–102)	1.4	.....	0.82±0.04 (0.72–0.85)	92±3 (90–105)	1.3	.....	0.75±0.07 (0.68–0.88)
JJ	100±0 (100–102)	1.4	.....	0.90±0.05 (0.84–1.02)	92±3 (90–105)	1.3	.....	0.80±0.07 (0.69–0.96)
GS	100±0 (100–102)	1.3	.....	0.86±0.04 (0.77–0.95)	92±3 (90–105)	1.2	.....	0.84±0.04 (0.79–0.94)
1947-48								
TC	100±0.4 (99–101)	1.2	0.90±0.06 (0.84–0.96)	0.90±0.02 (0.84–0.91)	90±0.6 (87–92)	1.1	0.82±0.09 (0.69–0.93)	0.84±0.05 (0.76–0.93)
DE	100±0.4 (99–101)	1.2	0.69±0.10 (0.62–0.77)	0.67±0.04 (0.62–0.74)	90±0.6 (87–92)	1.1	0.67±0.03 (0.61–0.71)	0.68±0.02 (0.65–0.71)
WP	100±0.4 (99–101)	1.7	0.79±0.09 (0.72–0.85)	0.81±0.04 (0.75–0.85)	90±0.6 (87–92)	1.5	0.72±0.07 (0.62–0.88)	0.74±0.06 (0.69–0.88)
DR	100±0.4 (99–101)	1.4	0.73±0.09 (0.64–0.84)	0.69±0.02 (0.64–0.72)	90±0.6 (87–92)	1.3	0.73±0.09 (0.59–0.89)	0.74±0.08 (0.59–0.83)

[1]Mean.
[2]Average deviation from the mean.
[3]Range.

Boys

The fairly low mean plasma ascorbic acid values of the boys (0.78, 0.39, 0.39, and 0.61 mg per cent) in the first period of the 1946-47 study when the ascorbic acid intake was not controlled is a general indication of a previously poor intake which may be due to a number of causes (Figure 3 and Table 2). These subjects did not get up regularly for breakfast which is the meal when most of the citrus fruits were served. VD ate citrus fruits only occasionally because he did not care for them.

A marked rise in plasma ascorbic acid was observed in three of the subjects, JC, VD, and GS, when 200 mg doses of ascorbic acid were given as supplements during the second or saturation week. Although the mean ascorbic acid intake during this saturation period was very high, 319 to 357 mg per day, it was questionable whether the subjects were saturated at the end of the week, particularly in the case of VD and GS whose values were still increasing day by day. A steady but more gradual rise was shown by JJ during this period, and his mean value for the period was considerably lower than those of the other subjects. On the fourth day of the saturation period, JJ reported to the Student Health Service at the college where he was given a series of injections for poison oak. Ten days later he was confined to the infirmary with poison oak and a secondary infection of impetigo. While he was in the infirmary for three days he was given considerable medication including penicillin, sulfathiazole, phenobarbitol, nembutol, and benzedrine. Calmitol ointment and ammoniated mercury were used locally on the infected areas. JJ remained on the experiment as a matter of interest although his data were not considered as those of a normal subject. His meals and supplements were carried to him and someone from the nutrition laboratory collected his blood samples daily.

During the third week, 100 mg of ascorbic acid, the recommended allowance of the National Research Council for this particular age, was given to the subjects. A marked downward trend was noticed in the blood plasma values at this time. The decrease in mean plasma values from the saturation period to the period of the 100 mg mean intake was 0.16, 0.19, and 0.21 mg per cent for JC, VD, and GS, respectively. These are significant changes according to statistical analysis (Table 10 in the Appendix). Although these means are not as high as the subjects' saturation means, they are in all cases above 0.80 mg per cent. The mean plasma value for JJ during this period remained the same as during the saturation period (0.90 mg per cent).

In the fourth period, when the ascorbic acid intake was de-

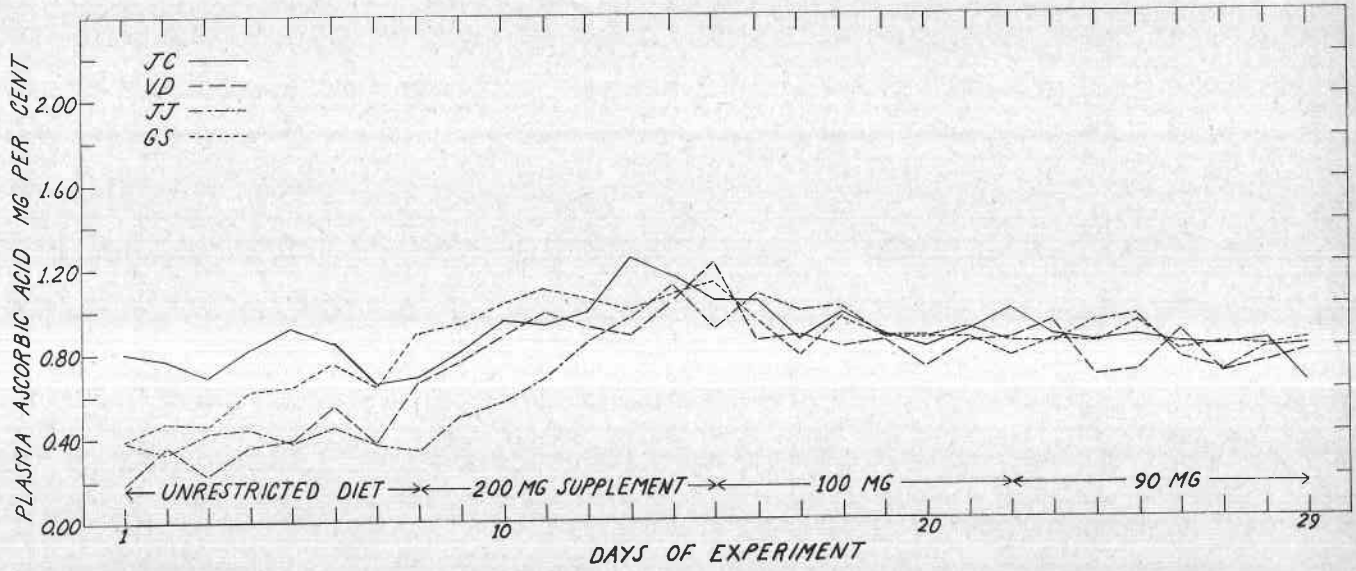


FIGURE 3. DAILY PLASMA ASCORBIC ACID VALUES OF THE BOYS, 1946-47.

creased 10 mg, a further significant (Table 10 in the Appendix) decrease in plasma ascorbic acid was shown only by JC. The plasma concentration of GS appeared to have reached a plateau by the end of the period at this level of intake but whether the plasma values of the other subjects had reached plateaus was not so convincing. The mean plasma ascorbic acid values for this period were 0.79, 0.75, 0.80, and 0.84 mg per cent for JC, VD, JJ, and GS, respectively.

In the 1947-48 study, the concentration of ascorbic acid in the plasma of WP and DR was indicative of saturation by the end of the 10-day saturation period (Figure 4 and Table 2). DR showed fairly low plasma ascorbic acid values the first few days, but his plasma ascorbic acid concentration rose rapidly after that time. At supper of the first day, DR reported that he was not feeling well, and by the next morning he had diarrhea accompanied by cold symptoms. On that day, he came to the cafeteria for his meals but did not eat all of the food. At the end of the day he was given 30 mg of crystalline ascorbic acid so that his total intake was similar to that of the other boys. DR felt better the next day and he returned to a more normal diet, eating at least those foods which were analyzed for ascorbic acid. By the third day of the study he had recovered completely. At the beginning of the study TC and DE had very low fasting plasma ascorbic acid concentrations, 0.21 and 0.34 mg per cent. The slowness with which their plasma concentrations increased even at the saturation level of ascorbic acid intake seemed to indicate prolonged ingestion of diets low in ascorbic acid prior to this study. This was confirmed by the subjects who stated that they did not eat breakfast and therefore did not have access to any fruit which might be served at that time. Neither of the boys allowed time for breakfast and although they both had good appetites, their preferences were for such foods as meat, potatoes, bread, and sweet rolls, rather than for fruits and vegetables. Throughout the saturation period their plasma values continued to rise so that the mean value for TC calculated on the data for eight days was 0.80 mg per cent but his mean value was 0.99 mg per cent when only the last five days were considered. For DE a similar difference in the mean was observed, i.e., 0.71 mg per cent on the data for eight days compared to 0.88 mg per cent on a basis of five days. (Table 9 in the Appendix.) From the plasma values of the last few days of this period it would appear that they were approaching saturation but we cannot say that they were definitely saturated.

When the intake of ascorbic acid was decreased to 100 mg in the second period, a significant lowering of the mean fasting plasma ascorbic acid occurred in all cases when calculated on the basis of

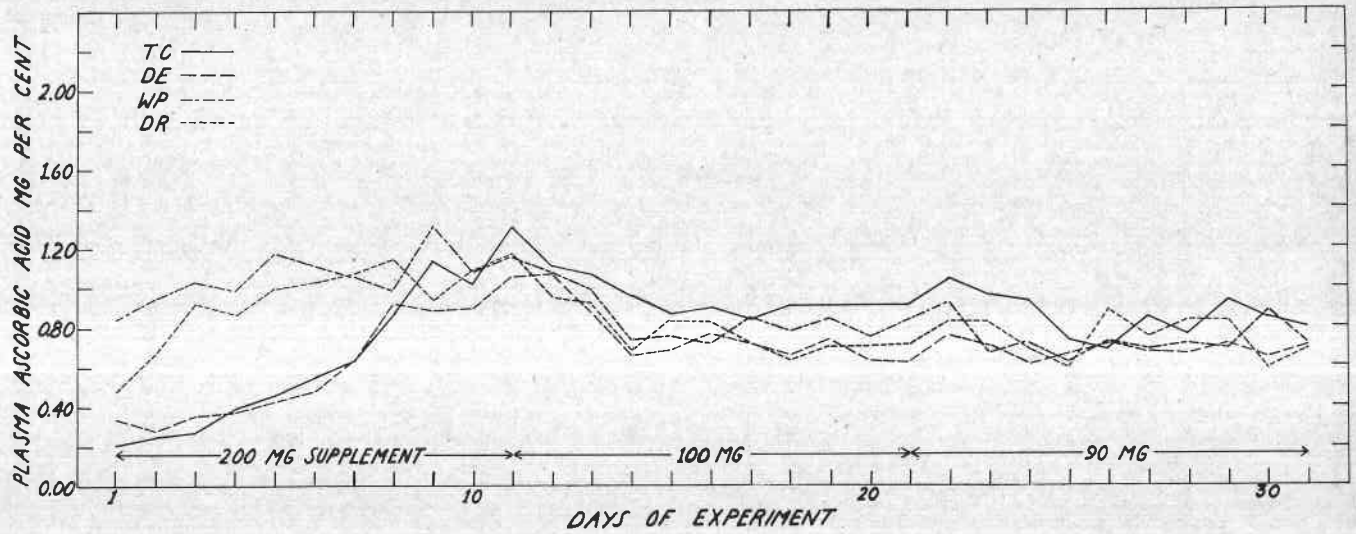


FIGURE 4. DAILY PLASMA ASCORBIC ACID VALUES OF THE BOYS, 1947-48.

the last five days of the experimental period. The means for this period were 0.90, 0.67, 0.81, and 0.69 mg per cent; the first two values are for the two subjects whose attainment of saturation was not convincing and the latter two from the two subjects who apparently were saturated in the previous period. Calculated on the basis of data from the last eight days of the period, only two of the subjects showed a significant decrease in the mean fasting plasma ascorbic acid content. The differences between the means of plasma ascorbic acid values were not significant for TC and DE, the two subjects who started the study with very low values. (Table 10 in the Appendix.)

A further decrease in the ascorbic acid intake to 90 mg made no significant difference in the mean fasting plasma ascorbic acid concentrations of all four subjects when calculated on the last five days of the experimental period. The calculations on the last eight days revealed inconsistent results, TC and WP showing a significant decrease between the means, whereas DE and DR did not. (Table 10 in the Appendix.) The mean plasma ascorbic acid values for the four subjects ranged from 0.68 to 0.84 mg per cent, with three of the four means below 0.80 mg per cent.

The mean plasma ascorbic acid values for all of the boys in the studies of both years, with the exclusion of JJ's values, showed a significant decrease between the saturation period and the period when 100 mg of ascorbic acid were ingested. For six of these seven subjects, a 90 mg intake of ascorbic acid was as effective as 100 mg in maintaining the plasma concentration of ascorbic acid under the conditions of this study. (Table 10 in the Appendix.)

In addition to the above-mentioned analysis of the results, the data of both years were also analyzed by analysis of variance (Snedecor, '46).[1] A statistically significant difference was found between the means of the saturation period and the period on the recommended allowance of the National Research Council, while the difference in the means between the period on the recommended allowance and the period of 10 mg less than this amount was not statistically significant for the boys but was significant for the girls as based on the analysis of variance (Tables 11 and 12 in the Appendix). It was interesting to note that although the girls were ingesting 20 mg of ascorbic acid less than the boys during comparable periods, they had significantly higher mean plasma ascorbic acid values than did the boys. (Table 13 in the Appendix.)

[1]The authors are indebted to Dr. J. C. R. Li, Associate Professor of Mathematics, Oregon State College, for assistance in the analysis of variance.

Comments:

The results of this study were similar to those found with the younger adolescent group previously studied in this laboratory, that is, the daily allowance of ascorbic acid recommended by the National Research Council did not maintain the plasma values as high as during the saturation period. For 21 of the 23 subjects, eight younger adolescents (Storvick, et al., 1947) and fifteen older adolescents of this present study, the National Research Council recommended allowance maintained mean plasma values above 0.80 mg per cent under the conditions of these studies. The two exceptions were older adolescent boys.

Table 3 shows the mean plasma ascorbic acid concentrations for each subject on various levels of intake, with the intake expressed in terms of mg of ascorbic acid per kg of body weight.

Table 3. MEAN CONCENTRATIONS OF PLASMA ASCORBIC ACID COMPARED WITH MILLIGRAMS OF REDUCED ASCORBIC ACID INGESTED PER KILOGRAM OF BODY WEIGHT.

Ascorbic acid intake per kilogram	Plasma ascorbic acid concentrations	
	Girls	Boys
	Milligrams per cent	*Milligrams per cent*
1.7 milligrams	.....	0.81
1.6 milligrams	1.07	.....
1.5 milligrams	0.99 0.96 0.83 0.90	0.74 ....
1.4 milligrams	0.97 1.04	0.91 0.82 0.90 0.69
1.3 milligrams	0.86 0.82 0.95	0.86 0.79 0.75 0.80 0.74
1.2 milligrams	0.80 0.92 0.98	0.84 0.90 0.67
1.1 milligrams	1.02 0.96	0.84 0.68
1.0 milligrams	0.99	.....

These plasma ascorbic acid concentrations seem to follow no particular pattern. They show the varying response of different individuals to the same levels of ascorbic acid intake.

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Appendix

Table 4. Reduced Ascorbic Acid Content of Foods Served at Snell Hall and the Memorial Union Cafeteria

Food	Ascorbic acid content				Total times served	Mean ascorbic acid content
	Snell Hall		Memorial Union			
	1946-47	1947-48	1946-47	1947-48		
	Milligrams per cent	*Milligrams per cent*	*Milligrams per cent*	*Milligrams per cent*		*Milligrams per cent*
Apple, baked	0.0	.....	0.0	.....		
	0.5	.....	0.0	.....		
	0.6	.....	0.0	.....		
Mean	0.4	.....	0.0	.....	6	0.2
Apple juice	0.4	1.1	0.0	0.1		
	.....	0.3	.....	0.8		
	.....	.....	.....	0.0		
	.....	.....	.....	0.0		
	.....	.....	.....	0.0		
	.....	.....	.....	0.0		
	.....	.....	.....	0.4		
	.....	.....	.....	0.5		
	.....	.....	.....	0.3		
Mean	0.4	0.7	0.0	0.2	13	0.3
Apple, raw	3.5	3.4	6.4	1.9		
	1.7	2.6	.....	.....		
	5.0	1.6	.....	.....		
	5.0	.....	.....	.....		
Mean	3.8	2.5	6.4	1.9	9	3.5
Apple sauce	0.0	0.5	0.0	.....		
	.....	0.0	0.0	.....		
	.....	0.0	.....	.....		
	.....	0.0	.....	.....		
	.....	0.0	.....	.....		
Mean	0.0	0.1	0.0	.....	8	0.1
Apricots, canned	3.0	4.5	2.0	5.2		
	2.0	3.1	5.5	4.2		
	2.0	2.6	0.8	3.6		
	2.6	3.6	.....	3.8		
	2.1	4.0	.....	5.0		
	0.0	.....	.....	6.6		
	2.2	.....	.....	6.9		
Mean	2.0	3.6	2.8	5.0	22	3.4
Apricot juice	3.6	2.5	0.6	6.9		
	1.5	3.2	.....	3.8		
	1.8	3.8	.....	5.7		
	1.8	.....	.....	.....		
	6.3	.....	.....	.....		
	3.6	.....	.....	.....		
Mean	3.1	3.2	0.6	5.5	13	3.5
Apricots dried, stewed	3.3	.....	.....	.....	1	3.3
Apricot juice, from dried stewed	3.3	.....	.....	.....	1	3.3
Apricot nectar	.....	1.6	.....	.....	1	1.6
Avocado	2.4	.....	.....	.....	1	2.4
Banana	5.5	8.2	9.4	8.6		
	12.4	9.2	.....	0.0		
	.....	.....	.....	8.1		
Mean	9.0	8.7	9.4	5.6	8	7.7

Table 4 (*Continued*). Reduced Ascorbic Acid Content of Foods Served at Snell Hall and the Memorial Union Cafeteria.

