ASCORBIC ACID ELIMINATION BY COLLEGE WOMEN

Thesis for the Degree of M. S.
MICHIGAN STATE COLLEGE

Theodora L. Peck

1937

THESIS

Ascorbic acid

Home economics

ASCORBIC ACID ELIMINATION BY COLLEGE WOMEN

by

Theodora Letta Peck

A Thesis Submitted to the Faculty of
Michigan State College of Agriculture
and
Applied Science
in Partial Fulfillment of the Requirements
for the Degree of Master of Science

Department of Foods and Nutrition
Division of Home Economics

1937

ACKNOWLEDGMENT

The author wishes to express her sincere appreciation to Dr. Marie Dye and Miss Flora Hanning for their guidance and advice in the attainment of this problem; and to thank the college women who cooperated so willingly for obtaining the experimental data used in the problem.

Table of contents

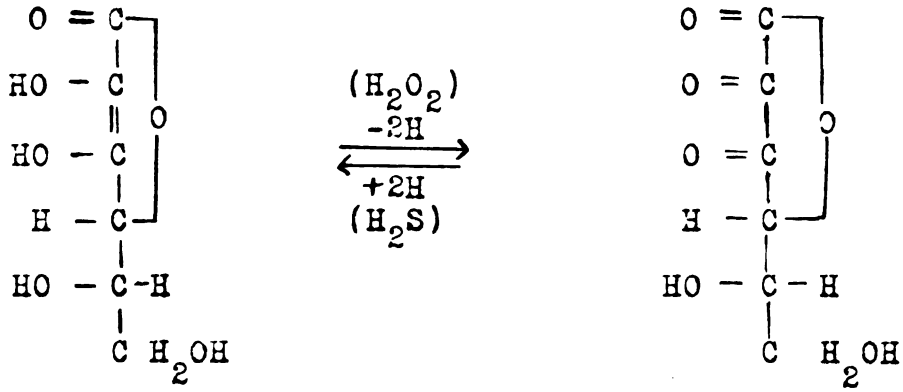
ASCORBIC ACID ELIMINATION BY COLLEGE WOMEN

Introduction

Vitamin C has long been known to be essential for human nutrition and has been identified as l-ascorbic acid. Recently much work has been done to develop methods of determining the state of vitamin C nutrition of an individual and to apply those methods in clinical studies. Scattered results have been obtained indicating the normal excretion of ascorbic acid and the relation of this to the state of vitamin C nutrition. However, these normal values have been obtained on only comparatively few persons and under few variations of conditions so that adequate information is not as yet available to set up absolute standards. Further studies must be made in order that there can be general clinical application of the knowledge. College women, representing age and income levels which have been little observed, form a desirable group for study because of the general uniformity of their living conditions and age. The present study of the urinary excretion of vitamin C by college women was planned to compare the values obtained for them with those obtained for other persons and to indicate factors which might influence the results.

Literature

Recent developments in the chemical tests for vitamin C date from its identification as l-ascorbic acid by Waugh and King (48) and by Svirbley and Szent-Gyorgyi (38). Further work confirmed the identity of the vitamin as a derivative of a six-carbon sugar which is easily oxidized to dehydroascorbic acid which is also biologically active. The following configurations have been accepted:



l-ascorbic acid (vitamin C)

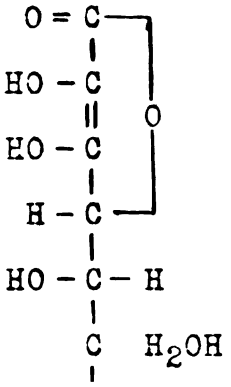
dehydroascorbic acid (reversibly oxidized form)

Chemical tests for it were soon developed. Tillmans and his associates (41) (42) (43) pointed out the close correlation between vitamin C biological assays on guinea pigs and the titration values with dichlorophenolindophenol, and developed a test involving quantitative reduction of this dye. Other methods of identification, all involving oxidation-reduction reactions, have been developed and are used with varying degrees of accuracy. Bezssonoff (36)

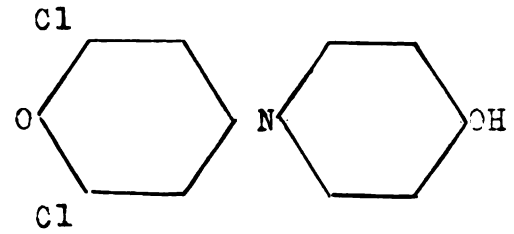
has used $MoO_3P_2O_5(NO_3)_{17}(H_2O_2)_4$ as a reagent although apparently it is less specific for ascorbic acid than the indophenol dyes. Tauber and Kleiner (39) use a ferricyanide titration method. The test used by Martini and Bonsignore (32) applies the reduction of methylene blue. Medes (33) advocates phospho-18-tungstic acid. Oxidation of iodine has been used by some workers although it reacts with many other reducing substances. Error is introduced into all of these methods because of the non-specificity of the testing reagent but the methods have been modified to decrease the error. Tauber and Kleiner (40) have prepared an enzyme from hubbard squash known as ascorbic oxidase, which is specific for ascorbic acid and they have developed a quantitative method for using it.

All of these methods are based upon an oxidation-reduction reaction and the most commonly used reagent is 2-6 dichlorophenolindophenol. This dye is blue in neutral or alkaline solution, red in acid solution, and the leucobase to which it is reduced by ascorbic acid is colorless. Therefore, when added to an acid medium containing ascorbic acid the solution will remain colorless until the ascorbic acid is used up. It will then turn red because of the excess dye in the acid medium.

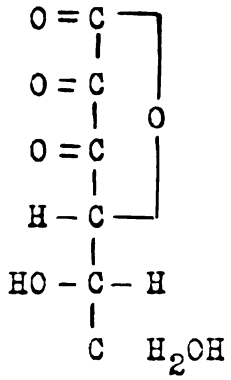
The reaction is shown by the following equation:



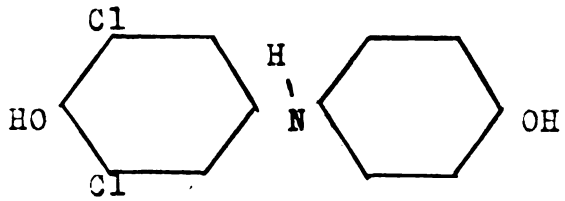
l-ascorbic acid



2-6 dichlorophenolindophenol



dehydroascorbic acid



Leucobase of 2-6 dichlorophenol-indophenol

The titration of ascorbic acid with 2-6 dichlorophenolindophenol as developed by Tillmans and his co-workers (41) (43) has been further modified by others to make it practical for routine use and to make it more specific for ascorbic acid. Birch, Harris, and Ray (9) were among the first to recognize the importance of maintaining an acid medium while titrating. Acidity aids in restricting the reaction with the dye of other substances such as glutathione and phenolic compounds. Ahmed (5) and Emmerie and Van Eekelen (14) found that trichloroacetic acid which had often been used does not

stablize the ascorbic acid well and in itself reduces the indicator more than acetic acid. In many substances ascorbic acid is found as dehydroascorbic acid or is changed into that form when prepared for determination. For testing these substances a method of reforming ascorbic acid by treatment with H_2S has been developed by Tillmans and coworkers (42). This fact was substantiated by Johnson (26) and further developed by Emmerie and Van Eekelen (14). The disadvantage of this method is that it is rigorous, undoubtedly producing other chemical changes, and requires a long period of treatment. Mercuric acetate may be used to precipitate interfering substances such as cysteine, ergothionine, and thiosulphate, in a method developed by Van Eekelen and Emmerie and coworkers (13) (44) (46) (47). Mercuric acetate treatment must be followed by H_2S as it reversibly oxidizes ascorbic acid to dehydroascorbic acid (14) (46).

Using dichlorophenolindophenol dye to determine ascorbic acid, experimenters have developed further modifications which may be applied in studying urinary excretion of ascorbic acid and the possible physiological significance of this excretion. Harris, Ray, and Ward (20) reported that the urine must be titrated immediately or within a short while after voiding to avoid destruction of the vitamin upon standing. If immediate titration is impossible preservation methods have been developed. The addition of

10% acetic acid is advocated by Harris and Ray (19); Bullowa, Rothstein, Ratisch, and Harde (11); Hawley, Stephens, and Anderson (23); O'Hara and Hauck (35); and Hess and Benjamin (25). Johnson and Zilva (27) and Everson and Daniels (15) used sulphuric acid and toluene as preservatives. The effectiveness of preservation is still debatable, since Burckhardt and Weister (12) reported 27 to 30 percent loss in four hours when the samples were prepared according to Harris's method. Harris himself (3) (19) does not advocate allowing the sample to stand for more than 12 hours. Preservation in dark bottles and at cold temperatures does much to prevent oxidation (3) (11) (44). Hawley and coworkers (22), collecting complete 24 hour specimens, reported less than 5% loss when the urine was stored with the addition of acetic acid and in dark brown bottles in an icebox. Musulin and King (34) reported that 2% metaphosphoric acid in addition to the acetic acid exerts a protective effect against atmospheric oxidation, even in the presence of copper. Kellie and Zilva (28) advocate the use of water redistilled from glass, since the presence of any metals during the procedure tends to catalyze the oxidation of ascorbic acid.

Van Eekelen, Emmerie, Josephy, and Wolff (46) stated that the ascorbic acid in urine is present only in the reduced form so that we may assume that treatment

with H_2S is not necessary unless the sample has stood or has been treated with mercuric acetate. Since interfering substances, namely cysteine, glutathione, ergothionine, and thiosulphate are present in urine, precautions must be taken either by removing them or by inhibiting their reaction with the dye. Van Eekelen (45) removed them with mercuric acetate. Abbasy, Harris, Ray, and Marrack (3) found that this nonspecific reduction titre is not ordinarily more than 3 to 6 mgm. daily out of a total of 20 mgm. reducing substance expressed as ascorbic acid. Most workers considered that this value would not vary considerably from day to day and therefore disregarded it. Everson and Daniels (15), working with children, reported that from their preliminary experiments approximately 3 mgm. ascorbic acid could be accounted for by these interfering substances. As mentioned above, titration in an acid solution will restrict the reaction of glutathione, which reduces the indicator in neutral solutions. Harris, Ray, and coworkers (3) (19) stated that these interfering substances are slower of reaction with ascorbic acid and do not interfere greatly if the titration is performed within 2 minutes. Emmerie (13) and Kohman (30) titrated to a pink coloration which persisted for 30 seconds, as a further means of standardizing the titration technique.

As chemical methods for determining the presence of

ascorbic acid have developed, many studies have been carried on with human beings. Urinary studies have been conducted in an attempt to learn about human metabolism and requirements of vitamin C. Van Eekelen (45), O'Hara and Hauck (35), and Johnson and Zilva (27) all have established the fact that ascorbic acid continues to be excreted even when the subject is on a vitamin C free diet, although both Van Eekelen (45) and O'Hara and Hauck (35) report that as the vitamin C free diet is continued the excretion gradually decreases. Values as low as 7 mgm. daily have been reported by Van Eekelen (45). This probably would indicate an endogenous source of the acid. Moreover, with the addition of vitamin C to the diet excretion continues at a low level, with possibly a slight increase, until suddenly a point is reached at which the tissues apparently become saturated and greatly increased excretion occurs. Johnson and Zilva (27) reported a study of one person, eating a winter diet in England, who reached this saturation point after ingesting 1485 mgm. ascorbic acid. O'Hara and Hauck (35) noted that after 29 to 30 days on a diet with 5 mgm. ascorbic acid daily, the ingestion of 2200 to 2800 mgm. taken over a period of 15 to 17 days produced this change. This point was characterized by a sudden excretion of 53 to 72% of the 200 mgm. intake administered on that day. They found that 1710 to 2181 mgm. had

not been accounted for in the urine and so must have been retained. Saturation studies of a similar nature have been reported by Archer and Graham (7); Johnson and Zilva (27); Van Eekelen (45); Hess and Benjamin (25); Harris and coworkers (19) (20); and Hawley and coworkers (22) (23). It was also found that when no further ascorbic acid was fed the excretion level dropped back to approximately the original level and rose again immediately with the ingestion of an increased dose of ascorbic acid. The amount of ascorbic acid needed to reach saturation seems to vary with the previous diet of the subject. These results all point to the probability of a storage of vitamin C by the tissues until they become saturated and an excretion of a large amount of the excess when this point is reached and indicate that a true picture of the state of saturation of a person could not be obtained by studying only urinary excretion results.

To apply a saturation method to clinical studies, Archer and Graham (7) advocate, as a test for vitamin C subnutrition, observation of the amount of ascorbic acid which must be administered in order to obtain a 75 percent output; Abbasy, Harris, and Hill (2) and Abbasy and Harris (1) and Abbasy, Hill, and Harris (4) in their studies on the effect of infection on vitamin C nutrition determined the state of saturation by finding the number of days of feeding a test dose before a definite, positive response

was observed. Ahmed (6), Hawley and coworkers (23) and Johnson and Zilva (27) all report that at saturation rapid excretion begins within 2 hours and continues for 3 to 7 hours after administration of the precipitating dose, and is followed by a slow return to normal at the end of 24 to 40 hours. Moreover, when a subject is depleted of vitamin C only a very slight response is observed in the few hours following a test dose of 100 to 200 mgm., irrespective of the method of administration.

The various investigators do not agree on excretion values which might be considered normal. This may possibly be due to variations in the nutritional state of the so-called "normal" persons being observed. Abbasy, Harris, Ray, and coworkers (1) (2) (4) (19) considered 13 mgm. excretion daily per 10 stone weight a minimum standard and obtained, in these studies, 20 to 40 mgm. per 10 stone weight for their normal controls. The minimum standard was determined as the level of ascorbic acid excretion assumed when 25 mgm., which they assumed to be the minimum adequate intake, was fed daily. This level was characterized by a good response to a test dose of 700 mgm. ascorbic acid on the first or second day of administration. Johnson and Zilva (27) reported normal values for subjects on a normal diet to be 10 to 15 mgm. daily for one subject but 80 to 150 mgm. daily for one subject who had been on a diet rather high in fruits and

vegetables. Hawley, Stephens, and Anderson (23) reported the excretion on a normal diet to be 15 to 28 mgm. daily; Ahmed (6) 23 to 35 mgm.; Van Eekelen (45) 9 to 27 mgm., O'Hara and Hauck (35) found that normal adult women on their usual diet had an average urinary excretion of 65 to 77 mgm. daily and that the excretion dropped to 6 to 14 mgm. after a 29 to 30 day period on a basal diet containing only 5 mgm. ascorbic acid. Harris and Ray (19) reported the average concentration of ascorbic acid in the urine, for adults, to be 0.02 to 0.03 mgm. per ml. but emphasized that the total daily output is more important than the concentration. Johnson and Zilva (27) found that diuresis did not affect the total excretion of ascorbic acid.