Food	Ascorbic acid content				Total times served	Mean ascorbic acid content
	Snell Hall		Memorial Union			
	1946-47	1947-48	1946-47	1947-48		
	Milligrams per cent	*Milligrams per cent*	*Milligrams per cent*	*Milligrams per cent*		*Milligrams per cent*
Cherries, red, canned	.....	.....	.....	0.0	1	0.0
Cherries, Royal Anne, pulp	2.4	.....	3.7	.....		
	0.4	.....	.....	.....		
	3.8	.....	.....	.....		
Mean	2.2	.....	3.7	.....	4	2.6
Cherries, Royal Anne, juice	4.3	.....	.....	.....		
	0.4	.....	.....	.....		
	2.6	.....	.....	.....		
Mean	2.4	.....	.....	.....	3	2.4
Dates	0.0	.....	.....	.....	1	0.0
Fruit cup	.....	3.2	2.4	2.9		
	.....	1.7	1.7	2.6		
	.....	4.3	2.1	.....		
	.....	3.7	.....	.....		
Mean	.....	3.2	2.1	2.8	9	2.7
Fruit cup, juice	.....	9.6	1.7	.....		
	.....	3.1	.....	.....		
	.....	3.8	.....	.....		
Mean	.....	5.5	1.7	.....	4	4.6
Fruit jello	.....	.....	.....	0.0		
	.....	.....	.....	3.9		
Mean	.....	.....	.....	2.0	2	2.0
Fruit juice mixture	19.6	9.7	.....	17.2		
	29.4	16.3	.....	13.6		
	28.3	.....	.....	.....		
Mean	25.8	13.0	.....	15.4	7	19.2
Grapefruit, fresh	49.4	.....	41.4	36.3		
	46.4	.....	48.9	21.0		
	.....	.....	42.0	20.2		
	.....	.....	50.8	.....		
Mean	47.9	.....	45.8	25.8	9	39.6
Grapefruit juice, fresh	.....	36.1	25.5	.....		
	.....	.....	27.6	.....		
Mean	.....	36.1	26.6	.....	3	29.7
Grape juice	0.0	0.0	0.0	0.0		
	.....	0.3	0.0	0.0		
	.....	.....	0.0	0.0		
	.....	.....	.....	0.0		
	.....	.....	.....	0.0		
Mean	0.0	0.2	0.0	0.0	11	0.0

Table 4 (*Continued*). Reduced Ascorbic Acid Content of Foods Served at Snell Hall and the Memorial Union Cafeteria.

Food	Ascorbic acid content				Total times served	Mean ascorbic acid content
	Snell Hall		Memorial Union			
	1946-47	1947-48	1946-47	1947-48		
	Milligrams per cent	*Milligrams per cent*	*Milligrams per cent*	*Milligrams per cent*		*Milligrams per cent*
Grape and apricot juice	.....	0.0	0.9	.....	2	0.5
Orange	69.2	.....	71.4	66.7		
	63.2	.....	56.5	58.8		
	.....	.....	52.1	52.1		
	.....	.....	47.2	.....		
	.....	.....	65.2	.....		
	.....	.....	89.0	.....		
Mean	66.2	.....	63.6	59.2	11	62.9
Orange juice, canned	.....	20.5	.....	.....	1	20.5
Orange juice, fresh	.....	47.9	.....	.....		
	.....	38.6	.....	.....		
	.....	33.7	.....	.....		
Mean	.....	40.1	.....	.....	3	40.1
Orange and grapefruit juice	.....	22.1	.....	.....	1	22.1
Peaches, canned	3.0	4.1	2.4	5.0		
	3.9	5.0	3.3	5.3		
	1.8	5.6	1.7	5.6		
	4.8	5.4	4.2	3.7		
	4.4	2.8	4.9	4.7		
	2.7	4.5	4.3	4.3		
	2.5	4.3	3.1	5.5		
	3.4	3.5	3.8	5.1		
	3.7	3.4	4.3	5.8		
	3.5	4.0	.....	2.1		
	1.6	.....	.....	3.1		
	4.3	.....	.....	.....		
	3.7	.....	.....	.....		
Mean	3.3	4.3	3.6	4.6	43	3.9
Peaches, canned, juice	3.1	2.6	.....	3.0		
	3.1	5.0	.....	.....		
	3.5	5.4	.....	.....		
	3.9	3.0	.....	.....		
	3.2	2.8	.....	.....		
	2.2	4.4	.....	.....		
	2.6	.....	.....	.....		
	4.1	.....	.....	.....		
	4.3	.....	.....	.....		
	3.9	.....	.....	.....		
	4.3	.....	.....	.....		
	4.0	.....	.....	.....		
Mean	3.5	3.9	.....	3.0	19	3.6
Peaches, frozen	3.0	.....	.....	.....	1	3.0
Pears, canned	0.0	1.5	1.2	1.0		
	0.6	1.2	1.0	0.7		
	1.2	0.6	0.0	0.4		
	1.0	2.3	0.0	1.8		
	1.0	.....	0.3	1.0		
	0.8	.....	0.0	2.8		
	1.0	.....	0.0	2.4		
	.....	.....	.....	1.0		
Mean	0.8	1.4	0.4	1.4	26	1.0

Table 4 (*Continued*). Reduced Ascorbic Acid Content of Foods Served at Snell Hall and the Memorial Union Cafeteria.

Food	Ascorbic acid content				Total times served	Mean ascorbic acid content
	Snell Hall		Memorial Union			
	1946-47	1947-48	1946-47	1947-48		
	Milligrams per cent	*Milligrams per cent*	*Milligrams per cent*	*Milligrams per cent*		*Milligrams per cent*
Pears, canned, juice	0.7	1.6	.....	.....		
	1.0	.....	.....	.....		
	0.7	.....	.....	.....		
	1.2	.....	.....	.....		
	1.1	.....	.....	.....		
Mean	0.9	1.6	.....	.....	6	1.1
Pears, fresh	.....	.....	.....	2.9		
	.....	.....	.....	1.4		
Mean	.....	.....	.....	2.2	2	2.2
Pineapple	8.3	5.2	6.6	4.7		
	8.0	5.5	4.8	5.0		
	6.5	4.9	6.0	7.6		
	5.7	6.3	7.8	5.8		
	5.4	.....	8.3	5.6		
	.....	.....	.....	6.2		
Mean	6.8	5.5	6.7	5.8	20	6.2
Prunes, canned	2.9	0.8	0.8	0.0		
	5.4	.....	1.4	0.0		
	2.4	.....	1.7	.....		
	2.8	.....	0.0	.....		
	3.4	.....	.....	.....		
	1.3	.....	.....	.....		
Mean	3.0	0.8	1.0	0.0	13	1.8
Prunes, canned, juice	1.9	1.0	1.5	0.1		
	1.0	.....	1.0	0.4		
	1.1	.....	.....	1.7		
	2.0	.....	.....	.....		
	1.2	.....	.....	.....		
	1.2	.....	.....	.....		
Mean	1.4	1.0	1.3	0.7	12	1.2
Prunes, dried stewed	0.0	3.1	0.8	2.0		
	0.2	2.4	1.7	3.0		
	.....	1.7	.....	1.7		
	.....	3.2	.....	1.2		
	.....	3.4	.....	2.3		
	.....	2.1	.....	.....		
	.....	3.7	.....	.....		
	.....	1.0	.....	.....		
Mean	0.1	2.6	1.3	2.0	17	2.0
Prunes, juice from dried stewed	0.0	1.3	.....	.....		
	0.0	0.3	.....	.....		
	.....	0.0	.....	.....		
	.....	1.2	.....	.....		
	.....	2.5	.....	.....		
	.....	1.0	.....	.....		
Mean	0.0	1.1	.....	.....	8	0.8
Raisins and nuts	.....	.....	0.0	.....	1	0.0

Table 4 (*Continued*). Reduced Ascorbic Acid Content of Foods Served at Snell Hall and the Memorial Union Cafeteria.

Food	Ascorbic acid content				Total times served	Mean ascorbic acid content
	Snell Hall		Memorial Union			
	1946-47	1947-48	1946-47	1947-48		
	Milligrams per cent	*Milligrams per cent*	*Milligrams per cent*	*Milligrams per cent*		*Milligrams per cent*
VEGETABLES						
Asparagus, canned	.....	16.6	.....	.....		
	.....	13.0	.....	.....		
Mean	.....	14.8	.....	.....	2	14.8
Beans, kidney, canned	.....	3.9	0.9	.....	2	2.4
Beans, string, canned	2.0	0.0	1.3	0.0		
	0.0	0.0	0.8	0.0		
	0.0	0.0	0.0	0.0		
	0.0	0.0	0.5	0.0		
	1.0	0.0	0.0	0.4		
	0.0	1.1	1.2	0.0		
	0.0	0.0	1.3	0.2		
	.....	0.0	0.0	0.0		
	.....	0.0	.....	0.0		
	.....	0.3	.....	0.0		
	.....	0.0	.....	0.4		
	.....	.....	.....	0.0		
Mean	0.4	0.1	0.6	0.1	38	0.3
Beets, canned	1.8	1.5	2.1	0.2		
	3.1	3.7	0.0	5.5		
	0.0	0.0	1.0	2.9		
	0.0	1.3	0.8	1.8		
	1.0	3.3	0.7	5.1		
	0.0	.....	0.0	3.3		
	.....	.....	0.0	0.5		
	.....	.....	1.7	5.5		
	.....	.....	.....	1.8		
	.....	.....	.....	0.0		
Mean	1.0	2.0	0.8	2.7	29	1.7
Beets, pickled	.....	0.7	.....	.....	1	0.7
Broccoli	1.9	54.5	.....	.....	2	28.2
Cabbage, cooked	.....	11.2	27.0	21.7		
	.....	.....	.....	28.2		
Mean	.....	11.2	27.0	25.0	4	22.0
Cabbage, raw	.....	70.8	.....	.....	1	70.8
Carrots, canned	.....	0.0	.....	.....	1	0.0
Carrots, cooked	0.3	1.2	0.0	0.0		
	0.6	0.0	0.0	2.4		
	0.0	3.3	0.0	3.1		
	0.0	.....	1.7	1.9		
	1.2	.....	0.0	3.3		
	.....	.....	0.8	3.7		
	.....	.....	0.4	.....		
	.....	.....	1.0	.....		
Mean	0.4	1.5	0.5	2.4	22	1.1
Carrots, raw	2.0	3.7	5.4	4.5		
	0.3	5.5	2.4	4.0		
	0.7	1.8	1.9	2.1		
	3.1	2.4	7.5	6.3		
	0.2	.....	4.8	.....		
	2.9	.....	3.7	.....		
	3.4	.....	.....	.....		
Mean	1.8	3.4	4.3	4.2	21	3.3

Table 4 (*Continued*). Reduced Ascorbic Acid Content of Foods Served at Snell Hall and the Memorial Union Cafeteria.

Food	Ascorbic acid content				Total times served	Mean ascorbic acid content
	Snell Hall		Memorial Union			
	1946-47	1947-48	1946-47	1947-48		
	Milligrams per cent	*Milligrams per cent*	*Milligrams per cent*	*Milligrams per cent*		*Milligrams per cent*
Carrots and peas	.....	1.6	0.0	1.6		
	.....	.....	0.0	.....		
Mean	.....	1.6	0.0	1.6	4	0.8
Cauliflower	61.4	.....	45.9	36.6	3	48.0
Celery, cooked	.....	.....	1.0	.....	1	1.0
Celery, raw	3.8	5.0	5.4	4.1		
	10.6	5.4	6.3	9.4		
	8.8	3.9	4.3	9.0		
	2.9	7.6	.....	4.8		
	9.8	6.6	.....	2.6		
	12.2	7.3	.....	5.8		
	15.7	10.6	.....	.....		
	9.0	9.1	.....	.....		
	6.5	6.9	.....	.....		
	6.4	.....	.....	.....		
Mean	8.6	6.9	5.3	6.0	28	7.1
Corn, canned	3.9	6.7	0.0	5.5		
	0.0	2.4	2.6	3.6		
	0.0	0.0	3.4	4.7		
	0.0	1.8	2.4	0.7		
	.....	1.3	1.1	4.4		
	.....	4.4	3.9	5.5		
	.....	0.0	4.2	.....		
	.....	0.8	3.4	.....		
	.....	.....	3.4	.....		
	.....	.....	4.0	.....		
Mean	1.0	2.2	2.8	4.1	28	2.6
Corn pudding	.....	2.1	.....	.....	1	2.1
Lettuce	3.0	1.0	1.5	2.1		
	2.5	1.7	5.5	1.6		
	2.3	1.1	0.2	3.1		
	1.9	0.6	0.0	0.0		
	0.6	1.1	0.0	0.0		
	1.6	0.5	1.7	2.0		
	2.1	0.0	1.7	1.8		
	2.0	3.6	0.3	0.0		
	2.1	1.5	0.0	0.0		
	2.8	0.7	0.0	0.2		
	1.8	1.1	2.4	0.2		
	0.5	0.4	0.8	0.2		
	3.6	0.7	1.4	1.8		
	.....	0.8	2.8	0.2		
	.....	1.8	2.1	1.3		
	.....	0.0	0.0	0.0		
	.....	0.7	3.6	0.5		
	.....	0.0	5.4	0.0		
	.....	.....	1.0	0.0		
	.....	.....	0.4	1.0		
	.....	.....	1.8	1.1		
	.....	.....	1.0	3.9		
	.....	.....	.....	0.0		
	.....	.....	.....	2.4		
	.....	.....	.....	0.5		
	.....	.....	.....	0.0		
	.....	.....	.....	0.0		
	.....	.....	.....	3.9		
	.....	.....	.....	0.3		
	.....	.....	.....	0.0		
	.....	.....	.....	2.3		
	.....	.....	.....	0.0		

Table 4 (*Continued*). Reduced Ascorbic Acid Content of Foods Served at Snell Hall and the Memorial Union Cafeteria.

Food	Ascorbic acid content				Total times served	Mean ascorbic acid content
	Snell Hall		Memorial Union			
	1946-47	1947-48	1946-47	1947-48		
	Milligrams per cent	*Milligrams per cent*	*Milligrams per cent*	*Milligrams per cent*		*Milligrams per cent*
	.....	.....	.....	2.8		
	.....	.....	.....	0.0		
	.....	.....	.....	1.0		
	.....	.....	.....	2.1		
	.....	.....	.....	4.1		
	.....	.....	.....	3.6		
	.....	.....	.....	1.8		
	.....	.....	.....	2.4		
	.....	.....	.....	1.6		
	.....	.....	.....	2.3		
	.....	.....	.....	1.6		
	.....	.....	.....	0.5		
	.....	.....	.....	2.1		
Mean	2.1	1.0	1.5	1.3	98	1.4
Peas, canned	4.6	6.7	2.2	1.6		
	1.5	0.0	7.0	0.0		
	4.4	0.0	2.6	0.0		
	7.6	0.0	4.8	5.5		
	5.0	0.0	4.9	4.6		
	5.2	5.8	7.5	0.5		
	6.7	.....	2.4	3.4		
	4.4	.....	1.9	5.1		
	6.3	.....	4.6	2.4		
	.....	.....	.....	2.0		
Mean	5.1	2.1	4.2	2.5	34	3.6
Peas, frozen	8.9	2.9	4.5	3.3		
	.....	2.8	2.4	2.0		
	.....	.....	2.4	9.8		
	.....	.....	2.7	.....		
	.....	.....	0.0	.....		
Mean	8.9	2.9	2.4	5.0	11	3.8
Potatoes, baked	11.4	.....	7.3	9.6	3	9.4
Potatoes, boiled	6.9	.....	4.1	.....		
	11.1	.....	1.8	.....		
	6.2	.....	.....	.....		
	8.3	.....	.....	.....		
	5.7	.....	.....	.....		
	7.8	.....	.....	.....		
Mean	7.7	.....	3.0	.....	8	6.5
Potatoes, browned	.....	.....	4.2	5.4	2	4.8
Potatoes, creamed	2.3	.....	0.2	0.7		
	.....	.....	4.7	4.9		
Mean	2.3	.....	2.5	2.8	5	2.6
Potatoes, escalloped	3.3	.....	.....	2.3	2	2.8
Potatoes, fried	3.8	.....	0.0	.....	2	1.9
Potatoes, mashed	4.9	8.0	2.0	1.1		
	0.0	6.5	0.0	0.0		
	2.1	12.9	0.0	1.5		
	4.1	10.4	1.6	0.0		
	.....	10.6	0.0	0.0		
	.....	8.5	1.1	0.0		
	.....	8.0	2.4	1.1		
	.....	0.0*	0.0	1.0		
	.....	4.6	0.8	0.0		

* Reheated.

Table 4 (*Continued*). Reduced Ascorbic Acid Content of Foods Served at Snell Hall and the Memorial Union Cafeteria.

Food	Ascorbic acid content				Total times served	Mean ascorbic acid content
	Snell Hall		Memorial Union			
	1946-47	1947-48	1946-47	1947-48		
	Milligrams per cent	*Milligrams per cent*	*Milligrams per cent*	*Milligrams per cent*		*Milligrams per cent*
	.....	4.9	0.5	1.6		
	.....	.....	0.0	0.0		
	.....	.....	0.0	0.5		
	.....	.....	0.8	0.0		
	.....	.....	.....	4.2		
	.....	.....	.....	4.2		
	.....	.....	.....	0.0		
	.....	.....	.....	3.4		
Mean	2.8	7.4	0.7	1.1	44	2.6
Potato patties	.....	.....	0.5	.....		
	.....	.....	0.0	.....		
Mean	.....	.....	0.3	.....	2	0.3
Potatoes, steamed	9.1	10.9	5.7	0.0		
	4.6	13.0	3.8	4.6		
	.....	.....	.....	2.8		
	.....	.....	.....	5.4		
Mean	6.9	12.0	4.8	3.2	10	6.0
Potatoes, sweet	14.5	33.0	20.0	15.6		
	.....	23.0	10.3	.....		
Mean	14.5	28.0	15.2	15.6	6	19.4
Radishes	.....	22.5	.....	.....	1	22.5
Spinach, canned	1.3	2.2	2.5	.....		
	1.8	.....	1.1	.....		
	0.9	.....	2.0	.....		
Mean	1.3	2.2	1.9	.....	7	1.7
Spinach, fresh	.....	11.6	.....	8.9	2	10.3
Squash	0.3	0.0	9.6	.....		
	2.9	.....	.....	.....		
	1.8	.....	.....	.....		
	12.5	.....	.....	.....		
Mean	4.4	0.0	9.6	.....	6	4.5
Succotash	.....	0.0	.....	.....	1	0.0
Tomato, fresh	.....	21.2	10.9	11.9		
	.....	21.0	17.6	9.8		
	.....	.....	9.6	12.9		
	.....	.....	26.6	13.8		
Mean	.....	21.1	16.2	12.1	10	15.5
Tomato juice	27.8	19.9	26.6	.....	3	24.8
Tomatoes, canned	.....	.....	20.7	7.7		
	.....	.....	21.0	.....		
Mean	.....	.....	20.9	7.7	3	16.5
Vegetables, mixed	.....	2.5	.....	0.0		
	.....	.....	.....	1.6		
	.....	.....	.....	0.4		
Mean	.....	2.5	.....	0.7	4	1.1

Table 4 (*Continued*). Reduced Ascorbic Acid Content of Foods Served at Snell Hall and the Memorial Union Cafeteria.

Food	Ascorbic acid content				Total times served	Mean ascorbic acid content
	Snell Hall		Memorial Union			
	1946-47	1947-48	1946-47	1947-48		
	Milligrams per cent	*Milligrams per cent*	*Milligrams per cent*	*Milligrams per cent*		*Milligrams per cent*
Meat Mixtures and Substitutes						
Beans, baked	.....	.....	1.0	0.0		
	.....	.....	0.0	2.6		
	.....	.....	.....	4.6		
Mean	.....	.....	0.5	2.4	5	1.6
Beans, Navy with tomato sauce	0.0	.....	2.4	.....	2	1.2
Beef hash	.....	0.0	0.0	0.0		
	.....	0.0	.....	.....		
Mean	.....	0.0	0.0	0.0	4	0.0
Beef with noodles	.....	0.0	.....	0.0	2	0.0
Beef stew	.....	7.5	3.0	0.0		
	.....	6.3	0.0	0.0		
	.....	1.6	2.5	0.0		
Mean	.....	5.1	1.8	0.0	9	2.3
Bread dressing	0.0	0.0	.....	.....		
	0.0	0.0	.....	.....		
	0.0	.....	.....	.....		
Mean	0.0	0.0	.....	.....	5	0.0
Chili	.....	.....	0.0	1.0	2	0.5
Eggs, scrambled	1.0	.....	0.0	.....		
	.....	.....	0.0	.....		
Mean	1.0	.....	0.0	.....	3	0.3
Ham, peas and corn	.....	0.0	.....	.....	1	0.0
Kidney beans with bacon	.....	.....	.....	0.7	1	0.7
Liver, fried	25.7	.....	.....	.....	1	25.7
Meat with corn	0.0	.....	.....	.....	1	0.0
Meat loaf with tomato	4.0	1.1	.....	.....		
	1.0	.....	.....	.....		
Mean	2.5	1.1	.....	.....	3	2.0
Meat pie	.....	.....	0.0	.....	1	0.0
Meat salad	1.1	.....	.....	.....		
	0.0	.....	.....	.....		
Mean	0.6	.....	.....	.....	2	0.6
Meat spread	0.0	.....	.....	.....	1	0.0
Rice and tomatoes	.....	1.4	.....	.....	1	1.4
Salmon loaf with lemon	0.0	.....	0.0	0.0	3	0.0
Spaghetti	0.0	.....	.....	1.2		
	.....	.....	.....	0.0		
Mean	0.0	.....	.....	0.6	3	0.4
Spaghetti with tomato	.....	.....	5.1	.....	1	5.1

Table 4 (*Continued*). Reduced Ascorbic Acid Content of Foods Served at Snell Hall and the Memorial Union Cafeteria.

Food	Ascorbic acid content				Total times served	Mean ascorbic acid content
	Snell Hall		Memorial Union			
	1946-47	1947-48	1946-47	1947-48		
	Milligrams per cent	*Milligrams per cent*	*Milligrams per cent*	*Milligrams per cent*		*Milligrams per cent*
Dairy Products						
Cheese, cottage	0.0	0.0	0.0	0.0		
	0.0	0.0	0.0	.....		
	0.0	0.3	0.0	.....		
	0.0	0.0	.....	.....		
Mean	0.0	0.1	0.0	0.0	12	0.0
Chocolate, hot	.....	0.0	.....	.....	1	0.0
Cocoa	0.0	.....	.....	.....		
	0.0	.....	.....	.....		
	0.0	.....	.....	.....		
Mean	0.0	.....	.....	.....	3	0.0
Cream	0.0	0.0	0.0	0.0		
	0.4	0.3	.....	0.0		
	0.0	0.0	.....	0.0		
	0.0	0.0	.....	0.0		
	0.6	0.0	.....	0.0		
	.....	0.0	.....	0.0		
	.....	0.0	.....	0.0		
	.....	0.0	.....	0.0		
	.....	0.3	.....	0.0		
	.....	.....	.....	0.0		
	.....	.....	.....	0.0		
	.....	.....	.....	0.0		
	.....	.....	.....	0.0		
	.....	.....	.....	0.0		
	.....	.....	.....	0.0		
	.....	.....	.....	0.0		
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	.....	.....	.....	0.0		
	.....	.....	.....	0.0		
	.....	.....	.....	0.0		
	.....	.....	.....	0.0		
	.....	.....	.....	0.0		
	.....	.....	.....	0.0		
	.....	.....	.....	0.0		
	.....	.....	.....	0.0		
	.....	.....	.....	0.0		
	.....	.....	.....	0.0		
Mean	0.2	0.1	0.0	0.0	45	0.0
Cream, whipped	0.0	0.1	0.0	0.1		
	0.6	.....	0.0	0.0		
	0.0	.....	.....	0.0		
	0.0	.....	.....	0.0		
	0.0	.....	.....	0.0		
	0.0	.....	.....	0.0		
	.....	.....	.....	0.0		
	.....	.....	.....	0.0		
Mean	0.1	0.1	0.0	0.0	17	0.0
Milk	0.0	0.0	0.0	0.0		
	0.5	0.4	1.0	0.0		
	1.0	0.0	0.0	0.0		
	1.2	0.4	0.1	0.0		
	0.6	0.0	1.3	0.0		
	0.0	0.0	0.0	0.0		
	0.8	0.0	0.0	0.1		

Table 4 (*Continued*). Reduced Ascorbic Acid Content of Foods Served at Snell Hall and the Memorial Union Cafeteria.

Food	Ascorbic acid content				Total times served	Mean ascorbic acid content
	Snell Hall		Memorial Union			
	1946-47	1947-48	1946-47	1947-48		
	Milligrams per cent	*Milligrams per cent*	*Milligrams per cent*	*Milligrams per cent*		*Milligrams per cent*
	0.2	0.1	0.1	0.0		
	0.0	0.0	0.5	0.0		
	0.9	0.3	1.0	0.0		
	0.4	0.9	0.4	0.0		
	0.6	0.0	0.0	0.0		
	0.8	0.5	0.4	0.0		
	0.4	0.0	0.0	0.0		
	0.0	0.1	0.0	0.0		
	0.0	0.0	0.4	0.0		
	0.3	0.4	0.1	0.0		
	0.3	0.0	0.0	0.0		
	0.3	0.4	0.9	0.0		
	0.0	0.0	0.0	0.0		
	0.0	0.5	0.0	0.0		
	1.0	0.0	0.4	0.0		
	0.1	0.0	0.0	0.0		
	0.7	0.3	0.7	0.0		
	1.0	0.9	0.0	0.0		
	1.0	0.1	0.1	0.0		
	0.7	0.9	0.5	0.0		
	0.4	0.2	0.0	0.0		
	.....	0.9	0.0	0.0		
	.....	0.4	.....	0.0		
Mean	0.5	0.3	0.3	0.0	117	0.2
Desserts						
Apple crisp	0.0	.....	.....	.....	1	0.0
Cake with orange glaze	.....	.....	3.6	.....	1	3.6
Cherry cobbler	0.0	.....	.....	0.0	2	0.0
Cherry roll	.....	0.0	.....	.....	1	0.0
Custard, baked	0.0	.....	.....	.....	1	0.0
Custard, pumpkin	.....	.....	.....	0.0	1	0.0
Date torte	.....	0.0	.....	.....	1	0.0
Ice cream:						
Apricot	0.0	.....	.....	.....	1	0.0
Berry	.....	0.4	.....	.....	1	0.4
Butterscotch ribbon	.....	.....	.....	0.0	1	0.0
Caramel ribbon	.....	.....	.....	0.0	1	0.0
Chocolate	0.4	0.7	.....	0.0		
	.....	0.0	.....	.....		
	.....	0.3	.....	.....		
	.....	0.0	.....	.....		
Mean	0.4	0.3	.....	0.0	6	0.2
Chocolate ribbon	.....	.....	0.0	0.0		
	.....	.....	0.0	0.0		
	.....	.....	0.3	0.0		
	.....	.....	0.0	.....		
	.....	.....	0.0	.....		
	.....	.....	0.0	.....		
	.....	.....	0.0	.....		
Mean	.....	.....	0.0	0.0	10	0.0
Peppermint	0.5	.....	.....	.....	1	0.5
Raspberry ripple	.....	.....	0.3	.....		
	.....	.....	0.0	.....		
	.....	.....	0.0	.....		
	.....	.....	0.0	.....		
Mean	.....	.....	0.1	.....	4	0.1

Table 4 (*Continued*). Reduced Ascorbic Acid Content of Foods Served at Snell Hall and the Memorial Union Cafeteria.

Food	Ascorbic acid content				Total times served	Mean ascorbic acid content
	Snell Hall		Memorial Union			
	1946-47	1947-48	1946-47	1947-48		
	Milligrams per cent	*Milligrams per cent*	*Milligrams per cent*	*Milligrams per cent*		*Milligrams per cent*
Strawberry	.....	0.1	.....	.....	1	0.1
Vanilla	0.4	0.6	0.0	0.0		
	0.6	0.0	.....	0.0		
	0.0	0.4	.....	0.0		
	0.0	0.8	.....	0.0		
	0.0	0.5	.....	0.0		
	0.0	0.7	.....	.....		
	0.0	0.0	.....	.....		
	1.0	.....	.....	.....		
Mean	0.3	0.4	0.0	0.0	21	0.2
Jello with apricots	.....	1.7	.....	.....	1	1.7
with bananas	.....	.....	1.7	.....	1	1.7
with blackberries	2.3	.....	.....	.....	1	2.3
with mixed fruit	.....	0.0	.....	3.0		
	.....	.....	.....	3.7		
Mean	.....	0.0	.....	3.4	3	2.2
with oranges	12.2	.....	.....	.....	1	12.2
with pear and peach	.....	1.7	.....	.....	1	1.7
with peaches	.....	.....	1.6	.....	1	1.6
with pears	.....	1.4	.....	.....		
	.....	1.2	.....	.....		
Mean	.....	1.3	.....	.....	2	1.3
with pineapple	.....	.....	3.4	.....		
	.....	.....	2.2	.....		
	.....	.....	2.4	.....		
Mean	.....	.....	2.7	.....	3	2.7
with strawberry, and pineapple	.....	.....	.....	2.3	1	2.3
Peach crisp	2.0	.....	.....	.....	1	2.0
Peach cobbler	0.0	.....	.....	.....	1	0.0
Pie filling, apple	.....	0.0	0.0	0.0		
	.....	0.0	0.0	.....		
	.....	.....	1.0	.....		
Mean	.....	0.0	0.3	0.0	6	0.2
Apricot	.....	.....	2.5	.....	1	2.5
Banana cream	.....	.....	.....	0.0	1	0.0
Cherry	.....	.....	.....	0.0	1	0.0
Mince	.....	.....	0.9	.....	1	0.9
Peach	.....	.....	.....	2.3	1	2.3
Pumpkin	.....	.....	0.2	.....		
	.....	.....	0.0	.....		
Mean	.....	.....	0.1	.....	2	0.1
Pudding, banana	.....	.....	.....	0.0	1	0.0
Banana butterscotch	.....	.....	.....	0.0	1	0.0
Blanc Mange	1.7	.....	0.0	.....		
	.....	.....	0.0	.....		
Mean	1.7	.....	0.0	.....	3	0.6

Table 4 (*Continued*). Reduced Ascorbic Acid Content of Foods Served at Snell Hall and the Memorial Union Cafeteria.

Food	Ascorbic acid content				Total times served	Mean ascorbic acid content
	Snell Hall		Memorial Union			
	1946-47	1947-48	1946-47	1947-48		
	Milligrams per cent	*Milligrams per cent*	*Milligrams per cent*	*Milligrams per cent*		*Milligrams per cent*
Butterscotch	.....	.....	.....	0.0	1	0.0
Chocolate	0.0	.....	2.3	.....		
	0.0	.....	0.4	.....		
Mean	0.0	.....	1.4	.....	4	0.7
Rice with raisins	.....	.....	.....	0.0	1	0.0
Pineapple upside down cake	1.3	.....	.....	0.0	2	0.7
Washington cream pie	.....	.....	.....	0.0		
	.....	.....	.....	0.0		
Mean	.....	.....	.....	0.0	2	0.0
Soups:						
Clam chowder	.....	.....	1.6	.....		
	.....	.....	1.2	.....		
Mean	.....	.....	1.4	.....	2	1.4
Split pea	.....	.....	.....	1.5	1	1.5
Split pea with ham	.....	1.4	.....	.....		
	.....	0.3	.....	.....		
Mean	.....	0.9	.....	.....	2	0.9
Turkey noodle	0.0	.....	.....	.....		
	0.0	.....	.....	.....		
Mean	0.0	.....	.....	.....	2	0.0
Vegetable	0.0	1.2	0.0	.....		
	0.2	3.4	2.0	.....		
	1.0	0.8	5.1	.....		
Mean	0.4	1.8	2.4	.....	9	1.5
Salads:						
Apple	4.0	3.3	3.0	1.6		
	2.2	5.1	1.3	2.3		
	.....	.....	4.1	0.5		
	.....	.....	3.5	2.3		
Mean	3.1	4.2	3.0	1.7	12	2.8
Cabbage slaw	32.9	34.8	.....	54.4	3	40.7
Carrot and celery	.....	2.4	.....	.....	1	2.4
Carrot and date	0.0	.....	.....	.....	1	0.0
Carrot and raisin	.....	1.2	.....	.....		
	.....	0.5	.....	.....		
Mean	.....	0.9	.....	.....	2	0.9
Carrot, string bean, and asparagus	.....	.....	.....	1.0	1	1.0
Fruit, mixed	1.8	.....	.....	.....		
	3.3	.....	.....	.....		
Mean	2.6	.....	.....	.....	2	2.6

Table 4 (*Continued*). Reduced Ascorbic Acid Content of Foods Served at Snell Hall and the Memorial Union Cafeteria.