A variety of factors have been reported to affect the normal excretion values. Hawley, Frazen, Button, and Stephens (22) found, by using a constant diet varied only by the addition of NH_4Cl or $NaHCO_3$, that the excretion of ascorbic acid was lower when the urine was alkaline. They attributed this result either to greater storage and utilization of the acid or to its destruction in the urinary tract. Recently, working with guinea pigs, Hawley, Daggs, and Stephens (21) found an increased concentration of ascorbic acid in the adrenals and in the liver on a very alkaline diet. This might explain the decreased urinary output as being due to storage in the

tissues.

Bullowa, Rothstein, Ratisch, and Harde (11) found low excretions for pneumonia patients and observed that abnormally long periods were required to obtain indications of saturation after administering test doses. Abbasy, Harris, and Hill (2) reported excretions of only 9 to 15 mgm. daily by subjects with active osteomyelitis, as compared with 20 to 40 mgm. for normal controls. They found that the degree of subnormality of the vitamin C titre was roughly parallel to the severity of the infection. These cases did not respond well to a test dose of 700 mgm. ascorbic acid, even on the third or fourth day of administration, while the normal controls and healed cases of osteomyelitis responded on the first day. Abbasy and Harris (1) found that active cases of tuberculosis excreted 5 to 13 mgm. with an average of 7.6 mgm. and responded poorly to test doses. Similar results (1) (4) were obtained with both adult and juvenile rheumatism. Therefore, apparently low excretion may be caused by an infective condition which increases the body needs and depletes the tissue stores.

Ahmed (6) first reported, and it has been substantiated by Heinemann (24), that there was an increased reducing capacity of the urine when a diet rich in protein was fed. Heinemann showed in his experiments that this increased reducing capacity was due to the

presence of increased thiosulphate.

Certainly, as so many of these studies have indicated, the previous diet does influence the excretion values obtained for any one day. A person who has been on a diet liberal with vitamin C, which should mean a gradual approach to the saturation point, might be expected to excrete a large share of a test dose, whereas a person primarily on a meager diet would give more constant and lower level of excretion and would show little reflection of his intake. Abbasy, Harris, Ray, and Marrack (3) report that healthy adults, with a habitual level of 33 mgm. excretion, when given 600 mgm. ascorbic acid, excreted 161 mgm. or 27% of the dose; those with a habitual level of 14 mgm. excreted 35 mgm. or 6% of the dose; those with a habitual level of 8 mgm. excreted only 17 mgm. or 3% of the dose. They reported (4) that children with subnormal "resting levels" give correspondingly diminished responses to test doses. Yavorsky, Almaden, and King (49), in analyzing human tissue for ascorbic acid, reported an apparent correlation between the diet and the tissue content. Seasonal variations in vitamin excretion has been explained on the basis of diet differences, as Harris and Ray (19) and Johnson and Zilva (27) both report higher values on the same subjects in summer than in winter.

Lower excretions have been observed for both

adults and children among the poorer classes of society subsisting at lower economic levels. Harris, Abbasy, Yudkin, and Kelly (18) reported an average daily excretion of 10 mgm. daily by adults subsisting on a low economic level as compared with a minimum standard of 13 mgm. When 11 adult subjects whose home diet was not rich in fruit or vegetables were given daily supplements of 40 mgm. ascorbic acid as orange juice the excretion at equilibrium, after 35 days, was 25 to 29 mgm. In this economic factor, we can see the background of the influence of diet on the degree of saturation and the excretion.

Age seems to be a factor influencing the excretion of ascorbic acid. Harris and Ray (19) found the normal output for a young child to be 1 to 2 mgm. daily, per stone weight, as compared with 15 to 30 mgm. per 10 stone for an adult. They stated that the requirement per unit weight, as indicated by the retention and by the larger doses needed to produce saturation, were higher than that for adults, presuming young organism to have a greater call on nutritive material for growth. Hess and Benjamin (25) considered the excretion of ascorbic acid by the children tested to be so small as to be negligible, regardless of whether the children were fed a diet in which the vitamin was strongly excluded or one in which the vitamin was present in adequate amounts. They obtained appreciable excretion only after 4 days of feeding 1 pint of orange

juice daily. On the other hand, Everson and Daniels (15), working with 3 normal boys 39 to 59 months of age reported 10.6 mgm. excretion as their lowest value. Since they obtained their highest retention with the youngest child they concluded that possibly young tissues need more vitamin C than mature tissues. Yavorsky, Almaden, and King (49) reported that the ascorbic acid content of all tissues for persons under 10 years of age was higher than for those over 10 years of age.

The requirements for vitamin C still have not been satisfactorily defined. King (29) states that the minimum for adults is 40 mgm. daily and for infants 25 mgm.. Van Eekelen (45) states that it varies with the degree of saturation of the subject and advocates 60 mgm. daily for a 70 kg. person, basing this figure on the requirements to obtain saturation. Using similar methods, Heinemann (24) found 34 mgm. daily to be required. Harris and Ray (20) reported 25 mgm. ascorbic acid for an adult of 10 stone weight as the minimum adequate dose.

Gothlin (17), on the basis of capillary resistance tests stated that the smallest daily dose of ascorbic acid which, given orally, protects a person weighing 60 kg. against the slightest objectively ascertainable pre-scorbutic alterations, those in the capillaries, is 19 to 27 mgm. However, the reliability of the capillary resistance test has been questioned by O'Hara and Hauck

(35); Hawley, Stephens, and Anderson (23) and by Van Eekelen (45). Each of these workers found that, in their saturation studies, the capillary resistance tests did not give results corresponding to the state of saturation of the subject.

In none of the literature reports have large numbers of college students been the subjects for study of ascorbic acid excretion. This thesis problem, therefore, was planned to deal with that group.

In setti

ermules stud

he freshmen l

hm nder fai

roup of seri

mition or v

ositions. C

hases, four

m working;

hse, and one

rsen lived f

n two days o

height, w-igh

he winter mo

ll appeared

The c

period of

hentieth ce

he values o

ved the sub

instruction

ffecting re

ce a week

ips. Compl

Method

In setting up this study, two groups of home economics students were chosen, 20 freshmen and 18 seniors. The freshmen lived at one dormitory on the campus and therefore under fairly uniform living conditions. A similar group of seniors was not available. They were foods and nutrition or vocational majors who lived under a variety of conditions. Of these seniors, eight lived in sorority houses, four in apartments which permitted them to do their own cooking; three ate their meals in restaurants, two at home, and one at a boarding house. Eight of these senior women lived in the home management practice house for one or two days of the study. Information concerning age, height, weight, diet, and number of colds during the preceding winter was noted for each individual. The women selected all appeared to be in good health.

The collections of urine samples were all made within a period of seven weeks between May first and June twentieth so that seasonal variation should not influence the values obtained. Samples were not collected on days when the subject had a cold or minor infection or during menstruation. To prevent any one variable factor from affecting results too greatly the test days were chosen once a week for three weeks rather than for three successive days. Complete 24 hour specimens of urine were collected

from each subject for three individual days. In several instances, for personal reasons, this time interval was extended or decreased so that more or less than a week elapsed between collection periods. A record was kept of the time interval between voiding and titration in order to determine whether the difference in time affected the values obtained. No attempt was made to preserve the urine.

The students kept a qualitative record of their food intake for each day on which they were tested. The diet for this day was then evaluated roughly, using the tables for vitamin C in foods compiled by Sherman (37). For instance, he indicated orange juice as being 3 + value and potatoes 2 + . One serving of orange juice was then rated 3, a large glassful as 5; one serving of potatoes was rated as 2, hash as 1. In only a very few instances does he distinguish in his rating between cooked and raw foods. Other errors as well were presented in this method of scoring the diets but since they were consistently applied to both groups probably comparable values of vitamin C intakes were obtained.

The urine, after collection, was titrated as soon as possible. The dye, Eastman organic chemicals P3463, sodium 2-6 dichlorobenzenoneindophenol, had previously been purified by treatment with ether in a soxhlett

extraction apparatus until practically no color was extracted. 0.1 gm. dye was dissolved in several successive portions of boiling water and filtered, a total of 200 ml. water being used. It was then cooled, stored in a brown bottle, and used over a period of no more than three days, usually made up fresh daily. The dye was standardized by titrating it against samples of lemon juice whose ascorbic acid content had been determined by an iodine titration. Lemon juice has been shown to contain ascorbic acid as the only reducing substance so that the iodine value gives a true measure of the ascorbic acid (8). In the dye titration the same endpoint was used for the lemon as was used for the urine. Since, according to the League of Nations vitamin standards (31) 11.4 ml. N/100 iodine is equivalent to 10.0 mgm. ascorbic acid, the ascorbic acid equivalent of the dye could be determined. For instance, 2 ml. lemon juice required in titration 3.25 ml. dye and 0.90 ml. N/100 iodine. Therefore, $\frac{0.90 \times 10}{11.4}$ equals the number of mgm. ascorbic acid in 2 ml. lemon juice. This value divided by 3.25 equals the ascorbic acid equivalent of 1 ml. dye. The dye was standardized daily, using a red coloration lasting 30 seconds as the endpoint in each titration.

The urine to be tested, 20 ml. accurately pipetted,

w placed in

ter and 90 :

atosphere i

ure avail-

reliminary t

uld require

ild was dee

the bulb

ight. Titr

pe to the e

Tos

f the erro

rolling and

% loss occ

n a beaker

0 minutes

% metaphc

after vola

amples wi

was placed in a 125 ml. erlenmeyer flask with 30 ml. water and 20 ml. acid solution which contained 2% metaphosphoric and 8% acetic acid. If the quantity of urine available was too small for this size sample or if preliminary titration indicated that the 20 ml. sample would require too much dye, less urine was used and the acid was decreased accordingly. An artificial light with a blue bulb afforded a light of constant intensity day or night. Titrations were made in triplicate by adding the dye to the acid urine sample.

Tests were run to determine the probable extent of the error resulting from the time interval between voiding and titration. It was found that approximately 5% loss occurred after the sample stood in the laboratory in a beaker for 20 minutes; 12% in 40 minutes; and 24% in 60 minutes. This loss was reduced by the addition of a 2% metaphosphoric and 8% acetic acid solution.immediately after voiding. Only 15% loss was noted in the acidified samples which stood for one hour.

In the

rmer on whi

ng class; I

ercent vari

ul during t

ources; and

tual volume

erpreted, th

and the area

n the appr

record and

The e

ximum or e

n chart I

ariation

the only c

very close

represents

n by Harr

hildrid

line; the

the third

on the

chart

Ch

Results and Discussion

In the appendix are the protocols for each of the women on which are summarized the data obtained, including class; living arrangement; age; height; weight; percent variation from ideal weight; number of colds she had during the preceding winter; daily menus with vitamin scores; and summary of urinary results which includes the total volume for the day, the total mgm. ascorbic acid excreted, the average mgm. ascorbic acid per ml. urine, and the average minutes before titrating. Included also in the appendix are sample direction sheets and diet record and data sheets.

The excretion of ascorbic acid for the freshmen women on each of the three days is graphically presented in Chart 1. There seems to be relatively little variation for any individual from day to day, CF being the only one with a large variation while several were very consistent for the three days. The red line represents the minimum standard value of 13 mgm. as set up by Harris and Ray (19). Fourteen of the sixty individual values for these students fall below this line; twelve were more than 20 mgm. per day. The remaining thirty-four were within the level of 13 to 20 mgm. On the whole this group presents a picture of rather uniform and low ascorbic acid excretion.