Food	Ascorbic acid content				Total times served	Mean ascorbic acid content
	Snell Hall		Memorial Union			
	1946-47	1947-48	1946-47	1947-48		
	Milligrams per cent	*Milligrams per cent*	*Milligrams per cent*	*Milligrams per cent*		*Milligrams per cent*
Gelatin with cottage cheese	.....	0.0	.....	.....	1	0.0
Gelatin with fruit, mixed	.....	1.4	.....	.....	1	1.4
Gelatin with pineapple	.....	.....	3.0	.....	1	3.0
Gelatin with pineapple and carrot	.....	0.0	.....	.....	1	0.0
Gelatin with vegetable	1.3	.....	.....	.....		
	1.2	.....	.....	.....		
Mean	1.3	.....	.....	.....	2	1.3
Halibut, egg, and celery	.....	1.7	.....	.....	1	1.7
Ham	.....	0.0	.....	.....	1	0.0
Macaroni	.....	0.2	.....	1.0	2	0.6
Potato	.....	5.7	0.0	0.0	3	1.9
Turkey	.....	1.5	.....	.....		
	.....	0.8	.....	.....		
Mean	.....	1.2	.....	.....	2	1.2
Vegetable and chicken	.....	0.9	.....	.....	1	0.9
Vegetable, mixed	7.4	0.0	22.4	30.8		
	10.7	2.9	17.4	.....		
	0.8	0.5	31.4	.....		
	0.2	4.7	28.8	.....		
	1.7	.....	18.8	.....		
	6.5	.....	37.6	.....		
	1.0	.....	25.7	.....		
	1.0	.....	.....	.....		
	0.0	.....	.....	.....		
	3.1	.....	.....	.....		
Mean	3.2	2.0	26.0	30.8	22	11.5
Waldorf	.....	1.6	.....	.....	1	1.6
Pickles, Relishes, Dressings:						
Catsup	14.9	.....	20.7	15.6		
	.....	.....	21.5	.....		
	.....	.....	25.6	.....		
Mean	14.9	.....	22.6	15.6	5	19.7
French dressing	.....	.....	.....	0.0		
	.....	.....	.....	0.1		
	.....	.....	.....	0.0		
	.....	.....	.....	0.8		
	.....	.....	.....	0.0		
Mean	.....	.....	.....	0.2	5	0.2
Maple syrup	.....	0.0	.....	.....	1	0.0
Mayonnaise with parsley	.....	.....	0.0	.....	1	0.0
Mustard	.....	.....	2.4	3.5	2	3.0
Mustard with horseradish	.....	4.3	.....	.....	1	4.3
Olives, stuffed	0.0	.....	.....	.....		
	0.0	.....	.....	.....		
	0.0	.....	.....	.....		
Mean	0.0	.....	.....	.....	3	0.0

Table 4 (*Continued*). Reduced Ascorbic Acid Content of Foods Served at Snell Hall and the Memorial Union Cafeteria.

Food	Ascorbic acid content				Total times served	Mean ascorbic acid content
	Snell Hall		Memorial Union			
	1946-47	1947-48	1946-47	1947-48		
	Milligrams per cent	*Milligrams per cent*	*Milligrams per cent*	*Milligrams per cent*		*Milligrams per cent*
Potato chips	32.4	.....	24.1	.....	2	28.3
Pickles, sweet	.....	0.0	0.0	0.0		
	.....	0.0	0.3	.....		
	.....	0.0	.....	.....		
Mean	.....	0.0	0.2	0.0	6	0.0
Salad dressing	0.9	0.4	.....	0.0		
	0.2	0.0	.....	4.2		
	3.7	.....	.....	1.7		
	2.6	.....	.....	.....		
Mean	1.9	0.2	.....	2.0	9	1.5
Tartar sauce	.....	.....	0.4	0.0	2	0.2
Tomato sauce	.....	9.8	.....	16.8	2	13.3
Topping (for ice cream, etc.) apricot	.....	2.8	.....	.....		
	.....	2.1	.....	.....		
Mean	.....	2.5	.....	.....	2	2.5
Cherry	.....	1.5	.....	.....	1	1.5
Chocolate	3.4	.....	.....	.....	1	3.4
Marshmallow	.....	0.0	.....	.....		
	.....	0.0	.....	.....		
Mean	.....	0.0	.....	.....	2	0.0
Marshmallow with apple	.....	0.6	.....	.....	1	0.6
White sauce	.....	.....	0.0	.....	1	0.0
Jams and Spreads:						
Jam, apricot	.....	0.7	1.0	0.0		
	.....	0.3	0.9	0.6		
	.....	0.4	0.4	.....		
	.....	0.7	.....	.....		
	.....	0.2	.....	.....		
Mean	.....	0.5	0.8	0.3	10	0.5
Apricot-pineapple	.....	2.3	.....	0.0		
	.....	0.7	.....	0.0		
	.....	0.4	.....	0.2		
	.....	0.5	.....	0.6		
	.....	0.7	.....	0.0		
	.....	0.9	.....	.....		
	.....	0.9	.....	.....		
	.....	0.4	.....	.....		
	.....	0.0	.....	.....		
	.....	0.1	.....	.....		
	.....	0.4	.....	.....		
Mean	.....	0.7	.....	0.2	16	0.5
Berry	1.0	.....	2.2	2.7		
	1.3	.....	2.5	3.9		
	0.5	.....	1.3	2.0		
	1.0	.....	4.7	2.4		
	.....	.....	6.1	2.3		
	.....	.....	1.8	0.4		
	.....	.....	2.5	1.4		
Mean	1.0	.....	3.0	2.2	18	2.2

Table 4 (*Continued*). Reduced Ascorbic Acid Content of Foods Served at Snell Hall and the Memorial Union Cafeteria.

Food	Ascorbic acid content				Total times served	Mean ascorbic acid content
	Snell Hall		Memorial Union			
	1946-47	1947-48	1946-47	1947-48		
	Milligrams per cent	*Milligrams per cent*	*Milligrams per cent*	*Milligrams per cent*		*Milligrams per cent*
Berry and apple	.....	.....	.....	0.0	1	0.0
Grape	.....	.....	.....	1.1		
	.....	.....	.....	1.2		
	.....	.....	.....	1.0		
	.....	.....	.....	0.0		
	.....	.....	.....	0.8		
Mean	.....	.....	.....	0.8	5	0.8
Loganberry	.....	.....	.....	2.2	1	2.2
Peach	.....	.....	.....	0.1		
	.....	.....	.....	0.0		
	.....	.....	.....	0.7		
Mean	.....	.....	.....	0.3	3	0.3
Peach and apricot	.....	.....	.....	0.1	1	0.1
Red raspberry	6.2	.....	.....	.....	1	6.2
Honey	0.0	.....	.....	.....		
	1.0	.....	.....	.....		
Mean	0.5	.....	.....	.....	2	0.5
Peach butter	1.1	.....	.....	.....		
	1.0	.....	.....	.....		
Mean	1.1	.....	.....	.....	2	1.1
Peanut butter	.....	4.6	.....	0.0	2	2.3
Peanut butter with apricot jam	.....	3.7	.....	.....	1	3.7

Table 5. Reduced Ascorbic Acid Content of Food Served at Oregon State College Dining Halls.

(Average ascorbic acid as milligrams per 100 grams.)

Food	Snell Hall		Memorial Union	
	1946-47	1947-48	1946-47	1947-48
	Milligrams per cent	*Milligrams per cent*	*Milligrams per cent*	*Milligrams per cent*
FRUITS:				
Apple, baked	0.4 (3)*	.....	0.0 (3)	.....
Apple juice	0.4 (1)	0.7 (2)	0.0 (1)	0.2 (9)
Apple, raw	3.8 (4)	2.5 (3)	6.4 (1)	1.9 (1)
Applesauce	0.0 (1)	0.1 (5)	0.0 (2)	.....
Apricots, canned	2.0 (7)	3.6 (5)	2.8 (3)	5.0 (7)
juice	3.1 (6)	3.2 (3)	0.6 (1)	5.5 (3)
dried, stewed	3.3 (1)	.....	.....	.....
juice from dried, stewed	3.3 (1)	.....	.....	.....
Apricot nectar	.....	1.6 (1)	.....	.....
Avocado	2.4 (1)	.....	.....	.....
Banana	9.0 (2)	8.7 (2)	9.4 (1)	5.6 (3)
Cherries, red canned	.....	.....	.....	0.0 (1)
Royal Anne	2.2 (3)	.....	3.7 (1)	.....
Royal Anne, juice	2.4 (3)	.....	.....	.....
Dates	0.0 (1)	.....	.....	.....
Fruit cup	.....	3.2 (4)	2.1 (3)	2.8 (2)
Fruit cup, juice	.....	5.5 (3)	1.7 (1)	.....
Fruit jello	.....	.....	.....	2.0 (1)
Fruit juice mixture	25.8 (3)	13.0 (2)	.....	15.4 (2)
Grapefruit, fresh	47.9 (2)	.....	45.8 (4)	25.8 (3)
juice	.....	36.1 (1)	26.6 (2)	.....
Grape juice	0.0 (1)	0.2 (2)	0.0 (3)	0.0 (5)
Grape and apricot juice	.....	0.0 (1)	0.9 (1)	.....
Orange	66.2 (2)	.....	63.6 (6)	59.2 (3)
Orange juice canned	.....	20.5 (1)	.....	.....
Orange juice fresh	.....	40.1 (3)	.....	.....
Orange and grapefruit juice	.....	22.1 (1)	.....	.....
Peaches, canned	3.3 (13)	4.3 (10)	3.6 (9)	4.6 (11)
juice	3.5 (12)	3.9 (6)	.....	3.0 (1)
frozen	3.0 (1)	.....	.....	.....
Pears, canned	0.8 (7)	1.4 (4)	0.4 (7)	1.4 (8)
juice	0.9 (5)	1.6 (1)	.....	.....
fresh	.....	.....	.....	2.2 (2)
Pineapple, canned	6.8 (5)	5.5 (4)	6.7 (5)	5.8 (6)
Prunes, canned	3.0 (6)	0.8 (1)	1.0 (4)	0.0 (2)
juice	1.4 (6)	1.0 (1)	1.3 (2)	0.7 (3)
dried, stewed	0.1 (2)	2.6 (8)	1.3 (2)	2.0 (5)
juice from dried, stewed	0.0 (2)	1.1 (6)	.....	.....
Raisins and nuts	.....	.....	0.0 (1)	.....
VEGETABLES:				
Asparagus, canned	.....	14.8 (2)	.....	.....
Beans, canned kidney	.....	3.9 (1)	0.9 (1)	.....
Beans, canned string	0.4 (7)	0.1 (11)	0.6 (8)	0.1 (12)
Beets, canned	1.0 (6)	2.0 (5)	0.8 (8)	2.7 (10)
pickled	.....	0.7 (1)	.....	.....
Broccoli, fresh	1.9 (1)	54.5 (1)	.....	.....
Cabbage, cooked	.....	11.2 (1)	27.0 (1)	25.0 (2)
raw	.....	70.8 (1)	.....	.....
Carrots, canned	.....	0.0 (1)	.....	.....
cooked	0.4 (5)	1.5 (3)	0.5 (8)	2.4 (6)
raw	1.8 (7)	3.4 (4)	4.3 (6)	4.2 (4)
Carrots and peas	.....	1.6 (1)	0.0 (2)	1.6 (1)
Cauliflower	61.4 (1)	.....	45.9 (1)	36.6 (1)
Celery, cooked	.....	.....	1.0 (1)	.....
raw	8.6 (10)	6.9 (9)	5.3 (3)	6.0 (6)
Corn, canned	1.0 (4)	2.2 (8)	2.8 (10)	4.1 (6)
Corn pudding	.....	2.1 (1)	.....	.....
Lettuce	2.1 (13)	1.0 (18)	1.5 (22)	1.3 (45)
Peas, canned	5.1 (9)	2.1 (6)	4.2 (9)	2.5 (10)
frozen	8.9 (1)	2.9 (2)	2.4 (5)	5.0 (3)
Potatoes, Irish cooked	5.7 (16)	8.2 (12)	1.7 (24)	2.1 (26)
sweet	14.5 (1)	28.0 (2)	15.2 (2)	15.6 (1)
Radishes	.....	22.5 (1)	.....	.....
Spinach, canned	1.3 (3)	2.2 (1)	1.9 (3)	.....
fresh	.....	11.6 (1)	.....	8.9 (1)
Squash	4.4 (4)	0.0 (1)	9.6 (1)	.....
Succotash	.....	0.0 (1)	.....	.....
Tomato, canned	.....	.....	20.9 (2)	7.7 (1)
fresh	.....	21.1 (2)	16.2 (4)	12.1 (4)
juice	27.8 (1)	19.9 (1)	26.6 (1)	.....
Vegetables, mixed	.....	2.5 (1)	.....	0.7 (3)

* The figures in the parentheses indicate the number of times the food was served and analyzed.

Table 5 (*Continued*). Reduced Ascorbic Acid Content of Food Served at Oregon State College Dining Halls.

(Average ascorbic acid as milligrams per 100 grams.)

Food	Snell Hall		Memorial Union	
	1946-47	1947-48	1946-47	1947-48
	Milligrams per cent	*Milligrams per cent*	*Milligrams per cent*	*Milligrams per cent*
Meat Mixtures and Substitutes:				
Baked beans	.....	.....	0.5 (2)*	2.4 (3)
Baked beans with tomato sauce	0.0 (1)	.....	2.4 (1)	.....
Beef hash	.....	0.0 (2)	0.0 (1)	0.0 (1)
Beef with noodles	.....	0.0 (1)	.....	0.0 (1)
Beef stew	.....	5.1 (3)	1.8 (3)	0.0 (3)
Bread dressing	0.0 (3)	0.0 (2)	.....	.....
Chili, canned	.....	.....	0.0 (1)	1.0 (1)
Eggs, scrambled	1.0 (1)	.....	0.0 (2)	.....
Ham, peas and corn	.....	0.0 (1)	.....	.....
Kidney beans with bacon	.....	.....	.....	0.7 (1)
Liver, fried	25.7 (1)	.....	.....	.....
Meat with corn	0.0 (1)	.....	.....	.....
Meat loaf	2.5 (2)	1.1 (1)	.....	.....
Meat pie	.....	.....	0.0 (1)	.....
Meat salad	0.6 (2)	.....	.....	.....
Meat spread	0.0 (1)	.....	.....	.....
Rice and tomatoes	.....	1.4 (1)	.....	.....
Salmon loaf	0.0 (1)	.....	0.0 (1)	0.0 (1)
Spaghetti	0.0 (1)	.....	.....	0.6 (2)
Spaghetti with tomato	.....	.....	5.1 (1)	.....
Dairy Products:				
Cheese, cottage	0.0 (4)	0.1 (4)	0.0 (3)	0.0 (1)
Chocolate, hot	.....	0.0 (1)	.....	.....
Cocoa	0.0 (3)	.....	.....	.....
Cream	0.2 (5)	0.1 (9)	0.0 (1)	0.0 (30)
Cream, whipped	0.1 (6)	0.1 (1)	0.0 (2)	0.0 (8)
Milk	0.5 (28)	0.3 (30)	0.3 (29)	0.0 (30)
Desserts:				
Apple crisp	0.0 (1)	.....	.....	.....
Cake, white with orange glaze	.....	.....	3.6 (1)	.....
Cherry cobbler	0.0 (1)	.....	.....	0.0 (1)
Cherry roll	.....	0.0 (1)	.....	.....
Custard, baked	0.0 (1)	.....	.....	.....
pumpkin	.....	.....	.....	0.0 (1)
Date torte	.....	0.0 (1)	.....	.....
Peach crisp	2.0 (1)	.....	.....	.....
Peach cobbler	0.0 (1)	.....	.....	.....
Ice cream:				
Apricot	0.0 (1)	.....	.....	.....
Berry	.....	0.4 (1)	.....	.....
Butterscotch ribbon	.....	.....	.....	0.0 (1)
Caramel ribbon	.....	.....	.....	0.0 (1)
Chocolate	0.4 (1)	0.3 (4)	.....	0.0 (1)
Chocolate ribbon	.....	.....	0.0 (7)	0.0 (3)
Peppermint	0.5 (1)	.....	.....	.....
Raspberry ribbon	.....	.....	0.1 (4)	.....
Strawberry	.....	0.1 (1)	.....	.....
Vanilla	0.3 (8)	0.4 (7)	0.0 (1)	0.0 (5)
Jello:				
with apricots	.....	1.7 (1)	.....	.....
with bananas	.....	.....	1.7 (1)	.....
with blackberries	2.3 (1)	.....	.....	.....
with mixed fruit	.....	0.0 (1)	.....	3.4 (2)
with oranges	12.2 (1)	.....	.....	.....
with peach and pear	.....	1.7 (1)	.....	.....
with peaches	.....	.....	1.6 (1)	.....
with pears	.....	1.3 (2)	.....	.....
with pineapple	.....	.....	2.7 (3)	2.3 (1)
Pie filling:				
Apple	.....	0.0 (2)	0.3 (3)	0.0 (1)
Apricot	.....	.....	2.5 (1)	.....
Banana cream	.....	.....	.....	0.0 (1)
Cherry	.....	.....	.....	0.0 (1)
Mince	.....	.....	0.9 (1)	.....
Peach	.....	.....	.....	2.3 (1)
Pumpkin	.....	.....	0.1 (2)	.....

* The figures in the parentheses indicate the number of times the food was served and analyzed.

Table 5 (*Continued*). Reduced Ascorbic Acid Content of Food Served at Oregon State College Dining Halls.
(Average ascorbic acid as milligrams per 100 grams.)

Food	Snell Hall		Memorial Union	
	1946-47	1947-48	1946-47	1947-48
	Milligrams per cent	*Milligrams per cent*	*Milligrams per cent*	*Milligrams per cent*
Puddings:				
Banana	.....	.....	.....	0.0 (1)*
Banana-butterscotch	.....	.....	.....	0.0 (1)
Blanc mange	1.7 (1)	.....	0.0 (2)	.....
Butterscotch	.....	.....	.....	0.0 (1)
Chocolate	0.0 (2)	.....	1.4 (2)	.....
Rice with raisins	.....	.....	.....	0.0 (1)
Pineapple upside down cake	1.3 (1)	.....	.....	0.0 (1)
Washington cream pie	.....	.....	.....	0.0 (2)
Soups:				
Clam chowder	.....	.....	1.4 (2)	.....
Split pea	.....	0.9 (2)	.....	1.5 (1)
Turkey noodle	0.0 (2)	.....	.....	.....
Vegetable	0.4 (3)	1.8 (3)	2.4 (3)	.....
Salads:				
Apple	3.1 (2)	4.2 (2)	3.0 (4)	1.7 (4)
Cabbage slaw	32.9 (1)	34.8 (1)	.....	54.4 (1)
Carrot and celery	.....	2.4 (1)	.....	.....
Carrot and date	0.0 (1)	.....	.....	.....
Carrot and raisin	.....	0.9 (2)	.....	.....
Carrot, string bean and asparagus	.....	.....	.....	1.0 (1)
Fruit, mixed	2.6 (2)	.....	.....	.....
Gelatin-cottage cheese	.....	0.0 (1)	.....	.....
Gelatin-fruit mixed	.....	1.4 (1)	.....	.....
Gelatin-pineapple	.....	.....	3.0 (1)	.....
Gelatin-pineapple and carrot	.....	0.0 (1)	.....	.....
Gelatin-vegetable	1.3 (2)	.....	.....	.....
Halibut, egg, and celery	.....	1.7 (1)	.....	.....
Ham	.....	0.0 (1)	.....	.....
Macaroni	.....	0.2 (1)	.....	1.0 (1)
Potato	.....	5.7 (1)	0.0 (1)	0.0 (1)
Turkey	.....	1.2 (2)	.....	.....
Vegetable and chicken	.....	0.9 (1)	.....	.....
Vegetable, mixed	3.2 (10)	2.0 (4)	26.0 (7)	30.8 (1)
Waldorf	.....	1.6 (1)	.....	.....
Pickles, Relishes, and Dressings, Etc.:				
Catsup	14.9 (1)	.....	22.6 (3)	15.6 (1)
French dressing	.....	.....	.....	0.2 (5)
Maple syrup	.....	0.0 (1)	.....	.....
Mayonnaise with parsley	.....	.....	0.0 (1)	.....
Mustard	.....	.....	2.4 (1)	3.5 (1)
Mustard and horseradish	.....	4.3 (1)	.....	.....
Olives stuffed	0.0 (3)	.....	.....	.....
Potato chips	32.4 (1)	.....	24.1 (1)	.....
Pickles, sweet	.....	0.0 (3)	0.2 (2)	0.0 (1)
Salad dressing	1.9 (4)	0.2 (2)	.....	2.0 (3)
Tartar sauce	.....	.....	0.4 (1)	0.0 (1)
Tomato sauce	.....	9.8 (1)	.....	16.8 (1)
Toppings (for ice cream, etc.)				
Apricot	.....	2.5 (2)	.....	.....
Cherry	.....	1.5 (1)	.....	.....
Chocolate	3.4 (1)	.....	.....	.....
Marshmallow	.....	0.0 (2)	.....	.....
Marshmallow with apples	.....	0.6 (1)	.....	.....
Jams and Spreads:				
Jam, apricot	.....	0.5 (5)	0.8 (3)	0.3 (2)
apricot and pineapple	.....	0.7 (11)	.....	0.2 (5)
berry	1.0 (4)	.....	3.0 (7)	2.2 (7)
berry and apple	.....	.....	.....	0.0 (1)
grape	.....	.....	.....	0.8 (5)
loganberry	.....	.....	.....	2.2 (1)
peach	.....	.....	.....	0.3 (3)
peach-apricot	.....	.....	.....	0.1 (1)
red raspberry	6.2 (1)	.....	.....	.....
Honey	0.5 (2)	.....	.....	.....
Peach butter	1.1 (2)	.....	.....	.....
Peanut butter	.....	4.6 (1)	.....	0.0 (1)
Peanut butter and apricot jam	.....	3.7 (1)	.....	.....

* The figures in the parentheses indicate the number of times the food was served and analyzed.

Table 6. Total Daily Intake of Reduced Ascorbic Acid and Daily Plasma Ascorbic Acid Values for Adolescent Girls During Four Consecutive Experimental Periods in 1946-47.
Subjects M.G., W.H., B.R., P.S.

Month and day	M.G.		W.H.		B.R.		P.S.	
	Ascorbic Acid		Ascorbic Acid		Ascorbic Acid		Ascorbic Acid	
	Intake	Plasma	Intake	Plasma	Intake	Plasma	Intake	Plasma
	Milligrams	*Milligrams per cent*	*Milligrams*	*Milligrams per cent*	*Milligrams*	*Milligrams per cent*	*Milligrams*	*Milligrams per cent*
Unrestricted diet period								
1-12	47	1.33	47	0.76	54	1.09	48	1.09
1-13	92	1.15	93	0.60	76	0.90	86	1.01
1-14	71	1.01	70	0.76	71	1.25	69	1.24
1-15	46	1.09	47	0.56	47	1.07	45	1.10
1-16	17	0.82	28	0.78	30	1.04	16	1.09
1-17	63	0.87	71	0.53	67	0.81	71	1.04
1-18	112	0.67	175	0.20	200	0.83	187	0.79
1-19	.....	1.14	.....	0.67	.....	1.02	.....	1.26
Mean for first period	64	1.01	76	0.61	78	1.00	75	1.08
Average deviation from the mean	±24	±0.17	±33	±0.14	±35	±0.12	±36	±0.10
Range	17–112	0.67–1.33	28–175	0.20–0.78	30–200	0.81–1.25	16–187	0.79–1.26
Saturation period								
1-19	226	.....	226	.....	226	.....	226	.....
1-20	210	1.13	210	0.82	210	1.17	210	1.36
1-21	216	1.27	216	1.12	216	1.19	216	1.25
1-22	221	1.13	221	1.06	221	1.13	221	1.28
1-23	216	1.19	216	1.20	216	1.24	216	1.17
1-24	218	1.14	218	1.01	218	1.07	218	1.13
1-25	225	1.04	225	1.00	225	1.17	225	1.29
1-26	.....	1.13	.....	1.30	.....	1.14	.....	1.20
Mean intake for entire period	219	.....	219	.....	219	.....	219	.....
Average deviation from the mean	±4	.....	±4	.....	±4	.....	±4	.....
Range	210–226	.....	210–226	.....	210–226	.....	210–226	.....
Mean plasma values for last 5 days of period	....	1.13	....	1.11	....	1.15	....	1.21
Average deviation from the mean	....	±0.03	....	±0.11	....	±0.04	....	±0.06
Range	....	1.04–1.19	....	1.00–1.30	....	1.07–1.24	....	1.13–1.29

Table 6 (*Continued*). Total Daily Intake of Reduced Ascorbic Acid and Daily Plasma Ascorbic Acid Values for Adolescent Girls During Four Consecutive Experimental Periods in 1946-47.
Subjects M.G., W.H., B.R., P.S.

Month and day	M.G.		W.H.		B.R.		P.S.	
	Ascorbic Acid		Ascorbic Acid		Ascorbic Acid		Ascorbic Acid	
	Intake	Plasma	Intake	Plasma	Intake	Plasma	Intake	Plasma
	Milligrams	*Milligrams per cent*	*Milligrams*	*Milligrams per cent*	*Milligrams*	*Milligrams per cent*	*Milligrams*	*Milligrams per cent*
National Research Council recommended allowance								
1-26	80	.....	80	.....	80	.....	80	.....
1-27	80	0.98	80	0.66	80	1.02	80	0.87
1-28	80	1.01	80	0.90	80	0.90	80	0.87
1-29	78	1.15	78	1.00	78	0.93	78	1.08
1-30	80	0.96	80	0.99	80	1.00	80	1.16
1-31	80	1.09	80	1.06	80	0.99	80	1.15
2-1	99	0.88	101	0.80	95	0.93	82	1.10
2-2	....	0.89	....	0.97	....	0.99	....	0.87
Mean intake for entire period	82	.....	83	.....	82	.....	80	.....
Average deviation from the mean	±4	.....	±5	.....	±4	.....	±1	.....
Range	78–99	.....	78–101	.....	78–95	.....	78–82	.....
Mean plasma values for last 5 days of period	....	0.99	....	0.96	....	0.97	....	1.07
Average deviation from the mean	....	±0.10	....	±0.07	....	±0.03	....	±0.08
Range	....	0.88–1.15	....	0.80–1.06	....	0.93–1.00	....	0.87–1.16
10 mg less than National Research Council recommended allowance								
2-2	74	.....	74	.....	74	.....	74	.....
2-3	70	0.89	70	0.79	70	0.99	70	1.27
2-4	70	0.80	70	0.89	70	0.91	70	1.14
2-5	72	0.75	72	0.83	72	0.86	72	1.12
2-6	74	0.78	74	0.76	74	0.87	74	1.09
2-7	70	0.90	70	0.85	70	0.99	70	1.15
2-8	70	0.92	70	0.72	70	0.99	70	0.96
2-9	....	0.93	....	0.86	....	0.89	....	0.86
Mean intake for entire period	71	.....	71	.....	71	.....	71	.....
Average deviation from the mean	±2	.....	±2	.....	±2	.....	±2	.....
Range	70–74	.....	70–74	.....	70–74	.....	70–74	.....
Mean plasma values for last 5 days of period	....	0.86	....	0.80	....	0.92	....	1.04
Average deviation from the mean	....	±0.07	....	±0.05	....	±0.06	....	±0.10
Range	....	0.75–0.93	....	0.72–0.86	....	0.86–0.99	....	0.86–1.15

Table 7. Total Daily Intake of Reduced Ascorbic Acid and Daily Plasma Ascorbic Acid Values for Adolescent Girls During Three Consecutive Experimental Periods in 1947-48.

Subjects N.A., B.D., M.F., R.R.

Month and day	N.A.		B.D.		M.F.		R.R.	
	Ascorbic Acid		Ascorbic Acid		Ascorbic Acid		Ascorbic Acid	
	Intake	Plasma	Intake	Plasma	Intake	Plasma	Intake	Plasma
	Milligrams	*Milligrams per cent*	*Milligrams*	*Milligrams per cent*	*Milligrams*	*Milligrams per cent*	*Milligrams*	*Milligrams per cent*
Saturation period								
10-18	268	1.12	268	1.24	268	0.76	268	0.87
10-19	274	1.01	274	1.29	274	1.05	274	1.29
10-20	243	1.05	243	1.13	243	1.28	243	1.15
10-21	250	1.07	250	1.25	250	1.25	250	1.19
10-22	270	1.00	270	1.13	270	1.27	270	0.94
10-23	261	1.03	261	1.09	261	1.13	261	1.28
10-24	252	0.90	252	1.23	252	1.10	252	1.27
10-25	256	1.07	256	1.29	256	1.35	256	1.17
10-26	249	0.98	249	1.17	249	1.19	249	1.40
10-27	289	1.07	289	1.12	289	1.25	289	1.22
10-28	....	1.10	....	1.13	....	1.42	....	1.30
Mean intake for entire period	261	.....	261	.....	261	.....	261	.....
Average deviation from the mean	±11	.....	±11	.....	±11	.....	±11	.....
Range	243–289	.....	243–289	.....	243–289	.....	243–289	.....
Mean plasma values for last 8 days of period	....	1.03	....	1.18	....	1.25	....	1.22
Average deviation from the mean	....	±0.05	....	±0.07	....	±0.12	....	±0.12
Range	....	0.90–1.10	....	1.09–1.29	....	1.10–1.42	....	0.94–1.40
Mean plasma values for last 5 days of period	....	1.02	....	1.19	....	1.26	....	1.27
Average deviation from the mean	....	±0.07	....	±0.06	....	±0.10	....	±0.06
Range	....	0.90–1.10	....	1.12–1.29	....	1.10–1.42	....	1.17–1.40
National Research Council recommended allowance								
10-28	81	.....	81	.....	81	.....	81	.....
10-29	78	0.79	78	1.04	78	1.19	78	1.11
10-30	80	0.73	80	0.97	80	1.12	80	1.01
10-31	80	0.85	80	0.87	80	1.05	80	1.09
11-1	80	0.85	80	0.84	80	0.90	80	1.01
11-2	80	0.93	80	0.87	80	0.87	80	1.00
11-3	80	0.89	80	0.94	80	1.01	80	1.05
11-4	80	0.94	80	0.78	80	0.96	80	1.09
11-5	80	0.85	80	0.90	80	0.96	80	1.01
11-6	81	0.73	81	0.98	81	0.93	81	0.98
11-7	....	0.74	....	0.88	....	1.04	....	0.99
Mean intake for entire period	80	.....	80	.....	80	.....	80	.....
Average deviation from the mean	±0.4	.....	±0.4	.....	±0.4	.....	±0.4	.....
Range	78–81	.....	78–81	.....	78–81	.....	78–81	.....
Mean plasma values for last 8 days of period	....	0.85	....	0.88	....	0.97	....	1.03
Average deviation from the mean	....	±0.07	....	±0.06	....	±0.08	....	±0.04
Range	....	0.73–0.94	....	0.78–0.98	....	0.87–1.05	....	0.98–1.09
Mean plasma values for last 5 days of period	....	0.83	....	0.90	....	0.98	....	1.02
Average deviation from the mean	....	±0.08	....	±0.05	....	±0.04	....	±0.04
Range	....	0.73–0.94	....	0.78–0.98	....	0.93–1.04	....	0.98–1.09

Table 7 (*Continued*). Total Daily Intake of Reduced Ascorbic Acid and Daily Plasma Ascorbic Acid Values for Adolescent Girls During Three Consecutive Experimental Periods in 1947-48.

Subjects N.A., B.D., M.F., R.R.