Chart 2 is a graphic representation of the daily

Chart 1
Urinary Excretion of
Ascorbic Acid for 3 days
by 20 freshman women

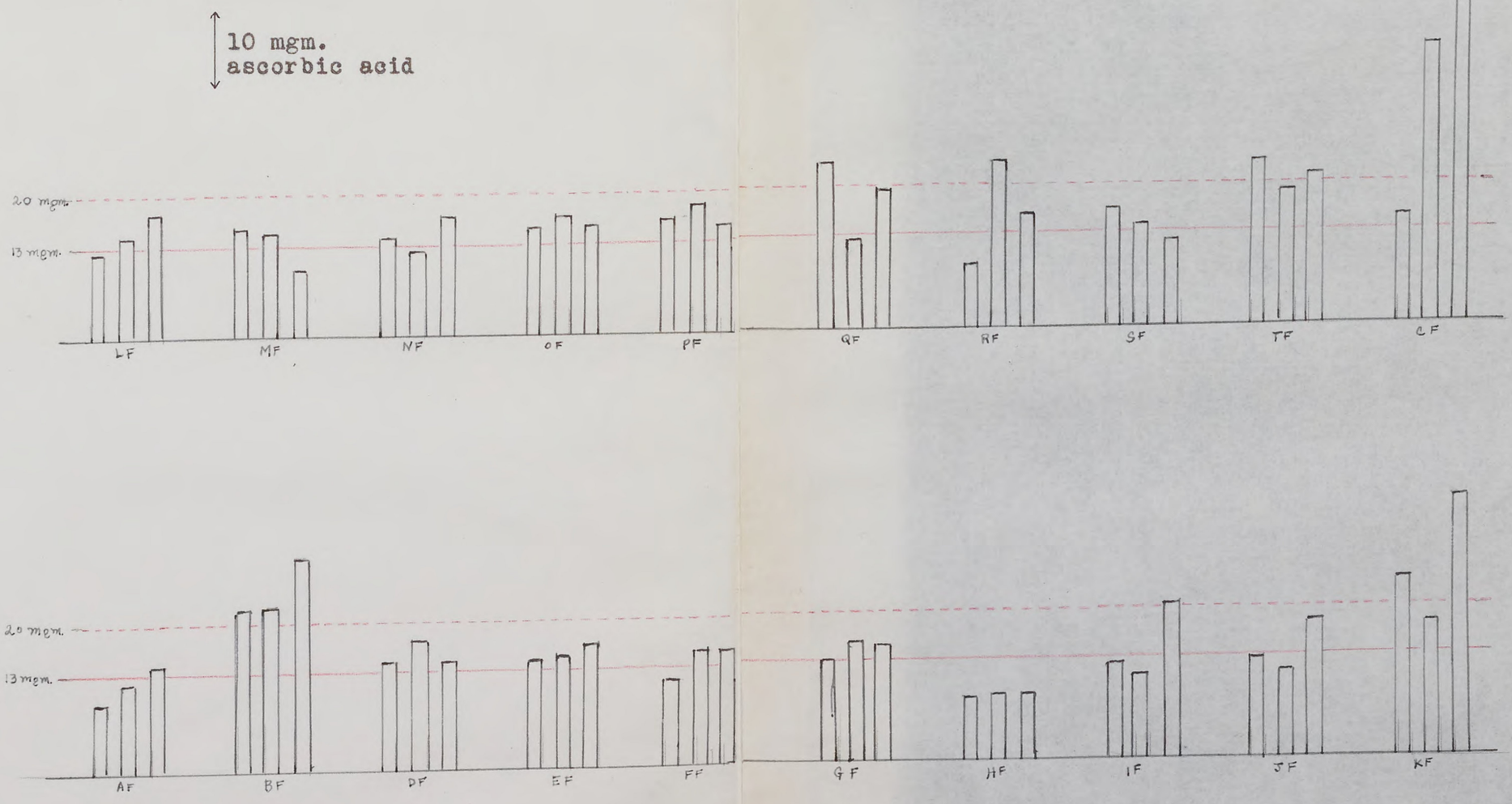


Chart 2
Urinary Excretion of
Ascorbic Acid for 3 days
by 18 Senior Women

↕ 10 mgm. ascorbic acid

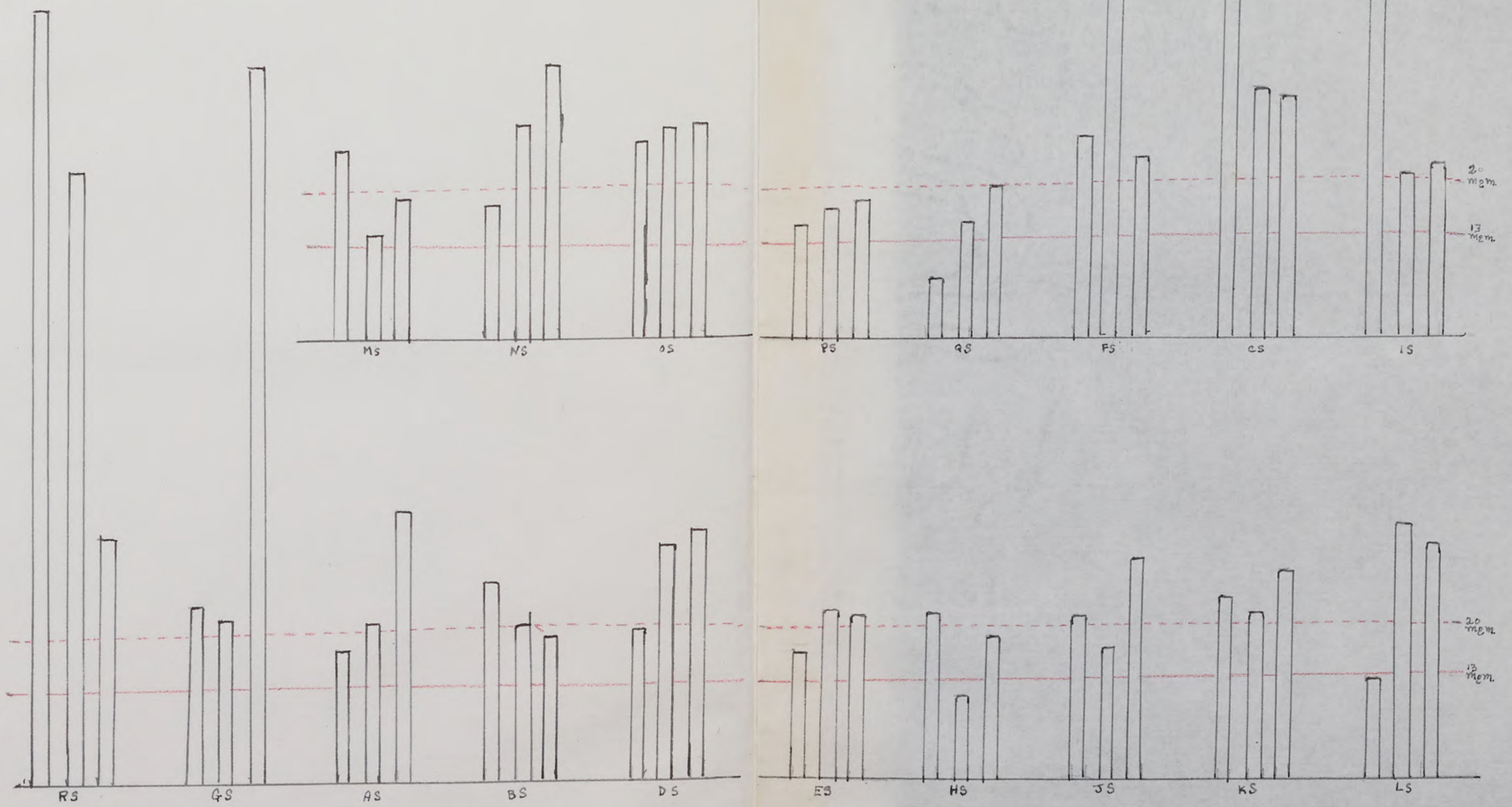
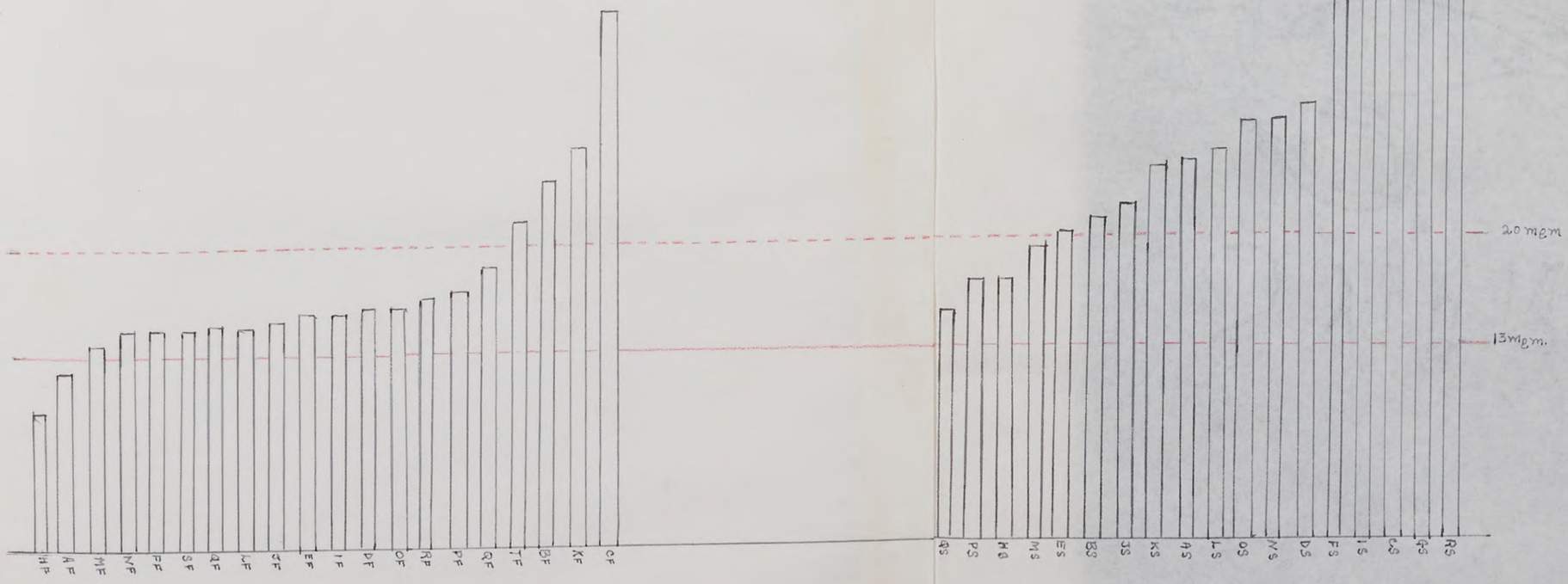


Chart 3
A Comparison of the Mean
Excretion of Ascorbic Acid
by each Woman in each Group



Freshmen

Seniors

unctions of th
nition is obs
ng for any one
ther maximum v
n 18 and 68. T
be observed only
is greater than
dividual days f
as compared with
the figures for
freshman, more t

Chart 3 pr
obtained from av
the women of th
lady, nine fre
and five senior

The data
on Table 1. T
verage of the
The average va
figure as give
350 ml., wi th
be a normal v
xcretion of
ximum stand
was obtained

excretions of the senior women. In general, much greater variation is observable between the values for individual days for any one student than were noted for the freshmen. Higher maximum values were shown, such as those obtained by RS and GS. These extraordinarily high values seem to be observed only in those students whose minimum excretion is greater than 20 mgm. Only two of the results for individual days fall below the minimum standard of 13 mgm. as compared with fourteen for the freshmen. On the whole, the figures for the seniors are higher than those for the freshmen, more than half of them being above 20 mgm.

Chart 3 presents a picture of the mean values obtained from averaging the three day results for each of the women of the freshman and the senior groups. Interestingly, nine freshmen average less than the lowest senior and five seniors average more than the highest freshman.

The data for the freshmen women are summarized on Table 1. The figure for each subject represents an average of the determinations made for three test days. The average volume, 972 ml. is slightly below the normal figure as given by Bodansky (10) who considers 1200 to 1500 ml., with still greater individual variations, to be a normal volume for adults. The average daily excretion of ascorbic acid 17.2 mg. is well above the minimum standard of 13 mg. but is below 20 mgm. which was obtained by Harris and Ray and coworkers (2) (19)

Table 1

Summary of Data of Ascorbic Acid in the Urine of Freshman Women with Corresponding Diet Scores

Subject	Weight of Subject	Average Time Before Titrating	Average Urine Volume	Average Daily Excretion Ascorbic Acid	Range of Ascorbic Acid Excretion	Extent of Range	Average mgm. ascorbic acid per ml. urine	Average mgm. ascorbic acid per kg. body weight	Average Vitamin C diet score	
	Kg.	Min.	Ml.	Mgm.	Mgm.	mgm.				
AF	50	37	856	11.684	8.912 - 14.376	5.464	0.0140	0.234	5.5	
BF	59	33	949	24.645	22.172 - 29.360	7.187	0.0270	0.418	10.2	
CF	47	35	769	35.629	15.738 - 51.435	35.698	0.0487	0.755	13.3	diet average 2 days
DF	57	42	736	15.729	14.575 - 17.720	3.155	0.0218	0.275	9.3	
EF	57	48	943	15.540	14.510 - 16.923	2.413	0.0173	0.274	10.3	
FF	61	61	1278	14.416	11.743 - 15.833	4.089	0.0123	0.237	10.2	
GF	65	64	904	14.623	13.143 - 15.516	2.374	0.0162	0.225	11.7	
HF	45	35	817	8.895	8.668 - 9.072	0.404	0.0109	0.196	6.8	
IF	59	48	600	15.547	11.617 - 21.742	10.125	0.0315	0.264	8.8	
JF	57	71	1087	15.161	12.078 - 19.575	7.497	0.0142	0.267	13.3	
KF	49		824	26.556	18.477 - 36.383	17.907	0.0437	0.542	9.8	
LF	70	51	919	14.658	12.025 - 17.778	5.753	0.0159	0.209	6.3	
MF	59	55	602	13.436	9.685 - 15.863	6.178	0.0221	0.228	10.5	
NF	44		851	14.319	12.128 - 16.950	4.822	0.0170	0.325	6.5	
OF	59	55	889	15.847	15.207 - 16.964	1.757	0.0179	0.269	11.2	
PF	57		1280	16.924	15.829 - 18.532	2.703	0.0140	0.299	10.3	diet average 2 days
QF	64	47	986	18.645	11.825 - 23.707	11.882	0.0186	0.294	10.2	
RF	57		1424	16.505	9.803 - 23.507	13.704	0.0116	0.289	9.8	
SF	47	30	875	14.598	12.394 - 16.958	4.565	0.0172	0.313	10.7	
TF	51	55	1841	21.626	19.779 - 23.860	4.081	0.0118	0.422	11.8	
Mean	56	48	972	17.249	13.515 - 26.103	7.587	0.0202	0.317	9.8	

Averages are for the three tests on one individual in all cases.