Month and day	N.A.		B.D.		M.F.		R.R.	
	Ascorbic Acid		Ascorbic Acid		Ascorbic Acid		Ascorbic Acid	
	Intake	Plasma	Intake	Plasma	Intake	Plasma	Intake	Plasma
	Milligrams	*Milligrams per cent*	*Milligrams*	*Milligrams per cent*	*Milligrams*	*Milligrams per cent*	*Milligrams*	*Milligrams per cent*
10 mg less than National Research Council recommended allowance								
11-7	70	.....	70	.....	70	.....	70	.....
11-8	70	0.84	70	0.83	70	0.93	70	0.84
11-9	70	0.92	70	0.96	70	0.95	70	1.00
11-10	72	0.87	72	0.89	72	1.01	72	0.97
11-11	69	0.69	69	0.77	69	0.95	69	0.96
11-12	70	0.81	70	0.86	70	0.93	70	0.99
11-13	70	0.84	70	1.00	70	0.99	70	0.96
11-14	70	0.72	70	0.82	70	0.96	70	0.94
11-15	70	0.82	70	0.96	70	0.99	70	0.96
11-16	70	0.85	70	0.97	70	0.94	70	1.03
11-17	....	0.86	....	1.02	....	0.94	....	1.04
Mean intake for entire period	70	.....	70	.....	70	.....	70	.....
Average deviation from the mean	±0.3	.....	±0.3	.....	±0.3	.....	±0.3	.....
Range	69–72	.....	69–72	.....	69–72	.....	69–72	.....
Mean plasma values for last 8 days of period	....	0.81	....	0.91	....	0.96	....	0.98
Average deviation from the mean	....	±0.05	....	±0.07	....	±0.02	....	±0.04
Range	....	0.69–0.87	....	0.77–1.02	....	0.93–1.01	....	0.94–1.04
Mean plasma values for last 5 days of period	....	0.82	....	0.95	....	0.96	....	0.99
Average deviation from the mean	....	±0.04	....	±0.06	....	±0.02	....	±0.04
Range	....	0.72–0.86	....	0.82–1.02	....	0.94–0.99	....	0.94–1.04

Table 8. Total Daily Intake of Reduced Ascorbic Acid and Daily Plasma Ascorbic Acid Values for Adolescent Boys During Four Consecutive Experimental Periods in 1946-47.

Subjects J.C., V.D., J.J., G.S.

Month and day	J.C.		V.D.		J.J.		G.S.	
	Ascorbic Acid		Ascorbic Acid		Ascorbic Acid		Ascorbic Acid	
	Intake	Plasma	Intake	Plasma	Intake	Plasma	Intake	Plasma
	Milligrams	*Milligrams per cent*	*Milligrams*	*Milligrams per cent*	*Milligrams*	*Milligrams per cent*	*Milligrams*	*Milligrams per cent*
Unrestricted diet period								
2-15	128	0.80	77	0.18	91	0.38	153	0.39
2-16	100	0.77	113	0.36	111	0.33	111	0.47
2-17	144	0.69	119	0.23	80	0.42	178	0.46
2-18	138	0.82	129	0.36	124	0.44	128	0.62
2-19	159	0.92	296	0.39	164	0.38	198	0.64
2-20	22	0.85	21	0.55	24	0.45	21	0.75
2-21	118	0.66	154	0.38	122	0.37	122	0.64
2-22	....	0.69	.....	0.66	.....	0.34	....	0.89
Mean for entire period	116	0.78	130	0.39	102	0.39	130	0.61
Average deviation from the mean	±31	±0.07	±54	±0.11	±32	±0.04	±40	±0.13
Range	22–159	0.66–0.92	21–296	0.18–0.66	24–164	0.33–0.45	21–198	0.39–0.89
Saturation period								
2-22	264	.....	289	.....	296	.....	294	.....
2-23	260	0.81	264	0.76	266	0.50	263	0.94
2-24	351	0.95	353	0.88	291	0.57	283	1.03
2-25	292	0.93	421	0.99	352	0.68	355	1.10
2-26	301	0.99	281	0.92	290	0.85	290	1.06
2-27	413	1.24	407	0.89	421	0.96	424	1.00
2-28	352	1.16	486	1.03	373	1.12	357	1.07
3-1	.....	1.05	....	1.22	....	0.91	....	1.13
Mean intake for entire period	319	.....	357	.....	327	.....	324	.....
Average deviation from the mean	±45	.....	±69	.....	±47	.....	±47	.....
Range	260–413	.....	264–486	.....	266–421	.....	263–424	.....
Mean plasma values for last 5 days of period	....	1.07	....	1.01	....	0.90	....	1.07
Average deviation from the mean	....	±0.10	....	±0.09	....	±0.11	....	±0.03
Range	....	0.93–1.24	....	0.89–1.22	....	0.68–1.12	....	1.00–1.13

Table 8 (*Continued*). Total Daily Intake of Reduced Ascorbic Acid and Daily Plasma Ascorbic Acid Values for Adolescent Boys During Four Consecutive Experimental Periods in 1947-48.

Subjects J.C., V.D., J.J., G.S.

Month and day	J.C.		V.D.		J.J.		G.S.	
	Ascorbic Acid		Ascorbic Acid		Ascorbic Acid		Ascorbic Acid	
	Intake	Plasma	Intake	Plasma	Intake	Plasma	Intake	Plasma
	Milligrams	*Milligrams per cent*	*Milligrams*	*Milligrams per cent*	*Milligrams*	*Milligrams per cent*	*Milligrams*	*Milligrams per cent*
National Research Council recommended allowance								
3-1	102	.....	102	.....	102	.....	102	.....
3-2	101	1.04	101	0.85	101	1.07	101	0.95
3-3	100	0.86	100	0.87	100	0.99	100	0.78
3-4	100	0.98	100	0.82	100	1.02	100	0.95
3-5	100	0.88	100	0.85	100	0.86	100	0.86
3-6	100	0.82	100	0.72	100	0.86	100	0.86
3-7	100	0.89	100	0.84	100	0.90	100	0.86
3-8	....	0.99	....	0.85	....	0.84	....	0.77
Mean intake for entire period	100	.....	100	.....	100	.....	100	.....
Average deviation from the mean	±0	.....	±0	.....	±0	.....	±0	.....
Range	100–102	.....	100–102	.....	100–102	.....	100–102	.....
Mean plasma values for last 5 days of period	....	0.91	....	0.82	....	0.90	....	0.86
Average deviation from the mean	....	±0.06	....	±0.04	....	±0.05	....	±0.04
Range	....	0.82–0.99	....	0.72–0.85	....	0.84–1.02	....	0.77–0.95
10 mg less than National Research Council recommended allowance								
3-8	90	.....	90	.....	90	.....	90	.....
3-9	105	0.87	105	0.93	105	0.83	105	0.84
3-10	90	0.84	90	0.67	90	0.93	90	0.83
3-11	91	0.86	91	0.69	91	0.96	91	0.94
3-12	90	0.82	90	0.88	90	0.75	90	0.79
3-13	90	0.81	90	0.68	90	0.69	90	0.82
3-14	90	0.84	90	0.72	90	0.79	90	0.81
3-15	....	0.63	....	0.79	....	0.81	....	0.84
Mean intake for entire period	92	.....	92	.....	92	.....	92	.....
Average deviation from the mean	±3	.....	±3	.....	±3	.....	±3	.....
Range	90–105	.....	90–105	.....	90–105	.....	90–105	.....
Mean plasma values for last 5 days of period	....	0.79	....	0.75	....	0.80	....	0.84
Average deviation from the mean	....	±0.07	....	±0.07	....	±0.07	....	±0.04
Range	....	0.63–0.86	....	0.68–0.88	....	0.69–0.96	....	0.79–0.94

Table 9. Total Daily Intake of Reduced Ascorbic Acid and Daily Plasma Ascorbic Acid Values for Adolescent Boys During Three Consecutive Experimental Periods in 1947-48.

Subjects T.C., D.E., W.P., D.R.

Month and day	T.C.		D.E.		W.P.		D.R.	
	Ascorbic Acid		Ascorbic Acid		Ascorbic Acid		Ascorbic Acid	
	Intake	Plasma	Intake	Plasma	Intake	Plasma	Intake	Plasma
	Milligrams	*Milligrams per cent*	*Milligrams*	*Milligrams per cent*	*Milligrams*	*Milligrams per cent*	*Milligrams*	*Milligrams per cent*
Saturation period								
1-31	297	0.21	291	0.34	294	0.85	298	0.48
2-1	245	0.25	247	0.29	245	0.95	244	0.67
2-2	251	0.27	247	0.36	250	1.03	246	0.93
2-3	305	0.39	306	0.38	318	0.99	280	0.87
2-4	247	0.46	240	0.43	244	1.18	244	1.00
2-5	299	0.54	320	0.48	299	1.12	298	1.03
2-6	274	0.63	253	0.63	260	1.06	268	1.07
2-7	246	0.87	246	0.92	246	0.99	246	1.15
2-8	243	1.14	243	0.89	243	1.32	243	0.94
2-9	311	1.02	309	0.90	305	1.08	285	1.09
2-10	....	1.31	....	1.06	....	1.16	....	1.18
Mean intake for entire period	272	.....	270	.....	270	.....	265	.....
Average deviation from the mean	±25	.....	±29	.....	±27	.....	±21	.....
Range	243–311	.....	240–320	.....	243–318	.....	243–298	.....
Mean plasma values for last 8 days of period	....	0.80	....	0.71	....	1.11	....	1.04
Average deviation from the mean	....	±0.44	....	±0.32	....	±0.11	....	±0.17
Range	....	0.39–1.31	....	0.38–1.06	....	0.99–1.32	....	0.87–1.18
Mean plasma values for last 5 days of period	....	0.99	....	0.88	....	1.12	....	1.09
Average deviation from the mean	....	±0.20	....	±0.10	....	±0.09	....	±0.06
Range	....	0.63–1.31	....	0.63–1.06	....	0.99–1.32	....	0.94–1.18
National Research Council recommended allowance								
2-10	99	.....	99	.....	99	.....	99	.....
2-11	101	1.11	101	1.07	101	1.08	101	0.96
2-12	99	1.07	99	0.88	99	0.99	99	0.93
2-13	100	0.96	100	0.66	100	0.74	100	0.69
2-14	100	0.87	100	0.69	100	0.76	100	0.84
2-15	100	0.90	100	0.77	100	0.72	100	0.83
2-16	99	0.84	99	0.72	99	0.85	99	0.72
2-17	100	0.91	100	0.66	100	0.78	100	0.64
2-18	100	0.91	100	0.74	100	0.85	100	0.70
2-19	100	0.91	100	0.63	100	0.75	100	0.70
2-20	....	0.91	....	0.62	....	0.84	....	0.71
Mean intake for entire period	100	.....	100	.....	100	.....	100	.....
Average deviation from the mean	±0.4	.....	±0.4	.....	±0.4	.....	±0.4	.....
Range	99–101	.....	99–101	.....	99–101	.....	99–101	.....
Mean plasma values for last 8 days of period	....	0.90	....	0.69	....	0.79	....	0.73
Average deviation from the mean	....	±0.06	....	±0.10	....	±0.09	....	±0.09
Range	....	0.84–0.96	....	0.62–0.77	....	0.72–0.85	....	0.64–0.84
Mean plasma values for last 5 days of period	....	0.90	....	0.67	....	0.81	....	0.69
Average deviation from the mean	....	±0.02	....	±0.04	....	±0.04	....	±0.02
Range	....	0.84–0.91	....	0.62–0.74	....	0.75–0.85	....	0.64–0.72

Table 9 (*Continued*). Total Daily Intake of Reduced Ascorbic Acid and Daily Plasma Ascorbic Acid Values for Adolescent Boys During Three Consecutive Experimental Periods in 1947-48.
Subjects T.C., D.E., W.P., D.R.

Month and day	T.C.		D.E.		W.P.		D.R.	
	Ascorbic Acid		Ascorbic Acid		Ascorbic Acid		Ascorbic Acid	
	Intake	Plasma	Intake	Plasma	Intake	Plasma	Intake	Plasma
	Milligrams	*Milligrams per cent*	*Milligrams*	*Milligrams per cent*	*Milligrams*	*Milligrams per cent*	*Milligrams*	*Milligrams per cent*
10 mg less than National Research Council recommended allowance								
2-20	90	.....	90	.....	90	.....	90	.....
2-21	90	1.04	90	0.76	90	0.92	90	0.83
2-22	90	0.96	90	0.70	90	0.69	90	0.82
2-23	92	0.93	92	0.61	92	0.72	92	0.68
2-24	90	0.73	90	0.67	90	0.62	90	0.59
2-25	87	0.69	87	0.71	87	0.73	87	0.89
2-26	91	0.85	91	0.67	91	0.69	91	0.75
2-27	90	0.76	90	0.66	90	0.71	90	0.83
2-28	90	0.93	90	0.71	90	0.69	90	0.83
2-29	90	0.85	90	0.65	90	0.88	90	0.59
3-1	....	0.79	....	0.70	....	0.71	....	0.68
Mean intake for entire period	90	.....	90	.....	90	.....	90	.....
Average deviation from the mean	±0.6	.....	±0.6	.....	±0.6	.....	±0.6	.....
Range	87–92	.....	87–92	.....	87–92	.....	87–92	.....
Mean plasma values for last 8 days of period	....	0.82	....	0.67	....	0.72	....	0.73
Average deviation from the mean	....	±0.09	....	±0.03	....	±0.07	....	±0.09
Range	....	0.69–0.93	....	0.61–0.71	....	0.62–0.88	....	0.59–0.89
Mean plasma values for last 5 days of period	....	0.84	....	0.68	....	0.74	....	0.74
Average deviation from the mean	....	±0.05	....	±0.02	....	±0.06	....	±0.08
Range	....	0.76–0.93	....	0.65–0.71	....	0.69–0.88	....	0.59–0.83

Table 10. Significance of Differences Between the Means for the Concentration (x) of Ascorbic Acid in the Plasma.

Month and day	Adolescent girls 1946-47															
	M.G.				W.H.				B.R.				P.S.			
	x	d	d^2	σ_m*	x	d	d^2	σ_m*	x	d	d^2	σ_m*	x	d	d^2	σ_m*
Saturation																
1-22	1.13	0.00	.0000	±.0242	1.06	—0.05	.0025	±.0586	1.13	—0.02	.0004	±.0277	1.28	+0.07	.0049	±.0311
1-23	1.19	+0.06	.0036		1.20	+0.09	.0081		1.24	+0.09	.0081		1.17	—0.04	.0016	
1-24	1.14	+0.01	.0001		1.01	—0.10	.0100		1.07	—0.08	.0064		1.13	—0.08	.0064	
1-25	1.04	—0.09	.0081		1.00	—0.11	.0121		1.17	+0.02	.0004		1.29	+0.08	.0064	
1-26	1.13	0.00	.0000		1.30	+0.19	.0361		1.14	—0.01	.0001		1.20	—0.01	.0001	
Mean	1.13	±0.03	.....		1.11	±0.11	.....		1.15	±0.04	.....		1.21	±0.06	.....	
Σd^2	.....	.....	.0118		.....	.....	.0688		.....	.....	.0154		.....	.....	.0194	
N.R.C.																
1-29	1.15	+0.16	.0256	±.0541	1.00	+0.04	.0016	±.0437	0.93	—0.04	.0016	±.01565	1.08	+0.01	.0001	±.0526
1-30	0.96	—0.03	.0009		0.99	+0.03	.0009		1.00	+0.03	.0009		1.16	+0.09	.0081	
1-31	1.09	+0.10	.0100		1.06	+0.10	.0100		0.99	+0.02	.0004		1.15	+0.08	.0064	
2-1	0.88	—0.11	.0121		0.80	—0.16	.0256		0.93	—0.04	.0016		1.10	+0.03	.0009	
2-2	0.89	—0.10	.0100		0.97	+0.01	.0001		0.99	+0.02	.0004		0.87	—0.20	.0400	
Mean	0.99	±0.10	.....		0.96	±0.07	.....		0.97	±0.03	.....		1.07	±0.08	.....	
Σd^2	.....	.....	.0586		.....	.....	.0382		.....	.....	.0049		.....	.....	.0555	
N.R.C.—10 mg																
2-5	0.75	—0.11	.0121	±.0378	0.83	+0.03	.0009	±.0273	0.86	—0.06	.0036	±.0289	1.12	+0.08	.0064	±.05468
2-6	0.78	—0.08	.0064		0.76	—0.04	.0016		0.87	—0.05	.0025		1.09	+0.05	.0025	
2-7	0.90	+0.04	.0016		0.85	+0.05	.0025		0.99	+0.07	.0049		1.15	+0.11	.0121	
2-8	0.92	+0.06	.0036		0.72	—0.08	.0064		0.99	+0.07	.0049		0.96	—0.08	.0064	
2-9	0.93	+0.07	.0049		0.86	+0.06	.0036		0.89	—0.03	.0009		0.86	—0.18	.0324	
Mean	0.86	±0.07	.....		0.80	±0.05	.....		0.92	±0.06	.....		1.04	±0.10	.....	
Σd^2	.....	.....	.0286		.....	.....	.0150		.....	.....	.0168		.....	.....	.0598	
N.R.C. vs. saturation																
Standard deviation†	±.05930				±.07314				±.03185				±.06119			
Difference‡	0.14 significant§				0.15 significant§				0.18 significant§				0.14 significant§			
N.R.C.—10 mg vs. N.R.C.																
Standard deviation†	±.06603				±.05157				±.03293				±.07592			
Difference‡	0.13 significant§				0.16 significant§				0.05 not significant§				0.03 not significant§			
N.R.C.—10 mg vs. saturation																
Standard deviation†	±.0449				±.06473				±.04012				±.0629			
Difference‡	0.27 significant§				0.31 significant§				0.23 significant§				0.17 significant§			

Table 10 (*Continued*). Significance of Differences Between the Means for the Concentration (x) of Ascorbic Acid in the Plasma.

Month and day	Adolescent girls 1947-48, deviation calculated on last 8 days of each period															
	N.A.				B.D.				M.F.				R.R.			
	x	d	d^2	σ_m*	x	d	d^2	σ_m*	x	d	d^2	σ_m*	x	d	d^2	σ_m*
Saturation																
10-21	1.07	+0.04	.0016	±.02315	1.25	+0.07	.0049	±.02545	1.25	0.00	.0000	±.037749	1.19	−0.03	.0009	±.04757
10-22	1.00	−0.03	.0009		1.13	−0.05	.0025		1.27	+0.02	.0004		0.94	−0.28	.0784	
10-23	1.03	0.00	.0000		1.09	−0.09	.0081		1.13	−0.12	.0144		1.28	+0.06	.0036	
10-24	0.90	−0.13	.0169		1.23	+0.05	.0025		1.10	−0.15	.0225		1.27	+0.05	.0025	
10-25	1.07	+0.04	.0016		1.29	+0.11	.0121		1.35	+0.10	.0100		1.17	−0.05	.0025	
10-26	0.98	−0.05	.0025		1.17	−0.01	.0001		1.19	−0.06	.0036		1.40	+0.18	.0324	
10-27	1.07	+0.04	.0016		1.12	−0.06	.0036		1.25	0.00	.0000		1.22	0.00	.0000	
10-28	1.10	+0.07	.0049		1.13	−0.05	.0025		1.42	+0.17	.0289		1.30	+0.08	.0064	
Mean	1.03	±0.05	.....		1.18	±0.06	.....		1.25	±0.08	.....		1.22	±0.09	.....	
Σd^2	.....	.....	.0300		.....	.....	.0363		.....	.....	.0798		.....	.....	.1267	
N.R.C.																
10-31	0.85	0.00	.0000	±.02758	0.87	−0.01	.0001	±.02147	1.05	+0.08	.0064	±.02300	1.09	+0.06	.0036	±.01545
11-1	0.85	0.00	.0000		0.84	−0.04	.0016		0.90	−0.07	.0049		1.01	−0.02	.0004	
11-2	0.93	+0.08	.0064		0.87	−0.01	.0001		0.87	−0.10	.0100		1.00	−0.03	.0009	
11-3	0.89	+0.04	.0016		0.94	+0.06	.0036		1.01	+0.04	.0016		1.05	+0.02	.0004	
11-4	0.94	+0.09	.0081		0.78	−0.10	.0100		0.96	−0.01	.0001		1.09	+0.06	.0036	
11-5	0.85	0.00	.0000		0.90	+0.02	.0004		0.96	−0.01	.0001		1.01	−0.02	.0004	
11-6	0.73	−0.12	.0144		0.98	+0.10	.0100		0.93	−0.04	.0016		0.98	−0.05	.0025	
11-7	0.74	−0.11	.0121		0.88	0.00	.0000		1.04	+0.07	.0049		0.99	−0.04	.0016	
Mean	0.85	±0.06	.....		0.88	±0.04	.....		0.97	±0.05	.....		1.03	±0.04	.....	
Σd^2	.....	.....	.0426		.....	.....	.0258		.....	.....	.0296		.....	.....	.0134	
N.R.C.—10 mg																
11-10	0.87	+0.06	.0036	±.02360	0.89	−0.02	.0004	±.03187	1.01	+0.05	.0025	±.01044	0.97	−0.01	.0001	±.01276
11-11	0.69	−0.12	.0144		0.77	−0.14	.0196		0.95	−0.01	.0001		0.96	−0.02	.0004	
11-12	0.81	0.00	.0000		0.86	−0.05	.0025		0.93	−0.03	.0009		0.99	+0.01	.0001	
11-13	0.84	+0.03	.0009		1.00	+0.09	.0081		0.99	+0.03	.0009		0.96	−0.02	.0004	
11-14	0.72	−0.09	.0081		0.82	−0.09	.0081		0.96	0.00	.0000		0.94	−0.04	.0016	
11-15	0.82	+0.01	.0001		0.96	+0.05	.0025		0.99	+0.03	.0009		0.96	−0.02	.0004	
11-16	0.85	+0.04	.0016		0.97	+0.06	.0036		0.94	−0.02	.0004		1.03	+0.05	.0025	
11-17	0.86	+0.05	.0025		1.02	+0.11	.0121		0.94	−0.02	.0004		1.04	+0.06	.0036	
Mean	0.81	±0.05	.....		0.91	±0.08	.....		0.96	±0.02	.....		0.98	±0.03	.....	
Σd^2	.....	.....	.0312		.....	.....	.0569		.....	.....	.0061		.....	.....	.0091	
N.R.C. vs. saturation																
Standard deviation†			±.03601				±.0333				±.0442				±.050019	
Difference‡			0.18 significant§				0.30 significant§				0.28 significant§				0.19 significant§	
N.R.C.—10 mg vs. N.R.C.																
Standard deviation†			±.0363				±.03843				±.02525				±.02004	
Difference‡			0.04 not significant§				0.03 not significant§				0.01 not significant§				0.05 significant§	
N.R.C.—10 mg vs. saturation																
Standard deviation†			±.03306				±.04079				±.03916				±.04925	
Difference‡			0.22 significant§				0.27 significant§				0.29 significant§				0.24 significant§	

Table 10 (*Continued*). Significance of Differences Between the Means for the Concentration (x) of Ascorbic Acid in the Plasma.

Month and day	Adolescent girls 1947-48, deviation calculated on last 5 days of each period															
	N.A.				B.D.				M.F.				R.R.			
	x	d	d^2	σ_m*	x	d	d^2	σ_m*	x	d	d^2	σ_m*	x	d	d^2	σ_m*
Saturation																
10-24	0.90	—0.12	.0144		1.23	+0.04	.0016		1.10	—0.16	.0256		1.27	0.00	.0000	
10-25	1.07	+0.05	.0025		1.29	+0.10	.0100		1.35	+0.09	.0081		1.17	—0.10	.0100	
10-26	0.98	—0.04	.0016		1.17	—0.02	.0004		1.19	—0.07	.0049		1.40	+0.13	.0169	
10-27	1.07	+0.05	.0025	±.0370	1.12	—0.07	.0049	±.032015	1.25	—0.01	.0001	±.0567	1.22	—0.05	.0025	±.03892
10-28	1.10	+0.08	.0064		1.13	—0.06	.0036		1.42	+0.16	.0256		1.30	+0.03	.0009	
Mean	1.02	±0.07	.....		1.19	±0.06	.....		1.27	±0.06	.....		1.26	±0.10	.....	
Σd^2	.....	.....	.0274		.....	.....	.0205		.....	.....	.0303		.....	.....	.0643	
N.R.C.																
11-3	0.89	+0.06	.0036		0.94	+0.04	.0016		1.01	+0.03	.0009		1.05	+0.03	.0009	
11-4	0.94	+0.11	.0121		0.78	—0.12	.0144		0.96	—0.02	.0004		1.09	+0.07	.0049	
11-5	0.85	+0.02	.0004	±.04135	0.90	0.00	.0000	±.03376	0.96	—0.02	.0004	±.01974	1.01	—0.01	.0001	±.02049
11-6	0.73	—0.10	.0100		0.98	+0.08	.0064		0.93	—0.05	.0025		0.98	—0.04	.0016	
11-7	0.74	—0.09	.0081		0.88	—0.02	.0004		1.04	+0.06	.0036		0.99	—0.03	.0009	
Mean	0.83	±0.08	.....		0.90	±0.05	.....		0.98	±0.04	.....		1.02	±0.04	.....	
Σd^2	.....	.....	.0342		.....	.....	.0228		.....	.....	.0078		.....	.....	.0084	
N.R.C.—10 mg																
11-13	0.84	+0.02	.0004		1.00	+0.05	.0025		0.99	+0.03	.0009		0.96	—0.03	.0009	
11-14	0.72	—0.10	.0100		0.82	—0.13	.0169		0.96	0.00	.0000		0.94	—0.05	.0025	
11-15	0.82	0.00	.0000	±.02539	0.96	+0.01	.0001	±.0352	0.99	+0.03	.0009	±.0114	0.96	—0.03	.0009	±.0204
11-16	0.85	+0.03	.0009		0.97	+0.02	.0004		0.94	—0.02	.0004		1.03	+0.04	.0016	
11-17	0.86	+0.04	.0016		1.02	+0.07	.0049		0.94	—0.02	.0004		1.04	+0.05	.0025	
Mean	0.82	±0.04	.....		0.99	±0.04	.....		0.96	±0.02	.....		0.95	±0.06	.....	
Σd^2	.....	.....	.0129		.....	.....	.0084		.....	.....	.0026		.....	.....	.0248	
N.R.C. vs. saturation																
Standard deviation†	±.05549				±.046529				±.06004				±.043988			
Difference‡	0.19 significant§				0.29 significant§				0.28 significant§				0.25 significant§			
N.R.C.—10 mg vs. N.R.C.																
Standard deviation†	±.048528				±.04878				±.0228				±.02898			
Difference‡	0.01 not significant§				0.05 not significant§				0.02 not significant§				0.03 not significant§			
N.R.C.—10 mg vs. saturation																
Standard deviation†	±.044888				±.04759				±.057835				±.043988			
Difference‡	0.20 significant§				0.24 significant§				0.30 significant§				0.28 significant§			

Table 10 (*Continued*). Significance of Differences Between the Means for the Concentration (x) of Ascorbic Acid in the Plasma.

Month and day	Adoescent boys 1946-47															
	J.C.				V.D.				J.J.				G.S.			
	x	d	d^2	σ_m*	x	d	d^2	σ_m*	x	d	d^2	σ_m*	x	d	d^2	σ_m*
Saturation																
2-25	0.93	—0.14	.0196	±.0563	0.99	—0.02	.0004	±.05805	0.68	—0.22	.0484	±.07176	1.10	+0.03	.0009	±.02179
2-26	0.99	—0.08	.0064		0.92	—0.09	.0081		0.85	—0.05	.0025		1.06	—0.01	.0001	
2-27	1.24	+0.17	.0289		0.89	—0.12	.0144		0.96	+0.06	.0036		1.00	—0.07	.0049	
2-28	1.16	+0.09	.0081		1.03	+0.02	.0004		1.12	+0.22	.0484		1.07	0.00	.0000	
3-1	1.05	—0.02	.0004		1.22	+0.21	.0441		0.91	+0.01	.0001		1.13	+0.06	.0036	
Mean	1.07	±0.10	.....		1.01	±0.09	.....		0.90	±0.11	.....		1.07	±0.03	.....	
Σd^2	.....	.....	.0634		.....	.....	.0674		.....	.....	.1030		.....	.....	.0095	
N.R.C.																
3-4	0.98	+0.07	.0049	±.03217	0.82	0.00	.0000	±.0246	1.02	+0.12	.0144	±.03255	0.95	+0.09	.0081	±.0284
3-5	0.88	—0.03	.0009		0.85	+0.03	.0009		0.86	—0.04	.0016		0.86	0.00	.0000	
3-6	0.82	—0.09	.0081		0.72	—0.10	.0100		0.86	—0.04	.0016		0.86	0.00	.0000	
3-7	0.89	—0.02	.0004		0.84	+0.02	.0004		0.90	0.00	.0000		0.86	0.00	.0000	
3-8	0.99	+0.08	.0064		0.85	+0.03	.0009		0.84	—0.06	.0036		0.77	—0.09	.0081	
Mean	0.91	±0.06	.....		0.82	±0.04	.....		0.90	±0.05	.....		0.86	±0.04	.....	
Σd^2	.....	.....	.0207		.....	.....	.0122		.....	.....	.0212		.....	.....	.0162	
N.R.C.—10 mg																
3-11	0.86	+0.07	.0049	±.04141	0.69	—0.06	.0036	±.037349	0.96	+0.16	.0256	±.04494	0.94	+0.10	.0100	±.0262
3-12	0.82	+0.03	.0009		0.88	+0.13	.0169		0.75	—0.05	.0025		0.79	—0.05	.0025	
3-13	0.81	+0.02	.0004		0.68	—0.07	.0049		0.69	—0.11	.0121		0.82	—0.02	.0004	
3-14	0.84	+0.05	.0025		0.72	—0.03	.0009		0.79	—0.01	.0001		0.81	—0.03	.0009	
3-15	0.63	—0.16	.0256		0.79	+0.04	.0016		0.81	+0.01	.0001		0.84	0.00	.0000	
Mean	0.79	±0.07	.....		0.75	±0.07	.....		0.80	±0.07	.....		0.84	±0.04	.....	
Σd^2	.....	.....	.0343		.....	.....	.0279		.....	.....	.0404		.....	.....	.0138	
N.R.C. vs. saturation																
Standard deviation†	±.064845				±.06308				±.0788				±.03584			
Difference‡	0.16 significant§				0.19 significant§				0.00 not significant§				0.21 significant§			
N.R.C.—10 mg vs. N.R.C.																
Standard deviation†	±.05244				±.04477				±.05549				±.038729			
Difference‡	0.12 significant§				0.07 not significant§				0.10 not significant§				0.02 not significant§			
N.R.C.—10 mg vs. saturation																
Standard deviation†	±.06989				±.06902				±.08467				±.03413			
Difference‡	0.28 significant§				0.26 significant§				0.10 not significant§				0.23 significant§			

Table 10 (*Continued*). Significance of Differences Between the Means for the Concentration (x) of Ascorbic Acid in the Plasma.