Table II

Summary of Data of Ascorbic Acid in the Urine of Senior Women with Corresponding Diet Scores

Subject	Weight of Subject	Average Time Before Titrating	Average Urine Volume	Average Daily Excretion Ascorbic Acid	Range of Ascorbic Acid Excretion	Extent of Range	Average mgm. ascorbic acid per ml. urine	Average mgm. ascorbic acid per kg. body weight	Average Vitamin C diet score	
	Kg.	Min.	Ml.	Mgm.	Mgm.	mgm.				
AS	57	73	903	25.499	18.017 - 37.156	19.139	0.0312	0.450	10.3	
BS	62	80	1227	22.604	19.758 - 26.968	7.210	0.0207	0.366	7.8	
CS	61	31	759	44.283	32.443 - 66.398	33.955	0.0761	0.723	6.5	diet average 2 days
DS	63	42	1237	28.921	20.467 - 34.120	13.654	0.0231	0.462	9.0	
ES	69	54	1235	20.608	17.178 - 22.640	5.462	0.0167	0.299	8.0	
FS	54	52	1039	36.299	24.729 - 56.635	31.905	0.0351	0.678	9.2	
GS	54		1296	47.863	22.262 - 97.265	75.003	0.0338	0.894	8.3	
HS	73	40	596	17.745	11.058 - 22.387	11.329	0.0295	0.245	10.7	
IS	63	47	1514	37.744	22.032 - 67.608	45.577	0.0333	0.599	10.5	
JS	73		1395	22.928	17.410 - 29.941	12.531	0.01640	0.316	10.5	
KS	59	24	2486	24.839	21.949 - 28.008	6.059	0.0102	0.421	9.8	
LS	58		856	26.412	13.059 - 34.722	21.663	0.0357	0.455	9.7	
MS	48	29	835	19.575	14.285 - 25.096	10.812	0.0232	0.407	8.8	
NS	54	31	747	28.178	18.498 - 37.318	18.821	0.0385	0.526	9.0	
OS	64	51	1111	28.102	26.961 - 28.985	2.024	0.0268	0.436	10.0	
PS	53	28	1076	17.469	15.399 - 19.166	3.767	0.0165	0.329	13.7	
QS	73	63	600	15.404	8.371 - 21.993	13.622	0.0263	0.212	11.8	
RS	57	38	926	74.126	33.918 -105.120	71.203	0.0775	1.307	12.3	
Mean	61	46	1102	29.922	19.8773- 43.3079	22.430	0.0317	0.507	9.8	

Averages are for the three tests on one individual in all cases.

for their normal controls. As observed on Chart 1, the extent of the range for any one person is relatively small, averaging 7.6 mgm. The average mgm. ascorbic acid per ml. urine is 0.02, within the usual limits set up by Harris and Ray (19) but some of the individual values are very low. The diets range, in scoring, from 5.5 to 13.3 units, averaging 9.8. Moreover, there seems to be no correlation between the diets recorded and the ascorbic acid excretion. The time which elapsed before titration, averaging 47.9 minutes is slightly higher than would be desirable. This table of the individual average records gives the same picture as that of Chart 1, namely rather uniform but low vitamin C excretion, not correlated with the diet scores.

The data for the senior women are summarized in Table 2. Here we find an average volume of 1102 ml. which is more nearly within the normal range. The average daily excretion of ascorbic acid, 29.9 mgm. is well above both the minimum standard and the average normal level of 13 mgm. and 20 mgm. respectively. None of the women averaged less than 13 mgm. and only four of them less than 20 mgm. which would designate them as being within the normal limits. The extent of the range, average 22.4 mgm., is much higher than 7.6 mgm. observed for the freshmen. In two instances, GS and RS, the extent was over 70 mgm. and in six cases it was over 20 mgm. Although no criteria have been set

up according to the extent of the range, it is not unlikely that those persons reflecting such large variations would be considered to be in a good state of saturation with high excretions from an exogenous source. No correlation, for the seniors, could be observed between the diet and the excretion values obtained, nor between the diet and the extent of the range. This might have been due to a carry-over excretion in the urine from the previous day's diet, or it might have been due to other conditions such as the state of health. The mgm. ascorbic acid per ml. urine, average 0.03 mgm., is at the upper limits of the normal 0.02 to 0.03 recorded by Harris and Ray (19). Since figures as high as 0.07 mgm. per ml. are recorded in this study this normal value is exceeded considerably. These high figures were associated with the women excreting the largest total amount of ascorbic acid, correspondingly high volumes did not seem to accompany low average values per ml. The average time before titrating, 46 minutes, is only 2 minutes less than that for the freshman women. The average diet score of 9.8 units is the same as that of the freshmen and covers approximately the same range, 6.5 to 13.7 units. The average excretion of 0.51 mgm. ascorbic acid per kg. body weight is considerably more than the 0.32 reported for the freshmen.

Much of this data, for freshmen and seniors, is

grouped side by side in Table 3 to aid in making comparison easier. The most outstanding feature, as shown by these results, is the marked difference in the average mgm. ascorbic acid excreted daily by the freshmen and by the seniors. The freshmen averaged 17.2 mgm. while the seniors average 29.9 mgm.

Various factors were examined in an effort to see how they might have influenced the values for each group and so explain the differences obtained. A difference in age was probably the most absolute and noteworthy difference between the two groups and might offer an explanation for the excretion differences. However, since the two groups were not comparable in age it was impossible to determine whether or not this was an influencing feature in the excretions. There was a discernable increase in the excretions as the age advanced but this might have been due to other factors which influenced the two groups differently.

The state of health of the two groups was gauged roughly by the percent each woman varied from her ideal weight and by the number of colds which she had during the previous winter, as recorded in Table 3. The freshmen averaged 1.2 percent underweight as compared with 3.4 percent overweight for the seniors. The freshmen averaged 1.8 colds for the winter and the seniors 1.2. This difference was felt to be of no importance because it was determined from subjective judgments which would be only roughly accurate.

Table 3

Comparison of Date
for Freshman and Senior Women

Subjects				Urinary Results		
		Freshmen	Seniors		Freshmen	Seniors
Number of Subjects		20	18	Volume ml.	972	1102
Age	yr.	18.5	21.7	Average time before titrating-minutes	48	46
Height	in.	64	64.9	Average daily excretion ascorbic acid - mgm.	17.25	29.92
Weight	kg.	56	61	Average ascorbic acid per ml. urine - mgm.	0.02	0.03
Average percent of ideal weight		-1.15	+3.37	Average ascorbic acid per kg. body weight - mgm.	0.32	0.51
Average number of colds		1.8	1.2			
Average Vitamin C score of diet		9.8	9.8			

Too little variation in height between the group was reported to influence the results.

There was possibility that dietary habits might influence the results. Interestingly enough, the average diet scores for the two groups were the same, 9.8 units. Moreover, there seemed to be no regular correlation either within the separate groups or in the entire group between the diet values and the urinary excretion of ascorbic acid.

The average volume of the senior women is greater than that for the freshmen, 1102 ml. as compared with 972 ml. This should not influence the results, since Johnson and Zilva (27) and Van Eekelen (45) report no effect of diuresis or of urine volume on the total daily excretion of ascorbic acid.

Since Harris and Ray determined their excretion values on the basis of a common unit of weight, the stone (10 stone for adults) it was thought that possibly more uniformity could be obtained in this study by converting the values obtained to mgm. ascorbic acid per kg. body weight. When this was done the results seemed to magnify rather than to diminish the difference between the two groups. An average of 0.5 mgm. per kg. was observed for the seniors and 0.3 for the freshmen.

The average interval of the time between voiding and titration for each of the groups is not significantly different, 46 minutes for the seniors and 48 for the

freshmen. According to the preliminary experiments which had been run to test the importance of this period of time, we would expect that this would indicate a probable error of about 12%, on the average, for the values obtained. The 2 minute difference between the two groups is within the errors of recording. This time interval before titration was probably one of the most important sources of error. During the daytime it was relatively short, 10 to 30 minutes as a rule, depending on the number of specimens supplied at the same time which must wait their turn for titrating. Any specimens which were titrated in less than 15 minutes were cooled under the cold water tap. The late evening specimens, especially those of the freshmen, were held longer before titration, since considerable time was consumed in the mere routine of collecting the bottles from the dormitory and preparing the samples for titration. Because of the irregular rising hours and because of the time required to collect the bottles it was felt that there would be no advantage to collecting the morning samples from the dormitory. The women brought them on their way to class. There was a continual problem of bad memories which increased the time interval in several instances and which accounted for the questionable time of voiding in others. Subjects JF and GS both had specimens in the middle of the night of one of the days, as indicated on the protocol in

the appendix. These are the only instances recorded.

In considering the accuracy of the method several questions come up. Although we have no absolute guarantee of the completeness of these 24 hour specimens we feel quite certain that they are complete. The women were impressed with the futility of collecting incomplete specimens and in instances where there was a loss of one or more of the samples they reported the loss and repeated the test. Total reducing capacity has been used in this study for computing the excretion of ascorbic acid. We have assumed, as have other workers (15) (35) that these substances would remain constant enough for any one person and within the entire group as not to affect the results. The inaccuracies due to the time interval have been discussed but are believed not to have produced a very profound influence on the comparative results. The diet score does not consider the diet of the previous day which might distort the results in those rare instances when the subject ate a considerable portion of vitamin C rich food late in the evening before the test day.

Certain statistics have been determined on the data of the urine excretion to aid in interpretation and are recorded in Table 4. The greater variability of the seniors is indicated here again, by a greater average extent of range, a higher standard deviation and coefficient of variability. This is especially marked when the mean

Table 4

Statistical Values Determined of Ascorbic Acid Excretion

	Freshmen	Seniors
Average ascorbic acid excreted daily - mgm.	17.25	29.92
Range of ascorbic acid excretion - mgm.	8.67-51.44	8.37-105.12
Average extent of range - mgm.	7.59	22.43
Median - ascorbic acid excretion - mgm.	15.35	25.96
Standard deviation-mgm.	7.74	20.11
Coefficient of Variability %	41.3	67.2

excretion per day is compared with the standard deviation as; freshmen mean 17.25 ±7.74; seniors mean 29.92 ±20.11. According the Fisher (16), Table 4, this is a significant difference with a probability of less than 1 in 100 that the two would be in the same group. It does not seem feasible to determine the correlation values between the various other factors, discussed.

CONCLUSIONS

In summarizing the results obtained in a study of the ascorbic acid elimination by college women the following conclusions could be drawn:

1. The freshmen students, with a mean excretion value of 17.2 mgm. ±7.74 ascorbic acid daily were within the range considered normal by most experimenters. However, they showed rather low but uniform ascorbic acid elimination.
2. The senior students, with a mean excretion of 29.9 mgm. ±20.11 ascorbic acid daily were within the range considered normal by most experimenters. They showed greater daily variation than the freshmen.
3. The diets consumed on the test days were rated for their vitamin C content and were similar.
4. No significant relationship was observed between age, state of health, or weight, and the excretion of ascorbic acid.

BIBLIOGRAPHY

1. Abbasy, M.A., and L. J. Harris 1937 Excretion of vitamin C in pulmonary tuberculosis and rheumatoid arthritis. Lancet vol. 233, p. 181.

2. Abbasy, M.A., and L. J. Harris, and N. G. Hill 1937 Excretion of vitamin C in osteomyelitis. Lancet vol. 233, p. 177.

3. Abbasy, M. A., L. J. Harris, S. N. Ray, and J. R. Marrack 1935 Diagnosis of vitamin C subnutrition by urine analysis. Lancet vol. 229, p. 1399.

4. Abbasy, M. A., N. G. Hill, and L. J. Harris 1936 Vitamin C and juvenile rheumatism with some observations on vitamin C reserves in surgical tuberculosis. Lancet vol. 231, p. 1413.

5. Ahmed, B. 1935 Observations on the chemical method for estimation of vitamin C. Biochem, J., vol. 29, p. 275.

6. Ahmed, B. 1936 Observations on the excretion of vitamin C in human urine. Biochem, J., vol. 30, p.11.

7. Archer, H. E., and G. Graham 1936 Some observations on the excretion of ascorbic acid. Lancet vol. 230, p. 710.

8. Bessey, O. A., and C. G. King 1933 The distribution of vitamin C in plant and animal tissue and its determination. J. Biol. Chem., vol. 103, pp. 687-698.

9. Birch, T. W., L. J. Harris, and S. N. Ray 1933 A microchemical method for determining the hexuronic acid (vitamin C) content of foodstuffs etc. Biochem, J., vol. 27, p. 590.

10. Bodansky, M. 1930 Introduction to Physiological Chemistry. Second edition. Johns Wiley and Sons Inc., New York.

11. Bullowa, J. G., I. A. Rothstein, H. D. Ratish, and E. Harde 1936 Cevitamic acid excretion in pneumonias and some other pathological conditions. Proc. Soc. Exp. Biol. Med. vol. 34, p. 1.

12. Burckhardt, J. L. and F. Weister 1936 Vitamin C excretion in tuberculous children. Schweiz. med. Wochenschr. vol. 66, p. 832 Abst. in Nutr. Abst. and Reviews vol. 6, p. 793.

13. Emmerie, A. 1934 Separation of cysteine from ascorbic acid with mercuric acetate. Biochem. J., vol. 28, p. 268.

14. Emmerie, A. and M. Van Eekelen 1934 The chemical determination of vitamin C with removal of interfering reducing and colored substances. Biochem. J., vol. 28, p. 1152.

15. Everson, G. J., A. L. Daniels, F. I. Scoular, and M. F. Deardoff 1936 Vitamin C studies with children of preschool age. J. Nutr., vol. 12, p. 15.

16. Fisher, R. A. 1936 Statistical methods for research workers. Oliver and Boyd, London.

17. Gothlin 1934 Human requirements of dietary ascorbic acid. Nature vol. 134, p. 569.

18. Harris, L. J., M. A. Abbasy, J. Yudkin, and S. Kelly 1936 Vitamins in human nutrition- vitamin C reserves of subjects of the voluntary hospital class. Lancet vol. 230, p. 1483.

19. Harris, L. J., and S. N. Ray 1935 Diagnosis of Vitamin C subnutrition by urine analysis. Lancet vol. 228, p. 71.

20. Harris, L. J., S. N. Ray, and A. Ward 1933 The excretion of vitamin C in human urine and its dependence on the dietary intake, Biochem. J., vol. 27, p. 2011.

21. Hawley, E. E., R. C. Boggs, and D. J. Stephens 1937 The affect of administration of acid and alkaline salts upon the ascorbic acid content of guinea pig tissues. J. Nutri., vol. 14, p. 1.

22. Hawley, E. E., J. P. Frazen, L. L. Button, and L. J. Stephens 1936 The effect of administration of sodium bicarbonate and of ammonium chloride on the amount of ascorbic acid found in urine. J. Nutr., vol. 12, p. 215.

23. Hawley, E. E., D. J. Stephens, and C. Anderson 1936 Excretion of vitamin C in normal individuals following a comparable quantitative administration in the form of orange juice, cevitamic acid by mouth and cevitamic acid intravenously, J. Nutr., vol. 11, p.135.

24. Heinemann, M. 1936 On the relation between diet and urinary output of thiosulphate (and ascorbic acid) 2. Human requirements for vitamin C. Biochem, J., vol. 30, p. 2299.

25. Hess, A. F and H. K. Benjamin 1934 Urinary excretion of vitamin C. Proc. Soc. Exp. Biol. and Med., vol. 31, p. 855.

26. Johnson, S. W. 1933 The regeneration of the reducing properties of oxidized lemon juice. Biochem, J., vol. 27, p. 1287.

27. Johnson, S. W. and S. S. Zilva 1934 The urinary excretion of ascorbic and dehydroascorbic acids in man. Biochem, J., vol. 28, p. 1393.

28. Kellie, A. E. and S. S. Zilva 1935 The catalytic oxidation of ascorbic acid. Biochem, J., vol. 29, p. 1028.

29. King, C. G. 1936 Vitamin C, ascorbic acid. Physiol. Rev., vol. 16, p. 238.

30. Kohman, 1937 The chemical determinations of vitamin C-ascorbic acid in tomatoes and tomato juice. Personal paper to F. Hanning.

31. League of Nations 1934 Second conference on vitamin standardization. Quart. Bul. Health. Org., vol. 3, p. 428.

32. Lund, H. and H. Lieck 1936 A specific reaction for the qualitative and quantitative determination of ascorbic acid in serum. Nature vol. 137, p. 784.

33. Medes, G. 1935 Determination of ascorbic acid in urine with phospho 18 tungstic acid. Biochem, J., vol. 29, p. 2251.

34. Musulin, R. R. and C. G. King 1936 Metaphosphoric acid in the extraction and titration of vitamin C. J. Biol. Chem., vol. 116, p. 409.

35. O'Hara, P. H. and H. A. Hauck 1936 Storage of vitamin C by normal adults following a period of low intake. J. Nutr., vol. 12, p. 412.

36. Rohmer, P., U. Sanders, and N. Bezssonoff 1934 Synthesis of vitamin C by infants. Nature vol. 134, p. 142.

37. Sherman, H. C. 1937 Chemistry of food and nutrition. 5th edition The MacMillan Company, New York

38. Svirbley, J. L. and A. Szent-Gyorgyi 1932 The chemical nature of vitamin C. Biochem, J., vol. 26, p. 865.

39. Tauber, H. and I. S. Kleiner 1935 A method for quantitative determination of ascorbic acid (vitamin C). J. Biol. Chem., vol. 108, p. 563.

40. Tauber, H. and I. S. Kleiner 1935 Isolation of a specific ascorbic acid (vitamin C) oxidase. Proc. Soc. Exp. Biol. Med., vol. 32, p. 577.

41. Tillmans, J., P. Hirsch, and J. Jackisch 1932 Reducing capacity of plant foodstuffs and its relation to vitamin C. Z. Untersuch Lebenson vol. 63, p. 241 Abst. in Chem. Abst. 1932 vol. 26, p. 5619.

42. Tillmans, J., P. Hirsch, and W. Hirsch 1932 Reduction capacity of plant foodstuffs and its relation to Vitamin C. Reducing substances in vitamin C. Z. Untersuch Lebenson vol. 63, p. 1. Abst. in Chem. Abst., 1932 vol. 26, p. 5324.

43. Tillmans, J., P. Hirsch, and H. Dick 1932 4. Reversibility of the oxidation of the reducing substance in lemon juice. Z. Untersuch Lebenson vol. 63, p. 267 Abst. in Chem. Abst. 1932 vol. 26, p. 5619.

44. Van Eekelen, M. 1935 Ascorbic acid and thiosulphate in urine. Nature vol. 135, p. 37.

45. Van Eekelen, M. 1936 On the amount of ascorbic acid in blood and urine. The daily human requirements for ascorbic acid. Biochem, J., vol. 30, p. 2291.

46. Van Eekelen, M., A. Emmerie, B. Josephy, and L. K. Wolff 1933 Vitamin C in blood and urine Nature vol. 132, p. 315.

47. Van Eekelen, M. and A. Emmerie 1936 Some critical remarks on the determination of ascorbic acid. Biochem, J., vol. 30, p. 25.

48. Waugh, W. A. and C. G. King 1932 Isolation and identification of vitamin C. J.Biol.Chem.,vol.97, p.325.

49. Yavorsky, M., P.Almaden, and C.G. King 1934 The vitamin C content of human tissues. J.Biol.Chem., vol.106,p.525.

APPENDIX

DIRECTIONS FOR VITAMIN C STUDY

Collecting specimens

The vitamin C determination must be made on single specimens immediately after voiding. Therefore, if at all possible, we are asking that it be taken in the Home Economics building in the utensils provided there. On the day on which the study is being made the first specimen in the morning, immediately after arising, at 7 A.M. approximately, is discarded but all thereafter are saved, through the 7 A.M. specimen of the next day. All are saved separately for testing and should be brought to me immediately. Someone will be in the Home Economics building to take care of the last specimen before retiring. At that time a utensil will be provided in which any other night samples and the first sample of the next morning (7 A.M.) may be saved and brought to the building at 8 o'clock.

The test is of no value if any specimen during the day is not saved. Therefore, please cooperate by saving them all. Suitable labels will be provided for the containers on which you may put your name, the time, and the time of the last meal. If possible we would like to have the specimens taken at about the same time for each of the days.

Record of meals

We would also like to have a general idea of your meals for the day. For these to be of any value they must be accurate, so please record them carefully. For instance, if you had a candy bar or coca cola between meals, or if you did not eat one of your meals, please indicate accordingly. We would prefer that the meals be as nearly as possible typical of your usual meals.

In recording your meals please tell in a general way how much of a given food you had, and whether it was raw or cooked. For instance-

Breakfast 7:30
- Orange juice - ½ cup
- egg - 1
- toast with butter and jam - 2 slices
- coffee with cream and sugar

Between meals 10 o'clock
- 1 chocolate candy bar

Lunch
- cheese sandwich - 1
- milk - 1 glass
- fruit salad - fresh

Dinner 6 o'clock
- ham - 1 slice
- potatoes - 1 serving
- peas, canned, 2 servings
- celery - raw
- chocolate pudding-1 serving
- coffee with cream and sugar

Evening 10 o'clock
- crackers and milk (1 glass)

INDIVIDUAL RECORDS

NAME

AGE

HEIGHT

WEIGHT

COLLEGE ADDRESS

COLLEGE COURSE

YEAR IN COLLEGE

OTHER INFORMATION

RECORD OF MEALS

NAME

DATE

Breakfast Time

Between meals Time

Noon Time

Between meals Time

Dinner, evening Time

Between meals Time

Identification

A.F.; freshman; Ate at dormitory;
18 yrs., age; 64 inches, height; 110 pounds, weight;
-10.6% of ideal weight 3 colds during past winter

Diet Record and Vitamin C Score for Each Day

May 26 Foods	Score	June 8 Foods	Score	June 9 Foods	Score
No breakfast		No breakfast		No breakfast	
Pineapple Ice		Potato chips		Corn chowder	½
Hash	1	Cold ham		Hash	1
Rye bread		Vegetable soup	1	Carrot-raisin) salad	1
Crackers		Crackers		Milk	1
Jello fruit salad	1	Sweet rolls			
Milk	1				
Meat balls		Corned beef		Beef with carrot gravy	
Potatoes	2	Potatoes	2	Potatoes	2
Corn	1	Cabbage	1	Poppy seed rolls	
Bread		Peaches	1	Jello	
Graham cracker) pudding		Rolls			
Total score	6	Total score	5	Total score	5½

Summary of Results for Each Day

Date	Total Volume of Urine	Total mgm. ascorbic acid excreted	Average mgm. ascorbic acid per ml. urine	Average minutes before titrating	Vitamin C score of diet
5/26	550	8.9123	0.01620	44	6
6/8	936	11.7633	0.01257	29	5
6/9	1081	14.7759	0.01330	38	5.5
Average	855.7	11.4840	0.01402	37	5.5

Identification

B.F.; freshman; Ate at dormitory;
18 yrs. age; 67 inches, height 130 pounds, weight;
-3.0% of ideal weight 1 or 2 colds during past winter

Diet Record and Vitamin C Score for Each Day

May 25 Foods	Score	June 7 Foods	Score	June 8 Foods	Score
Grapefruit	3	Grapefruit	3	Grapefruit	3
Toast		Toast		Toast	
Cocoa	1	Cocoa	1	Cocoa	1
Stew		Lima beans	1	Cold sliced ham	
Whole wheat roll		Bread		Potato chips	
Lettuce salad	1	Strawberry short cake	1	Lettuce salad	1
				Bread & butter	
Roast beef		Swiss steak		Devilled eggs	
Mashed potatoes	2	Mashed potatoes	2	Potato salad	2
Asparagus	2	Rolls & butter		Vegetable bowl	2
Rolls		Fruit cup	2	Baked beans	
Strawberry ice cream	½	Marble cake		Creamed asparagus	2
				Ice cream	
				Peanut butter cookies	
Total score	9½	Total score	10	Total score	11

Summary of Results for Each Day

Date	Total Volume of Urine	Total mgm. ascorbic acid excreted	Average mgm. ascorbic acid per ml. urine	Average minutes before titrating	Vitamin C score of diet
5/25	1060	22.1723	0.02092	32	9.5
6/7	1007	22.4034	0.02225	35	10
6/8	779	29.3595	0.03769	32	11
Average	948.7	24.6451	0.02695	33	10.2

Identification

C.F.; freshman; Ate at dormitory
18 yrs., age; 61 inches, height; 104 pounds, weight;
-8.8% of ideal weight; 2 or 3 colds during past winter

Diet Record and Vitamin C Score for Each Day

June 2	June 7		June 9	
No diet record	Foods	Score	Foods	Score
	Grapefruit	3	Orange	3
	Branflakes		Branflakes	
	Toast		Toast	
	Milk	1	Cocoa	1
	Vegetable soup	1	Pea soup	½
	Hash	1	German potato salad	2
	Brown bread		Brown bread	
	Strawberry short) cake	1	Orange salad	2
	Milk	1	Milk	1
	Beef		Roast beef & gravy	
	Potatoes	2	Mashed potatoes	2
	Asparagus	2	Asparagus	2
	Sticky rolls		Rolls	
	Fruit cup cake		Jello with fruit	1
	Tea		Tea	
	Total score	12	Total score	14½

Summary of Results for Each day

Date	Total Volume of Urine	Total mgm. ascorbic acid excreted	Average mgm. ascorbic acid per ml. urine	Average minutes before titrating	Vitamin C score of diet
6/2	573	15.7375	0.02747	36	no record
6/7	521	39.7154	0.07623	42	12
6/9	1213	51.4353	0.04240	28	14.5
Average	769	35.6294	0.04870	35.3	13.3

Identification

D.F.; freshman; Ate at dormitory
18 yrs., age; 64 inches, height; 126 pounds, weight;
+2.4% of ideal weight 2 or 3 colds during past winter

Diet Record and Vitamin C Score for Each Day

May 25 Foods	Score	June 8 Foods	Score	June 9 Foods	Score
1 glass tomato) Juice	3	No breakfast		No breakfast	
Bran with milk				1 mint jelly) sandwich	
1 glass milk	1			3 cookies	
Carrots	1	Carrots	1	Hash	1
Beans	2	Spinach	2	Rye bread	
Apricot marshmallow) salad	½	Potatoes	2	Orange salad	2
2 Crackers		Rye bread		1 Glass chocolate) milk	1
Rye bread		Banana salad	2		
1 Glass milk	1	1 Glass milk	1		
1 piece cake		½ sugar cake		Asparagus	2
				Rolls	
Roast beef with) tomato sauce	½	Corned beef		Jello with) fruit	1
Asparagus	2	Cabbage	1		
Roll		Roll			
Raspberry ice cream	½	½ peach with) caramel sauce	½		
Total score	11½	Total score	9½	Total score	7

Summary of Results for Each Day

Date	Total Volume of Urine	Total mgm. ascorbic acid excreted	Average mgm. ascorbic acid per ml. urine	Average minutes before titrating	Vitamin C score of diet
5/25	658	14.5746	0.02215	47	11.5
6/8	680	17.7197	0.02606	45	9.5
6/9	871	14.8924	0.01710	33	7
Average	736.3	15.7289	0.02177	41.7	9.3

Identification

E.F.; freshman; Ate at dormitory
18 yrs, age; 62 inches, height; 125 pounds, weight
+6.8% of ideal weight many colds during past winter

Diet Record and Vitamin C Score for Each Day

May 17 Foods	Score	June 2 Foods	Score	June 7 Foods	Score
Rhubarb	1	½ orange	1½	Bl.raspberries	2
Cream of Wheat		Toast		Cocoa	
Raisin toast		Cocoa	1	Toast	
Cocoa	1				
Banana	2			Candy bar	
Corn fritter		Bean soup		Noodle soup	
Carrot loaf with) peas	1	Canadian bacon		Lima beans & tomato sauce	1
Cabbage-carrot-cucumber) tomato salad	3	Cucumber salad	1	Strawberry short) cake	1
Whole wheat bread		Potato chips		1 Class milk	1
1 Glass milk	1	Whole wheat roll			
Apple	2	Small candy bar			
Corned beef		Beef with olive gravy		Roast beef	
Boiled potatoes	2	2 boiled potatoes	2	Mashed potatoes	2
Cabbage	1	Salad-cabbage-pine-apple marshmallow	2	Sticky rolls	
Roll & butter		Rolls		Fruit cocktail	2
Chocolate cake		Fresh strawberry) sundae	½	Chocolate cake	
		Coca Cola			
		Candy bar			
Total score	14	Total score	8	Total score	9

Summary of Results for Each Day

Date	Total Volume of Urine	Total Mgm. ascorbic acid excreted	Average mgm. ascorbic acid per ml. urine	Average minutes before titrating	Vitamin C score of diet
5/17	825	14.5102	0.01759	50	14
6/2	1231	15.1865	0.01234	53	8
6/7	773	16.9230	0.02189	40	9
Average	943	15.5399	0.01727	47.7	10.3

Identification

F.F.; freshman; Ate at dormitory;
20 yrs., age; 64 inches, height; 134 pounds, weight
+7.2% of ideal weight no colds during past winter