Month and day	Adolescent boys 1947-48, deviation calculated on last 8 days of each period															
	T.C.				D.E.				W.P.				D.R.			
	x	d	d^2	σ_m*	x	d	d^2	σ_m*	x	d	d^2	σ_m*	x	d	d^2	σ_m*
Saturation																
2-3	0.39	—0.41	.1681		0.38	—0.33	.1089		0.99	—0.12	.0144		0.87	—0.17	.0289	
2-4	0.46	—0.34	.1156		0.43	—0.28	.0784		1.18	+0.07	.0049		1.00	—0.04	.0016	
2-5	0.54	—0.26	.0676	±.1202	0.48	—0.23	.0529	±.09274	1.12	+0.01	.0001	±.03867	1.03	—0.01	.0001	±.03676
2-6	0.63	—0.17	.0289		0.63	—0.08	.0064		1.06	—0.05	.0025		1.07	+0.03	.0009	
2-7	0.87	+0.07	.0049		0.92	+0.21	.0441		0.99	—0.12	.0144		1.15	+0.11	.0121	
2-8	1.14	+0.34	.1156		0.89	+0.18	.0324		1.32	+0.21	.0441		0.94	—0.10	.0100	
2-9	1.02	+0.22	.0484		0.90	+0.19	.0361		1.08	—0.03	.0009		1.09	+0.05	.0025	
2-10	1.31	+0.51	.2601		1.06	+0.35	.1225		1.16	+0.05	.0025		1.18	+0.14	.0196	
Mean	0.80	±0.29	.....		0.71	±0.23	.....		1.11	±0.08	.....		1.04	±0.08	.....	
Σd^2	.....	.....	.8092		.....	.....	.4817		.....	.....	.0838		.....	.....	.0757	
N.R.C.																
2-13	0.96	+0.06	.0036		0.66	—0.03	.0009		0.74	—0.05	.0025		0.69	—0.04	.0016	
2-14	0.87	—0.03	.0009		0.69	0.00	.0000		0.76	—0.03	.0009		0.84	+0.11	.0121	
2-15	0.90	0.00	.0000	±.01232	0.77	+0.08	.0064	±.01894	0.72	—0.07	.0049	±.01876	0.83	+0.10	.0100	±.02467
2-16	0.84	—0.06	.0036		0.72	+0.03	.0009		0.85	+0.06	.0036		0.72	—0.01	.0001	
2-17	0.91	+0.01	.0001		0.66	—0.03	.0009		0.78	—0.01	.0001		0.64	—0.09	.0081	
2-18	0.91	+0.01	.0001		0.74	+0.05	.0025		0.85	+0.06	.0036		0.70	—0.03	.0009	
2-19	0.91	+0.01	.0001		0.63	—0.06	.0036		0.75	—0.04	.0016		0.70	—0.03	.0009	
2-20	0.91	+0.01	.0001		0.62	—0.07	.0049		0.84	+0.05	.0025		0.71	—0.02	.0004	
Mean	0.90	±0.02	.....		0.69	±0.04	.....		0.79	±0.05	.....		0.73	±0.05	.....	
Σd^2	.....	.....	.0085		.....	.....	.0201		.....	.....	.0197		.....	.....	.0341	
N.R.C.—10 mg																
2-23	0.93	+0.11	.0121		0.61	—0.06	.0036		0.72	0.00	.0000		0.68	—0.05	.0025	
2-24	0.73	—0.09	.0081		0.67	0.00	.0000		0.62	—0.10	.0100		0.59	—0.14	.0196	
2-25	0.69	—0.13	.0169	±.03148	0.71	+0.04	.0016	±.01208	0.73	+0.01	.0001	±.02594	0.89	+0.16	.0256	±.04013
2-26	0.85	+0.03	.0009		0.67	0.00	.0000		0.69	—0.03	.0009		0.75	+0.02	.0004	
2-27	0.76	—0.06	.0036		0.66	—0.01	.0001		0.71	—0.01	.0001		0.83	+0.10	.0100	
2-28	0.93	+0.11	.0121		0.71	+0.04	.0016		0.69	—0.03	.0009		0.83	+0.10	.0100	
2-29	0.85	+0.03	.0009		0.65	—0.02	.0004		0.88	+0.16	.0256		0.59	—0.14	.0196	
3-1	0.79	—0.03	.0009		0.70	+0.03	.0009		0.71	—0.01	.0001		0.68	—0.05	.0025	
Mean	0.82	±0.07	.....		0.67	±0.03	.....		0.72	±0.04	.....		0.73	±0.10	.....	
Σd^2	.....	.....	.0555		.....	.....	.0082		.....	.....	.0377		.....	.....	.0902	
N.R.C. vs saturation																
Standard deviation†	±.12083				±.09466				±.042988				±.04428			
Difference‡	0.10 not significant§				0.02 not significant§				0.32 significant§				0.31 significant§			
N.R.C.—10 mg vs. N.R.C.																
Standard deviation†	±.033808				±.02247				±.03201				±.04711			
Difference‡	0.08 significant§				0.02 not significant§				0.07 significant§				0.00 not significant§			
N.R.C.—10 mg vs. saturation																
Standard deviation†	±.12426				±.09353				±.04657				±.05443			
Difference‡	0.02 not significant§				0.04 not significant§				0.39 significant§				0.31 significant§			

Month and day	Adolescent boys 1947-48, deviation calculated on last 5 days of each period															
	T.C.				D.E.				W.P.				D.R.			
	x	d	d^2	σ_m*	x	d	d^2	σ_m*	x	d	d^2	σ_m*	x	d	d^2	σ_m*
Saturation																
2-6	0.63	−0.36	.1296		0.63	−0.25	.0625		1.06	−0.06	.0036		1.07	−0.02	.0004	
2-7	0.87	−0.12	.0144		0.92	+0.04	.0016		0.99	−0.13	.0169		1.15	+0.06	.0036	
2-8	1.14	+0.15	.0225	±.11614	0.89	−0.01	.0001	±.06964	1.32	+0.20	.0400	±.056435	0.94	−0.15	.0225	±.04159
2-9	1.02	+0.13	.0009		0.90	+0.02	.0004		1.08	−0.04	.0016		1.09	0.00	.0000	
2-10	1.31	+0.32	.1024		1.06	+0.18	.0324		1.16	+0.04	.0016		1.18	+0.09	.0081	
Mean	0.99	±0.20	.....		0.88	±0.10	.....		1.12	±0.09	.....		1.09	±0.06	.....	
Σd^2	.....	.....	.2698		.....	.....	.0970		.....	.....	.0637		.....	.....	.0346	
N.R.C.																
2-16	0.84	−0.06	.0036		0.72	+0.05	.0025		0.85	+0.04	.0016		0.72	+0.03	.0009	
2-17	0.91	+0.01	.0001		0.66	−0.01	.0001		0.78	−0.03	.0009		0.64	−0.05	.0025	
2-18	0.91	+0.01	.0001	±.01414	0.74	+0.07	.0049	±.02408	0.85	+0.04	.0016	±.020736	0.70	+0.01	.0001	±.01414
2-19	0.91	+0.01	.0001		0.63	−0.04	.0016		0.75	−0.06	.0036		0.70	+0.01	.0001	
2-20	0.91	+0.01	.0001		0.62	−0.05	.0025		0.84	+0.03	.0009		0.71	+0.02	.0004	
Mean	0.90	±0.02	.....		0.67	±0.04	.....		0.81	±0.04	.....		0.69	±0.02	.....	
Σd^2	.....	.....	.0040		.....	.....	.0116		.....	.....	.0086		.....	.....	.0040	
N.R.C.—10 mg																
2-26	0.85	+0.01	.0001		0.67	−0.01	.0001		0.69	−0.05	.0025		0.75	+0.01	.0001	
2-27	0.76	−0.08	.0064		0.66	−0.02	.0004		0.71	−0.03	.0009		0.83	+0.09	.0081	
2-28	0.93	+0.09	.0081	±.02932	0.71	+0.03	.0009	±.01161	0.69	−0.05	.0025	±.03633	0.83	+0.09	.0081	±.04604
2-29	0.85	+0.01	.0001		0.65	−0.03	.0009		0.88	+0.14	.0196		0.59	−0.15	.0225	
3-1	0.79	−0.05	.0025		0.70	+0.02	.0004		0.71	−0.03	.0009		0.68	−0.06	.0036	
Mean	0.84	±0.05	.....		0.68	±0.02	.....		0.74	±0.06	.....		0.74	±0.08	.....	
Σd^2	.....	.....	.0172		.....	.....	.0027		.....	.....	.0264		.....	.....	.0424	
N.R.C. vs. saturation																
Standard deviation†	±.0117				±.07368				±.060124				±.04393			
Difference‡	0.09 significant§				0.21 significant§				0.31 significant§				0.40 significant§			
N.R.C.—10 mg vs. N.R.C.																
Standard deviation†	±.03255				±.026739				±.041833				±.04816			
Difference‡	0.06 not significant§				0.01 not significant§				0.07 not significant§				0.05 not significant§			
N.R.C.—10 mg vs. saturation																
Standard deviation†	±.011979				±.070604				±.067119				±.06204			
Difference‡	0.15 significant§				0.20 significant§				0.38 significant§				0.35 significant§			

* The standard deviation of the mean (σ_m) in each case has been computed using the formula: $\sigma_m = \pm\sqrt{\frac{\Sigma d^2}{n(n-1)}}$ where d = deviation from actual mean; n = number of cases; and m = mean of the plasma ascorbic acid concentrations. Sample computation: $\sigma_{m_1} = \pm\sqrt{\frac{.0118}{5(5-1)}} = \pm\sqrt{.00059} = \pm.0242$.

† The standard deviation of the difference between two means in each case has been computed using the formula: $\sigma D_{m_1 - m_2} = \pm\sqrt{\sigma_{m_1}^2 + \sigma_{m_2}^2}$ in which $D_{m_1 - m_2}$ = difference between first and second means. Sample computation: $\sigma D_{m_1 - m_2} = \pm\sqrt{.00059 + .00293} = \pm.0593$.

‡ Difference between means. Sample computation: $m_1 - m_2 = 1.13 - 0.99 = 0.14$.

§ For the purposes of this study, a difference between means of two times the standard deviation of the difference between means is considered significant.

Table 11. Significance of the Means for the Concentration of Ascorbic Acid in Plasma by Analysis of Variance.

Period	Adolescent girls									
	M.G.	W.H.	B.R.	P.S.	N.A.	B.D.	M.F.	R.R.		
	Plasma ascorbic acid	Plasma ascorbic acid	Plasma ascorbic acid	Plasma ascorbic acid	Plasma ascorbic acid	Plasma ascorbic acid	Plasma ascorbic acid	Plasma ascorbic acid	Totals	Means
	Milligrams per cent	*Milligrams per cent*	*Milligrams per cent*	*Milligrams per cent*	*Milligrams per cent*	*Milligrams per cent*	*Milligrams per cent*	*Milligrams per cent*		
Saturation period	1.13	1.06	1.13	1.28	0.90	1.23	1.10	1.27		
	1.19	1.20	1.24	1.17	1.07	1.29	1.35	1.17		
	1.14	1.01	1.07	1.13	0.98	1.17	1.19	1.40		
	1.04	1.00	1.17	1.29	1.07	1.12	1.25	1.22		
	1.13	1.30	1.14	1.20	1.10	1.13	1.42	1.30		
N.R.C. period	1.15	1.00	0.93	1.08	0.89	0.94	1.01	1.05		
	0.96	0.99	1.00	1.16	0.94	0.78	0.96	1.09		
	1.09	1.06	0.99	1.15	0.85	0.90	0.96	1.01		
	0.88	0.80	0.93	1.10	0.73	0.98	0.93	0.98		
	0.89	0.97	0.99	0.87	0.74	0.88	1.04	0.99		
N.R.C.—10 mg period	0.75	0.83	0.86	1.12	0.84	1.00	0.99	0.96		
	0.78	0.76	0.87	1.09	0.72	0.82	0.96	0.94		
	0.90	0.85	0.99	1.15	0.82	0.96	0.99	0.96		
	0.92	0.72	0.99	0.96	0.85	0.97	0.94	1.03		
	0.93	0.86	0.89	0.86	0.86	1.02	0.94	1.04		
									Totals	Means*
Saturation total	5.63	5.57	5.75	6.07	5.12	5.94	6.31	6.36	46.75	1.17
N.R.C. total	4.97	4.82	4.84	5.36	4.15	4.48	4.90	5.12	38.64	0.97
N.R.C.-10 mg, total	4.28	4.02	4.60	5.18	4.09	4.77	4.82	4.93	36.69	0.92
Totals	14.88	14.41	15.19	16.61	13.36	15.19	16.03	16.41	122.08	.....
Means	0.99	0.96	1.01	1.11	0.89	1.01	1.07	1.09	.....	.....

Table 11 (*Continued*). Significance of the Means for the Concentration of Ascorbic Acid in Plasma by Analysis of Variance.

Period	Adolescent boys								
	J.C.	V.D.	G.S.	T.C.	D.E.	W.P.	D.R.		
	Plasma ascorbic acid	Plasma ascorbic acid	Plasma ascorbic acid	Plasma ascorbic acid	Plasma ascorbic acid	Plasma ascorbic acid	Plasma ascorbic acid	Totals	Means
	Milligrams per cent	*Milligrams per cent*	*Milligrams per cent*	*Milligrams per cent*	*Milligrams per cent*	*Milligrams per cent*	*Milligrams per cent*		
Saturation period	0.93	0.99	1.10	0.63	0.63	1.06	1.07		
	0.99	0.92	1.06	0.87	0.92	0.99	1.15		
	1.24	0.89	1.00	1.14	0.89	1.32	0.94		
	1.16	1.03	1.07	1.02	0.90	1.08	1.09		
	1.05	1.22	1.13	1.31	1.06	1.16	1.18		
N.R.C. period	0.98	0.82	0.95	0.84	0.72	0.85	0.72		
	0.88	0.85	0.86	0.91	0.66	0.78	0.64		
	0.82	0.72	0.86	0.91	0.74	0.85	0.70		
	0.89	0.84	0.86	0.91	0.63	0.75	0.70		
	0.99	0.85	0.77	0.91	0.62	0.84	0.71		
N.R.C.—10 mg period	0.86	0.69	0.94	0.85	0.67	0.69	0.75		
	0.82	0.88	0.79	0.76	0.66	0.71	0.83		
	0.81	0.68	0.82	0.93	0.71	0.69	0.83		
	0.84	0.72	0.81	0.85	0.65	0.88	0.59		
	0.63	0.79	0.84	0.79	0.70	0.71	0.68		
								Totals	Means†
Saturation total	5.37	5.05	5.36	4.97	4.40	5.61	5.43	36.19	1.03
N.R.C. total	4.56	4.08	4.30	4.48	3.37	4.07	3.47	28.33	0.81
N.R.C.-10 mg, total	3.96	3.76	4.20	4.18	3.39	3.68	3.68	26.85	0.77
Totals	13.89	12.89	13.86	13.63	11.16	13.36	12.58	91.37	.....
Means	0.93	0.86	0.92	0.91	0.74	0.89	0.84	.....	.....

* 1.17 — 0.97 = 0.20, significant.
0.97 — 0.92 = 0.05, significant.
† 1.03 — 0.81 = 0.22, significant.
0.81 — 0.77 = 0.04, not significant.

Table 11 (*Continued*). Significance of the Means for the Concentration of Ascorbic Acid in Plasma by Analysis of Variance

	Adolescent girls				Adolescent boys			
	Σx^2	Divisor	$\frac{\Sigma x^2}{\text{divisor}}$	Sum of squares	Σx^2	Divisor	$\frac{\Sigma x^2}{\text{divisor}}$	Sum of squares
Person	1,871.1654	15	124.7444	0.5483	1,198.2523	15	79.8834866	0.3741828
Period	5,024.7682	40	125.6192	1.4231	2,833.2275	35	80.9493571	1.4400533
Group	631.4882	5	126.2976	2.1015	407.5585	5	81.5117	2.0023962
Error	.....	.....	.....	0.6560	.....	.....	.....	0.8464
Total	126.9536	1	126.9536	2.7575	82.3581	1	82.3581	2.8487962
Correction	14,903.5264	120	124.1961	.....	8,348.4769	105	79.5093038	.....
Interaction sum of squares	.....	.....	.....	0.1301	.....	.....	.....	0.1882

Variation	Adolescent girls				Adolescent boys			
	Degrees of freedom	Sum of squares	Variance	F (variance ratio)	Degrees of freedom	Sum of squares	Variance	F (variance ratio)
Person	7	0.5483	0.0783286	11.46 significant	6	0.3741828	0.0623638	6.189 significant
Period	2	1.4231	0.7116	104.14 significant	2	1.4400533	0.7200267	71.4595 significant
Interaction	14	0.1301	0.0092929	1.36 not significant	12	0.1881601	0.0156800	1.5561 not significant
Error	96	0.6560	0.006833	.....	84	0.8464	0.010076	.....
Total	119	2.7575	.....	.....	104	2.8487962	.....	.....

Table 12. THE t TEST FOR LEAST SIGNIFICANT DIFFERENCE BETWEEN MEANS FOR THE CONCENTRATION OF ASCORBIC ACID IN THE PLASMA.

Girls' Studies

Least significant (5 per cent) difference between any two means of periods:

$$t_{.05}\sqrt{\frac{2(.006833)}{40}} \text{ with 96 degrees of freedom}$$

$$1.985\sqrt{\frac{2(.006833)}{40}} = 0.03670$$

Least significance (5 per cent) difference between any two means of persons:

$$t_{.05}\sqrt{\frac{2(.006833)}{15}} \text{ with 96 degrees of freedom}$$

$$1.985\sqrt{\frac{2(.006833)}{15}} = 0.05991$$

Boys' studies

Least significant (5 per cent) difference between any two means of periods:

$$t_{.05}\sqrt{\frac{2(.010076)}{35}} \text{ with 84 degrees of freedom}$$

$$1.989\sqrt{\frac{2(.010076)}{35}} = 0.047736$$

Least significant (5 per cent) difference between any two means of persons:

$$t_{.05}\sqrt{\frac{2(.010076)}{15}} \text{ with 84 degrees of freedom}$$

$$1.989\sqrt{\frac{2(.010076)}{15}} = 0.072897$$

Table 13. COMPARISON OF MEAN PLASMA ASCORBIC ACID VALUES OF BOYS AND GIRLS.

	Number of observations N	Mean x	Variance s^2	Degrees of freedom
Girls	120	1.0173	0.006833	96
Boys	105	0.8702	0.010076	84

$$t = \frac{x_1 - x_2}{\sqrt{\frac{s_1^2}{N_1} + \frac{s_2^2}{N_2}}}$$

$$t = \frac{1.0173 - 0.8702}{\sqrt{\frac{0.006833}{120} + \frac{0.010076}{105}}}$$

$t = 11.89$ with 84 degrees of freedom.