Diet Record and Vitamin C Score for Each Day

May 4 Foods	Score	May 18 Foods	Score	May 19 Foods	Score
Cooked pineapple & Rhubarb	2	½ grapefruit	3	½ orange	1½
Rice krispies		Rice with raisins		Cornflakes	
Cinnamon toast		Cinnamon toast		Toast	
1 cup cocoa	1	1 cup cocoa	1	1 cup cocoa	1
Celery soup	½	Soup		Cream soup	
Macaroni & cheese		Lima beans, beets, corn, potatoes	2	Spinach & eggs	2
Bread		Apple betty	½	Bread	
Banana salad	2	1 glass milk	1	Fresh peach salad	1
Chocolate milk	1			1 glass milk	1
Roast beef		Veal sandwich		Salmon loaf	
Lettuce salad	1	Radishes	½	Fried potatoes	1
Pickles		Fresh pineapple & strawberries	3	Stewed tomatoes	3
Sweet rolls				Radishes	½
Chocolate marshmallow roll				Bread	
1 glass milk	1			Chocolate ice cream	
Total score	8½	Total score	11	Total score	11

Summary of Results for Each Day

Date	Total Volume of Urine	Total mgm. ascorbic acid excreted	Average mgm. ascorbic acid per ml. urine	Average minutes before titrating	Vitamin C score of diet
5/4	1515	11.7432	0.007751	63	8½
5/18	1464	15.8721	0.01070	56	11
5/19	855	15.8325	0.01852	65	11
Average	1278	14.4159	0.01232	61.3	10.2

Identification

G.F.; freshman; Ate at dormitory
18 yrs., age; 64 inches, height; 143 pounds, weight
+16.3% of ideal weight 1 or 2 colds during past winter

Diet Record and Vitamin C Score for Each Day

May 6		May 18		May 25	
Foods	Score	Foods	Score	Foods	Score
Grapefruit	3	Grapefruit	3	Tomato juice	3
Cinnamon toast		Cinnamon toast		Cinnamon toast	
Cocoa	1	Cocoa	1	Cocoa	1
Tomato soup with macaroni	1	Escalloped potatoes with ham	1	Fried potatoes	1
Potato salad	2	Beets	1	Carrots	1
Roll		Rye bread		String beans	2
1 Slice pineapple with date garnish	1	Apple betty	½	Whole wheat bread	
				Apricot-marshmallow salad	½
		Candy bar		Candy bar	
Swiss steak		Breaded veal		Beef roast	
Mashed potatoes with gravy	2	Carrots	1	Mashed potatoes	2
Carrots	1	Whole wheat roll		Asparagus	2
Rolls and butter		Strawberries & pineapple	3	Roll and butter	
Marshmallow-peach wh. cream dessert	½	Cookie		Raspberry ice cream	½
				Tea	
Total score	11½	Total score	10½	Total score	13

Date	Total Volume of Urine	Total mgm. ascorbic acid excreted	Average mgm. ascorbic acid per ml. urine	Average minutes before titrating	Vitamin C score of diet
5/6	845	13.1425	0.01555	96	11.5
5/18	903	15.5163	0.01718	44	10.5
5/25	964	15.2088	0.01578	51	13.
Average	904	14.6225	0.01617	63.7	11.7

Identification

H.F.; freshman Ate at dormitory
19 yrs., age; 61 inches, height 100 pounds, weight
-13.0% of ideal weight no colds during past winter

Diet Record and Vitamin C Score for Each Day

May 18 Foods	Score	May 25 Foods	Score	June 8 Foods	Score
No breakfast		Milk	1	No breakfast	
		Rolls			
Potatoes with corned beef	1	Meat		Meat loaf	
Custard		Potato	2	Potato chips	
Bread and butter		Apricot salad	1	Lettuce	1
Milk	1	Bread		Bread	
		Milk	1	Milk	1
Candy bar				Ham sandwich	
				Coca Cola	
Veal		Roast beef		Potatoes	2
Potatoes	2	Potatoes	2	Cabbage	1
Radishes	½	Rolls		Bread	
Carrots	1	Ice Cream		Tea	
Strawberries	3	Tea			
Tea					
Coca Cola				Candy bar	
Popcorn					
Total score	8½	Total score	7	Total score	5

Summary of Results for Each Day

Date	Total Volume of Urine	Total mgm. ascorbic acid excreted	Average mgm. ascorbic acid per ml. urine	Average minutes before titrating	Vitamin C score of diet
5/18	752	8.6679	0.01153	33	8.5
5/25	879	8.9449	0.01018	40	7.0
6/8	819	9.0716	0.01108	33	5.0
Average	816.7	8.8948	0.01093	35.3	6.8

Identification

I.F.; freshman; Ate at dormitory
19 yrs., age; 63 inches, height 130 pounds, weight
+7.4% of ideal weight 2 colds during past winter

Diet Record and Vitamin C Score for Each Day

May 25 Foods	Score	June 2 Foods	Score	June 14 Foods	Score
No breakfast		No breakfast		Branflakes Rye toast	
Pea soup Fried potatoes	1	Scrambled eggs Tomato-cucumber) salad	2	Ham salad sandwich Chocolate milk) shake	1
Green beans	2	Rye bread		Grapefruit juice	3
Apricot-marshmallow) salad	½	Milk	1		
Rye bread 1 glass milk	1				
Roast beef Mashed potato & gravy	2	Swiss steak Mashed potatoes	2	Mashed potato	2
Asparagus	2	Roll		Pickle Cherry cobbler	1
Roll Tea		Pineapple-cucumber) salad	2		
Raspberry sherbet	½	Strawberry sundae Iced tea	½		
				Grapefruit juice	3
Total score	9	Total score	7½	Total score	10

Summary of Results for Each Day

Date	Total Volume of Urine	Total mgm. ascorbic acid excreted	Average mgm. ascorbic acid per ml. urine	Average minutes before titrating	Vitamin C score of diet
5/25	632	13.2815	0.02102	54	9
6/2	801	11.6170	0.01450	76	7.5
6/14	368	21.7418	0.05908	13	10
Average	600.3	15.5468	0.03153	47.7	8.8

Identification

J.F.; freshman; Ate at dormitory
18 yrs., age; 64 inches, height 125 pounds, weight
+1.6% of ideal weight 1 cold during past winter

Diet Record and Vitamin C Score for Each Day

May 12 Foods	Score	May 17 Foods	Score	May 24 Foods	Score
1 Grapefruit	5	1 dish stewed apricots		Applesauce	1
				Bran cereal	
				Whole wheat toast	
				Cocoa	1
Tomato soup	1	Hash	1	Vegetable soup	1
Macaroni & tomato	1	Vegetable salad and crackers	1	Chop suey with rice	1
Whole wheat bread & jam		Fresh fruit salad	3	Crackers	
Fresh fruit salad	3	Rye bread		Roll	
2 glasses chocolate milk	2	1 glass milk	1	Fresh pineapple	2
				Cookie	
				1 glass milk	1
		½ brownie (cookie)			
Roast beef		Ham		Stew	
2 servings potato	3	Potatoes	2	Potatoes	2
Aspic vegetable salad	2	Cabbage	1	Cabbage salad	3
Raspberry ice cream	½	Pickle		Cracked wheat roll	
		Roll		Apple pudding	½
		1 glass milk	1		
		Cake			
Small piece cake					
Total score	17½	Total score	10	Total score	12½

Summary of Results for Each Day

Date	Total Volume of Urine	Total mgm. ascorbic acid excreted	Average mgm. ascorbic acid per ml. urine	Average minutes before titrating	Vitamin C score of diet
5/12	890	13.8291	0.01554	86	17.5
5/17	873	12.0784	0.01384	73	10
5/24	1498	19.5751	0.01307	54	12.5
Average	1087.0	15.1609	0.01415	71	13.3

Identification

K.F.; freshman; Ate at dormitory
19 yrs., age; 62 inches, height 108 pounds, weight
-8.5 % of ideal weight 3 colds during past winter

Diet Record and Vitamin C Score for Each Day

May 18 Foods	Score	May 26 Foods	Score	June 1 Foods	Score
½ grapefruit	3	½ grapefruit	3	1 canned peach	1
Cinnamon toast		Cinnamon toast		Cinnamon toast	
Coffee		Coffee		Coffee	
Scalloped potatoes with ham	2	Noodle soup		Soup	
Rye bread & butter		2 pancakes & syrup-		Macaroni	
Brown betty	½	Bread & butter		Roll & butter	
1 glass milk	1	Chocolate milk	1	Pineapple salad	1
		Fruit jello salad) with mayonnaise	1	1 glass milk	1
Breaded veal		Meat balls-tomato) sauce	1	Veal	
Mashed potatoes	2	Boiled potatoes	2	Mashed potato and) gravy	2
Carrots	1	Corn	1	Asparagus	2
Roll & butter		Pickle		Pickles	
Strawberry & pine-apple	3	Roll & butter		Roll & butter	
Small cookies		Date-marshmallow) Graham cracker) Dessert with Whipped cream		Rhubarb-banana) short cake	1
		Tin roof sundae			
Total score	12½	Total score	9	Total score	8

Summary of Results for Each Day

Date	Total Volume of Urine	Total mgm. ascorbic acid excreted	Average mgm. ascorbic acid per ml. urine	Average minutes before titrating	Vitamin C score of diet
5/18	806	24.8081	0.03078	43	12.5
5/26	1239	18.4766	0.01491	?	9
6/1	426	36.3831	0.08541	49	8
Average	823.7	26.5559	0.04370		9.8

Identification

L.F.; freshman; Ate at dormitory
18 yrs., age 68 inches, height 155 pounds, weight
+12.3% of ideal weight 3 colds during past winter

Diet Record and Vitamin C Score for Each Day

May 12 Foods	Score	May 17 Foods	Score	May 24 Foods	Score
No breakfast		Raisin bread		Graham crackers	
Chocolate candy bar					
Tomato soup	1	Vegetable soup	1	Vegetable soup	1
Cheese souffle		Corn fritter		Roll & butter	
Brown bread		Banana salad	2	Fresh pineapple	2
Lime bean salad	1	1 glass milk	1	Cookie	
1 glass milk	1			1 glass milk	1
1 white cookie				Graham crackers	
Roast beef & gravy		Boiled ham		Stew	
Gelatine salad	½	2 servings) cabbage	2	Roll & butter	
Poppyseed rolls		Mustard pickles		Cabbage salad	3
Raspberry ice cream)	½	1 glass milk	1	Apple turnover	1
		Chocolate cake			
Small piece cake				Peanut butter cookies	
				Graham crackers	
Total Score	4	Total score	7	Total score	8

Summary of Results for Each Day

Date	Total Volume of Urine	Total mgm. ascorbic acid excreted	Average mgm. ascorbic acid per ml. urine	Average minutes before titrating	Vitamin C score of diet
5/12	809	12.0249	0.01486	56	4
5/17	914	14.1720	0.01551	55	7
5/24	1035	17.7780	0.01718	42	8
Average	919.3	14.6583	0.01585	51	6.3

Identification

M.F.; 18 yrs., age; +7.4% of ideal weight

freshman; 63½ inches, height; 1 cold during past winter

Ate at dormitory; 130 pounds, weight;

Diet Record and Vitamin C Score for Each Day

May 10 Foods	Score	May 12 Foods	Score	May 17 Foods	Score
No breakfast		No breakfast		Toast	
Potato salad	2			Fudge	
Crackers					
Soup		Soup		Soup	
Scrambled eggs		Crackers		Crackers	
Rolls & butter		Whole wheat bread		Creamed peas	2
Stewed rhubarb	1	Noodles with) tomato sauce	1	Salad	2
1 glass milk	1	Salad	1	Roll	
		Milk	1		
Ice cream cone				Popcorn	
				Fudge	
Ham		Meat & gravy		Meat	
Creamed potatoes	2	Mashed potatoes	2	Mashed potatoes	2
Radishes		Gelatine-vegetable) salad	1	Cabbage salad	3
Vegetable salad	2	Roll		Roll	
Roll & butter		Raspberry ice	½	Apple pie	1
Pumpkin pie				Milk	1
1 glass milk	1				
Banana	2	Cake		Hard boiled egg	
Orange	3	Sundae		Cookies	
Total score	14	Total score	6½	Total score	11

Summary of Results for Each Day

Date	Total Volume of Urine	Total mgm. ascorbic acid excreted	Average mgm. ascorbic acid per c.c. urine	Average minutes before titrating	Vitamin C score of diet
5/10	648	15.8089	0.02448	38	14
5/12	634	14.7595	0.02328	55	6.5
5/17	535	9.6848	0.01845	73	11
Average	602.3	13.4357	0.02207	55.3	10.5

Identification

M.F.; freshman; Ate at dormitory;
18 yrs., age; 61½ inches, height 97 pounds, weight
-16.4% of ideal weight could not remember colds of past winter

Diet Record and Vitamin C Score for Each Day

May 3 Foods	Score	May 25 Foods	Score	June 7 Foods	Score
½ grapefruit	3	Tomato juice	3	Prunes	
Toast		Toast		Bread	
Coffee		Coffee		Coffee	
1 chocolate bar					
Celery soup	½	2 servings green beans	3	Hash	1
Meat		Apricot-marshmallow salad	½	Bread	
Potatoes	2	Bread		Custard	
Rolls					
Hot fudge sundae					
City chicken		Beef		Ham salad sandwich	
Creamed potatoes	2	Mashed potatoes	2	Lime phosphate	
Cabbage-pineapple salad	2	Roll			
Coffee		Strawberry ice cream	½		
Fudge					
Total score	9½	Total score	9	Total score	1

Summary of Results for Each Day

Date	Total Volume of Urine	Total mgm. ascorbic acid excreted	Average mgm. ascorbic acid per ml. urine	Average minutes before titrating	Vitamin C score of diet
5/3	877	13.8784	0.01582	?	9.5
5/25	645	12.1280	0.01880	53	9.
6/7	1031	16.9504	0.01644	?	1.
Average	851.0	14.3189	0.01702		6.5

Identification

O.F.; freshman; Ate at dormitory;
19 yrs., age; 64½ inches, height; 130 pounds, weight
+3.2% of ideal weight colds continuously during past winter

Diet Record and Vitamin C Score for Each Day

May 10 Foods	Score	May 12 Foods	Score	May 19 Foods	Score
½ orange	1½	½ grapefruit	3	Can blackberries	2
Hot cereal-milk & sugar		Cornflakes-milk & sugar		Cornflakes-milk & sugar	
Cinnamon toast		Cinnamon toast		Toast	
1 glass milk	1	1 glass milk	1		
		1 baked apple	2		
Bean soup		Vegetable soup & crackers	1	Spanish rice	1
Vegetable stew) with biscuit	1	Macaroni		Cracked wheat roll) and butter	
Bread		Bread		Custard	
Rhubarb sauce	1	Orange salad	2	1 glass milk	1
1 cookie		Chocolate milk	1		
1 glass milk	1				
Weiners		Roast beef - gravy		Beef	
French fried) potatoes	2	Potatoes	2	Fried potatoes	1
Rolls & butter		Jello salad with) nuts & vegetables	1	Rye rolls & butter	
Peaches & wh.cream	1	Roll		Stewed tomatoes	3
½ piece cake		Ice cream		Chocolate ice cream	
Cookies					
Cake					
1 orange	3				
Total score	11½	Total score	13	Total score	9

Summary of Results for Each Day

Date	Total Volume of Urine	Total mgm. ascorbic acid excreted	Average mgm. ascorbic acid per ml. urine	Average minutes before titrating	Vitamin C score of diet
5/10	857	15.2067	0.01774	44	11.5
5/12	995	16.9636	0.01705	54	13.
5/19	814	15.3711	0.01888	66	9
Average	888.7	15.8471	0.01789	54.7	11.2

Identification

P.F.; freshman; Ate at dormitory
18 yrs., age 67 inches, height 125 pounds, weight
-6.7% of ideal weight many colds during past winter

List Record and Vitamin C Score for Each Day

June 3 Foods	Score	June 8 Foods	Score	June 10 Foods	Score
1 banana	2	No record		Banana	2
Rice Krispies				Rice Krispies	
Sugared toast				Toast	
1 cup cocoa	1			Cocoa	1
Apricot-marshmallow salad	½			Spanish rice	1
Whole wheat bread				Fruit jello salad	1
1 glass milk	1			Rye bread	
				1 glass milk	1
Beef				Ham	
2 small potatoes	2			Creamed potatoes	2
Onion-cabbage-carrot	2			Spinach	2
Whole wheat roll				Pickles	
Cherry tart with whipped cream	1			Apricot	1
				Whole wheat rolls	
				Chocolate chip ice cream	
Total score	9½			Total score	11

Summary of Results for Each Day

Date	Total Volume of Urine	Total mgm. ascorbic acid excreted	Average mgm. ascorbic acid per ml. urine	Average minutes before titrating	Vitamin C score of diet
6/3	1693	16.4090	0.009692	?	9.5
6/8	1195	18.5323	0.01551	49	?
6/10	951	15.8294	0.01365	?	11
Average	1279.7	16.9236	0.01395		10.3

Identification

Q.F.; freshman; Ate at dormitory;
18 yrs., age; 66 inches, height; 140 pounds, weight;
+7.7% of ideal weight; 1 cold during past winter

Diet Record and Vitamin C Score for Each Day

May 19 Foods	Score	June 2 Foods	Score	June 3 Foods	Score
½ orange	1½	½ grapefruit	3	½ grapefruit	3
Rice Krispies		Grapenuts		Puffed rice krispies	
Cinnamon toast		Cinnamon toast		Cinnamon toast	
½ cup cocoa	½	1 cup cocoa	1	1 cup cocoa	1
Potato soup	1	Bean soup & crackers		Potato soup	1
1 egg		Potato chips		Creamed veal & noodles with cheese	
1 serving spinach	2	Ham		Bacon-lettuce sandwich	
Spanish rice	1	Orange salad	2	Jello cubes with whipped cream	
Graham bread & butter		Rye rolls & butter			
Custard		Chocolate milk	1		
Salmon loaf & tartar sauce		Beef with olive gravy		Beef-cabbage-onion carrot	1
Fried potatoes	1	Parsley potatoes	2	2 parsley potatoes	2
Tomatoes	3	Cabbage-pineapple marshmallow salad		Roll & butter	
Sweet pickles		Rolls & butter		Cherry tart with whipped cream	1
3 radishes		Fresh strawberry ice cream	½	Tea	
Rye rolls & butter		Iced tea			
Chocolate ice cream		Hamburger		Ice cream cone	
Total score	10	Total score	11½	Total score	9

Q.F.; continued

Summary of Results for Each Day

Date	Total Volume of Urine	Total mgm. ascorbic acid excreted	Average mgm. ascorbic acid per ml. urine	Average minutes before titrating	Vitamin C score of diet
5/19	1175	23.7070	0.02018	52	10
6/2	773	11.8251	0.01530	38	11.5
6/3	1010	20.4038	0.02020	50	9.
Average	986	18.6453	0.01856	46.7	10.2

Identification

R.F.; freshman; Ate at dormitory
19 yrs., age; 66 inches, height; 126 pounds, weight
-3.8% of ideal weight; 1 cold during past winter

Diet Record and Vitamin C Score for Each Day

May 3 Foods	Score	May 17 Foods	Score	May 24 Foods	Score
Oranges	3	No breakfast		No breakfast	
Bacon					
Pecan roll					
Milk	1				
		Chocolate bar			
Celery soup	½	Vegetable broth	1	Vegetable soup	1
Rice-meat dish		Hash	1	Chop suey	1
Whole wheat bread		Corn fritter		Spring salad	2
Baked apple	2	Whole wheat bread		Date bread	
Molasses stick candy		Banana salad	2	Milk	1
Milk	1	Milk	1		
				Dates	
Weiners		Meat balls		Meat loaf	
Potato	2	Potato	2	Creamed potatoes	2
Beets	1	Sugared carrots)		Green onions	½
Pineapple salad	1	green onions	1	Fruit salad	1½
Roll		Date cake with)		Whole wheat roll	
Iced tea		whipped cream		Chocolate cake	
		Coffee		Coffee	
Milk	1				
Hamburger					
Total score	15½	Total score	8	Total score	9

R.F.; continued

Summary of Results for Each Day

Date	Total Volume of Urine	Total mgm. ascorbic acid excreted	Average mgm. ascorbic acid per ml. urine	Average minutes before titrating	Vitamin C score of diet
5/3	1336	9.8087	0.00734	?	12.5
5/17	1378	23.5071	0.01706	51	8
5/24	1558	16.2057	0.01040	42	9
Average	1424	16.5072	0.01160	47	9.8

Identification

S.F.;	freshman;	Ate at dormitory
19 yrs., age	64 inches, height	103 pounds, weight
-15.6% of ideal weight	1 cold during past winter	

Diet Record and Vitamin C Score for Each Day

May 20 Foods	Score	May 27 Foods	Score	June 3 Foods	Score
½ grapefruit	3	½ orange	1½	Stewed rhubarb	1
Cornflakes		Cornflakes		Whole wheat toast	
Whole wheat toast		Whole wheat toast		Milk	1
Milk	1	Milk	1		
French toast		Roast pork		Veal and noodles	
Bacon		Potato salad	2	Whole wheat bread	
Orange and carrot salad	2	Tomato & lettuce salad	2	Peach marshmallow salad	½
Milk	1	Milk	1	Milk	1
Chili		Breaded veal		Beef roast	
Mashed potato	2	Baked potato	2	Boiled potato	2
Lettuce salad with Russian dressing	1	Fresh peas	3	Carrots & onion	1
Whole wheat roll		Pear salad	1	Boiled cabbage	1
Tea		Roll		Cherry tart with whipped cream	1
		Coffee		Whole wheat roll	
				Tea	
Total score	10	Total score	13½	Total score	8½

Summary of Results for Each Day

Date	Total Volume of Urine	Total mgm. ascorbic acid excreted	Average mgm. ascorbic acid per ml. urine	Average minutes before titrating	Vitamin C score of diet
5/20	1161	16.9552	0.01461	24	10
5/27	842	14.4424	0.01715	27	13.5
6/3	623	12.3936	0.01989	38	8.5
Average	875.3	14.5981	0.01722	30	10.7

Identification

T.F.; freshman Ate at dormitory
19 yrs., age 64 inches, height 113 pounds, weight
-8.9% of ideal weight

1 cold during past winter

Diet Record and Vitamin C Score for Each Day

May 27 Foods	Score	June 2 Foods	Score	June 8 Foods	Score
½ orange	1½	Grapefruit	3	½ grapefruit	3
Toast and jelly		Toast		Toast	
Cocoa 1 cup	1	Cocoa	1	Coffee	
Tomato soup	1	Ham and eggs		Meat sandwich	
Crackers		Potato chips		Potato chips	
Potato salad	2	Bread		Asparagus	2
Meat loaf		Cucumber salad	1	Banana salad	2
Tomato salad	2			Milk	1
Breaded veal		Roast beef		Milk shake	1
Fried potatoes	1	Potatoes, gravy	2		
Peas	3	Cabbage salad	3		
Pear salad	1	Roll		Corned beef	
Roll & butter		Strawberry sundae	½	Cabbage	1
Chocolate cake		Iced tea		Potato	2
Coffee				Tea	
Pineapple sundae	½			Candy bar	
Total score	13	Total score	10½	Total score	12

Summary of Results for Each Day

Date	Total Volume of Urine	Total mgm. ascorbic acid excreted	Average mgm. ascorbic acid per ml. urine	Average minutes before titrating	Vitamin C score of diet
5/27	2063	23.8602	0.01157	38	13
6/2	1845	19.7792	0.01072	64	10.5
6/8	1616	21.2390	0.01314	64	12
Average	1841.3	21.6261	0.01181	55.3	11.8

Identification

A.S.; senior; Does own cooking
23 yrs., age; 66 inches, height; On 5/4 & 5/5 at home management house
-6.7% of ideal weight
several colds and sinus trouble during past winter

Diet Record and Vitamin C Score for Each Day

May 4 Foods	Score	May 5 Foods	Score	May 19 Foods	Score
Wheatena		Canned grapefruit	3	1 orange	3
½ cup loganberry juice	1	Poached egg		Whole wheat flakes	
Toast & butter		Toast & butter		1 glass milk	1
1 cup cocoa	1	1½ cups cocoa	1½		
		Rye bread			
		Cold meat			
Escalloped eggs		Escalloped corn	1	Ham & lettuce sandwich on whole wheat bread	
Muffins and jam		Bran muffins & butter		Milk shake	1
4 stalks canned asparagus	1	Small grapefruit & apple salad	2		
1½ glasses milk	1½	Chocolate wafer			
		Milk	1		
Weiners		1 carrot		Meat loaf	
Potato salad	2	small serving onions	1	Small serving fried potatoes	2
Cheese		Roll & butter		Green beans	2
Hamburg pattie		1 canned apricot	½	Whole wheat bread	
Buns				Tomato-celery-lettuce	2
Pickles				Small dish raspberries	2
1 glass milk	1			Cake	
Pineapple pie				Small cup milk	½
Coffee					
Total score	7½	Total score	10	Total score	13½

A.S.; continued

Date	Total Volume of Urine	Total mgm. ascorbic acid excreted	Average mgm. ascorbic acid per ml. urine	Average minutes before titrating	Vitamin C score of diet
5/4	1069	18.0166	C.01685	101	7.5
5/5	957	21.3256	0.02228	60	10
5/19	684	37.1557	C.05432	58	13.5
Average	903.3	25.4993	0.03115	73	10.3

Identification

B.S.; senior; (Ate at sorority house
21 yrs., age 66 inches, height; (at home management
+3.0% of ideal weight (house 5/5 and 5/6
No colds during past winter

Diet Record and Vitamin C Score for Each Day

May 5 Foods	Score	May 6 Foods	Score	May 25 Foods	Score
Canned grapefruit	-3	Stewed prunes		No breakfast	
Poached egg		French omelet			
Toast & butter		Whole wheat toast			
1½ cups cocoa	-1½	Cocoa	-1		
Rye bread					
Meat					
Escalloped corn	-1	Cream mushroom soup		Split green pea soup	
Bran muffins		Crackers		Whole wheat bread	
Small grapefruit & apple salad	-2	Meat sandwiches		Grapefuit-cottage cheese salad	-2
Chocolate wafers		Relish		Chocolate candy	
1 glass milk	-1	Baked apple	-2		
		Milk	-1		
1 carrot		Weiners		Breaded veal	
Small serving onions	-1	Potato salad	-2	Parsley new potatoes	-2
Roll & butter		Cheese		Creamed asparagus	-2
Canned apricots	-1	Hamburg pattie		Bread	
		Buns		Cherry cobbler	
		Pickle		Coffee	
		1 glass milk	-1		
		Pineapple pie			
				Peanut butter sandwich	
Total score	10½	Total score	7	Total score	6

Summary of Results for Each Day

Date	Total Volume of Urine	Total mgm. ascorbic acid excreted	Average mgm. ascorbic acid per ml. urine	Average minutes before titrating	Vitamin C score of diet
5/5	1130	26.9681	0.02387	68	10.5
5/6	1810	21.0846	0.01165	129	7
5/25	740	19.7579	0.02670	43	6
Average	1226.7	22.6035	0.02074	80.0	7.8

Identification

C.S.; senior; Ate at sorority house
21 yrs., age; 64 inches, height; 135 pounds, weight
+8.9% of ideal weight; Several colds during past winter

Diet Record and Vitamin C Score for Each Day

May 31 Foods	Score	June 2 Foods	Score	June 13 Foods	Score
No record		No breakfast		No breakfast	
		Date muffins		Roast beef-gravy	
		Kidney bean salad) beans, celery, pickle		Mashed potato	2
		1 slice canned) pineapple		2 slices tomato) with lettuce and mayonnaise	2
		½ slice canned) peach	1	¼ cup corn	1
		Milk	1	Roll	
				Chocolate sundae	
				Strawberry sundae	½
		Roast Canadian bacon		Fr. pineapple) sundae	½
		Mashed potatoes-gravy	2	Sandwich spread) sandwich	
		Carrots & peas	2	Coffee	
		Milk	1		
		Total score	7	Total score	6

Summary of Results for Each Day

Date	Total Volume of Urine	Total mgm. ascorbic acid excreted	Average mgm. ascorbic acid per ml. urine	Average minutes before titrating	Vitamin C score of diet
5/31	497	66.3983	0.1336	15	no record
6/2	490	34.0059	0.06940	63	7
6/13	1290	32.4432	0.02515	15	6
Average	759.0	44.2835	0.07605	31	6.5

Identification

D.S.; senior; Ate at sorority house
22 yrs., age; 68 inches, height 138 pounds, weight
-0.7% of ideal weight 1 cold during past winter

Diet Record and Vitamin C Score for Each Day

May 31 Foods	Score	June 2 Foods	Score	June 3 Foods	Score
½ cup canned grapefruit	3	Stewed rhubarb	1	2/3 cup canned grapefruit	3
Toast		Toast		Toast	
Coffee		Coffee		Coffee	
Roast beef - gravy		Kidney bean salad (beans, celery, pickle)		Hamburg	
Mashed potato	2	Date muffins		Cottage cheese, pineapple salad	1
Buttered asparagus	2	Milk	1	1½ cup milk	1½
Roll		1 slice canned pineapple			
Graham cracker, banana dessert	1	½ slice canned peach	1		
Root beer					
Fresh pineapple sundae	½	Roast Canadian bacon		Chicken	
Orange float		Mashed potatoes, gravy	2	Mashed potato	2
		Carrots and peas	1	Asparagus	2
		Milk	1	Fresh vegetable salad	2
		Roll		Biscuit	
				Ice cream	
				Chocolate cake	
				Coffee	
				Hamburg	
				Coffee	
Total score	8½	Total score	7	Total score	11½

L.L.; continued

Summary of Results for Each Day

Date	Total Volume of Urine	Total mgm. ascorbic acid excreted	Average mgm. ascorbic acid per ml. urine	Average minutes before titrating	Vitamin C score of diet
5/31	1100	20.4668	0.01861	47	8.5
6/2	1320	22.1753	0.01678	39	7.
6/3	1291	34.1204	0.02643	40	11.5
Average	1237.0	25.9208	0.02054	42	9.0

Identification

E.S.; Senior Ate at home
21 yrs., age 64 inches, height 152 pounds, weight
+20.6% of ideal weight No colds during past Winter

May 5		May 12		May 17	
Foods	Score	Foods	Score	Foods	Score
1 glass skimmed milk	1	Rhubarb sauce	1	1 pint chocolate milk	2
Buttered toast		Puffed wheat with milk & sugar			
Large tunafish salad with fresh tomato & hard boiled egg	1	Raw carrot, cabbage celery & tomato salad	2	Meat & potatoes	1
Cherry jello with whipped cream		Strawberry shortcake	1	Stewed tomatoes	3
1 glass skimmed milk	1	1 glass skimmed milk	1	Applesauce cake	
Fig newtons				1 glass skimmed milk	1
				Custard	
Spaghetti with bacon & tomato sauce	1	Meat		1½ eggs scrambled	
1/3 cup cottage cheese		Salad-raw carrot celery & tomato	2	Bacon	
Wilted lettuce	1	1 glass skimmed milk	1	1 slice tomato	1
Fresh pineapple	2			1 glass skimmed milk	1
Fig newtons				Applesauce cake	
				Coffee	
Pineapple ice				Coca cola	
Total score	7	Total score	8	Total score	9

E.S., continued

Summary of Results for Each Day

Date	Total Volume of Urine	Total mgm. ascorbic acid excreted	Average mgm. ascorbic acid per ml. urine	Average minutes before titrating	Vitamin C score of diet
5/5	1107	17.1779	0.01552	68	7
5/12	1181	22.6401	0.01917	38	8
5/17	1417	22.0070	0.01553	55	9
Average	1235.0	20.6083	0.01674	53.7	8

Identification

F.S.;
23 yrs., age
-7.1% of ideal weight

senior
64 inches, height

Ate at sorority 5/4 at home management house
118 pounds, weight
1 cold during past winter

Diet Record and Vitamin C Score for Each Day

May 4 Foods	Score	May 27 Foods	Score	June 8 Foods	Score
½ cup loganberry) juice	1	1 orange, sliced	3	½ cup applesauce	1
Wheatena		Toast-honey		Toast-butter	
Toast & butter		Coffee		Coffee	
1 cup cocoa	1				
Escalloped eggs		½ cup apple salad	2	Macaroni & cheese	
Muffins and jam		Hamburg sandwich) with catsup		½ cup apple-banana) salad	2
4 stalks canned) asparagus	1	Milk	1	Cinnamon roll	
1½ glasses milk	1½			Milk	1
Frankfurters		Frankfurters		Sliced ham	
Potato salad	2	Sauerkraut	1	Creamed new peas) & potatoes	2
Cheese		Creamed potatoes	2	Cabbage-carrot) salad	2
Hamburg pattie		Rye bread		Raisin bread	
Buns		Pineapple, whipped) cream dessert		Jello with orange, banana & apple	2
Pickle		Coffee		Coffee	
1 glass milk	1				
Pineapple pie				Mint ice	
				Punch	1
				Cake	
				Nuts	
				Toast	
Total score	7½	Total score	9	Total score	11

F.B., continued

Summary of Results for Each Day

Date	Total Volume of Urine	Total mgm. ascorbic acid excreted	Average mgm. ascorbic acid per ml. urine	Average Minutes before titrating	Vitamin C score of diet
5/4	1145	27.5385	0.02405	33	7.5
5/27	1026	56.6345	0.05520	28	9
6/8	945	24.7204	0.02617	40	11
Average	1038.7	36.2978	0.03514	32	9.2

Identification

C.S.;	senior	June 3 & 4 ate at home
20 yrs., age;	62 inches, height;	management house
-0.9% of ideal weight		June 7 ate at restaurant
		118 pounds, weight
	1 cold during past winter	

Diet Record and Vitamin C Score for Each Day

June 3		June 4		June 7	
Foods	Score	Foods	Score	Foods	Score
Banana	2	Prune juice		Apricots & prunes	
Oatmeal		Egg		Waffles-syrup	
Toast		Toast		Cocoa	1
Cocoa	1	Milk	1		
Cream of potato) soup	1	Large fruit salad	3	Egg and rice	
apple-orange salad	3	Crackers		whole wheat roll	
Whole wheat bread		Bread		Tomato-aspic)	
Tea		Prune cake		lettuce & radish	3
		Milk	1	1 glass grapefruit) & lemon juice	3
				1 glass milk	1
				Cookie	
Ice cream					
Hamburg-tomato	1	Tuna shrimp) casserole		Egg salad sandwich	
Scalloped au gratin		Rice		Chocolate cookie	
Beets	1	Carrots	1		
Prunes		Pineapple & straw- berries	3		
Coffee		Coffee			
				Chocolate sundae	
Total score	9	Total score	9	Total score	7

G.S.; continued

Summary of Results for Each Day

Date	Total Volume of Urine	Total mgm. ascorbic acid excreted	Average mgm. ascorbic acid per ml. urine	Average minutes before titrating	Vitamin C score of diet
6/3*	1161	24.0619	0.02073	?	9
6/4	1130	22.2616	0.01970	13	9
6/7	1596	97.2649	0.06094	28	7
Average	1295.7	47.8628	0.03379	20.5	8.3

* A midnight specimen which was not titrated until morning.

Identification

H.S.; Senior Ate at restaurant
20 yrs., age 69 inches, height 160 pounds, weight
+12.7% of ideal weight 1 cold during past winter

Diet Record and Vitamin C Score for Each Day

May 24 Foods	Score	June 2 Foods	Score	June 7 Foods	Score
1 orange	3	1 orange	3	1 orange	3
Hamburg		Ham salad sandwich		Ham salad sandwich	
Large glass grapefruit juice	5	Coffee		Mud sundae	
French fried potatoes	2	Creamed cauliflower	1	Veal stew, dumplings	
Carrots	1	Buttered green beans	2	Mixed fruit salad	3
Peas	3	French fried potatoes	2	Rye bread	
Cottage cheese		Cabbage salad	3	Butterscotch sundae	
Rye bread		Small strawberry sundae	½	Coffee	
Small strawberry sundae	½				
Total score	14½	Total score	11½	Total score	6

Summary of Results for Each Day

Date	Total Volume of Urine	Total mgm. ascorbic acid excreted	Average mgm. ascorbic acid per ml. urine	Average minutes before titrating	Vitamin C score of diet
5/24	769	22.3872	0.02911	39	14.5
6/2	447	11.0582	0.02474	50	11.5
6/7	571	19.7883	0.03466	32	6.
Average	595.7	17.7446	0.02950	40	10.7

Identification

I.S.;	senior	Does own cooking
21 yrs., age	66 inches, height	139 pounds, weight
+6.1% of ideal weight	1 or 2 colds during past winter	

Diet Record and Vitamin C Score for Each Day

May 5 Foods	Score	May 10 Foods	Score	May 31 Foods	Score
1 orange	3	½ grapefruit	3	1 glass milk	1
1 glass milk	1				
1 apple	2				
Meat sandwich with lettuce & mayonnaise		Goldenrod eggs		Poached egg on toast	
½ serving chil con carne		Creamed cabbage	1	Canned pineapple	1
Almond paste		Tomato sandwich	2	Toast and honey	
1 glass milk	1	1 serving mixed fruit	1	Milk	1
		Cookies			
		1 glass milk	1		
				Coca cola	
1 slice corned beef		Chicken noodle soup		Hash	1
Macaroni & cheese		Meat & lettuce sandwich		Green peas	3
Creamed asparagus on toast	2	1 serving apricots	1	Carrot-cucumber salad	1
Lettuce, celery, radish salad	2	1½ glasses milk	1½	Canned pineapple	1
Chocolate pudding				Cheese wafers	
1 glass milk	1			Coffee	
Total score	12	Total score	10½	Total score	9

I.S.;continued

Summary of Results for Each Day

Date	Total Volume of Urine	Total mgm. ascorbic acid excreted	Average mgm. ascorbic acid per ml. urine	Average minutes before titrating	Vitamin C score of diet
5/5	913	67.6082	0.07405	53	12
5/10	1476	22.0316	0.01493	56	10.5
5/31	2152	23.5929	0.01096	31	9
Average	1513.7	37.7442	0.03331	46.7	10.5

Identification.

J.S.;
27 yrs., age
+19.4% of ideal weight

senior
66 inches, height

Does own cooking
May 6 ate at home management house
100 pounds, weight
1 cold during past winter

Diet Record and Vitamin C Score for Each Day

May 6 Foods	Score	May 27 Foods	Score	June 3 Foods	Score
Stewed prunes French omelet Whole wheat toast Cocoa	1	Tomato juice Wheaties Coffee	3	Orange-pineapple) juice Wheaties Sliced bananas Coffee	3 2
Cream of mushroom) soup Crackers Meat sandwich Relish Baked apple Milk	2 1	Graham waffles-syrup Sliced peaches Milk	1 1	Ham salad sandwich Lemon coca cola ½ pt. chocolate) milk Raspberry ice cream	1 ½
Potato salad Frankfurter Cheese Hamburg pattie Buns Pickle 1 glass milk Pineapple pie	2 1	Broiled steak Mashed potato Asparagus Tomato salad Watermelon	2 2 2 3	Baked ham Potato chips Cabbage salad Cherry pie	3 1
Total score	7	Total score	14	Total score	10½

J.S.; continued

Summary of Results for Each Day

Date	Total Volume of Urine	Total mgm. ascorbic acid excreted	Average mgm. ascorbic acid per ml. urine	Average minutes before titrating	Vitamin C score of diet
5/6	1430	21.4330	0.01499	?	7
5/27	1039	17.4097	0.01676	?	14
6/3	1716	29.9410	0.01745	?	10.5
Average	1395.0	22.9279	0.01640	?	10.5

Identification

K.S.; senior; Does own cooking
22 yrs., age; 63 inches, height; 130 pounds, weight
+5.7% of ideal weight 2 colds during past winter

Diet Record and Vitamin C Score for Each Day

May 25 Foods	Score	June 1 Foods	Score	June 8 Foods	Score
(Approximate record of foods containing vitamin C)		Lemon juice	3	Lemon juice	3
½ grapefruit	3	Canned pineapple	1	Toast & butter	
½ cup raw cabbage	3	Toast		Orange marmalade	½
½ cup rhubarb	1	Apple butter			
Vegetable stew	1	Coffee			
		Chocolate cake		Cake	
		Butterscotch tart		Strawberry shortcake	1
		Scrambled eggs		Celery	
		Cabbage-carrot salad	2	Canned peaches	1
		Milk	1		
		Toasted cheese sandwich		Cold meat sandwich	
		Pickles		Buttered peas	3
		Celery		Celery-pickles lettuce salad	1
		Buttered peas	3	Bananas & cream	2
Total score	8	Total score	10	Total score	11½

Summary of Results for Each Day

Date	Total Volume of Urine	Total mgm. ascorbic acid excreted	Average mgm. ascorbic acid per ml. urine	Average minutes before titrating	Vitamin C score of diet
5/25	2920	24.5592	0.008411	20	8
6/1	2314	21.9486	0.009485	24	10
6/8	2225	28.0078	0.01259	29	11.5
Average	2486.3	24.8385	0.01016	24.3	9.8

Identification

L.S.;
21 yrs.,age
-3.0% of ideal weight

senior
66 inches,height
1 cold during past winter

Ate at sorority house
May 6 ate at home management house
128 pounds, weight
past winter

Diet Record and Vitamin C Score for Each Day

May 6 Foods	Score	May 26 Foods	Score	June 3 Foods	Score
Prunes		Rhubarb	1	Applesauce	1
French omelet		Toast		Whole wheat toast	
Whole wheat toast		Coffee		Coffee	
Cocoa	1				
Cream of mushroom) soup		Cheese sauce on) toast		Macaroni & tomato	1
Crackers		Pear & banana) salad	2	Apple-date salad	2
Meat sandwich		Milk	1	Milk	1
Relish				Cookies	
Baked apple	2				
Milk	1				
Frankfurters		2 servings chili		Small sausages	
Potato salad	2	Cabbage salad	3	Creamed potatoes	2
Cheese		Rolls		Applesauce	1
Hamburg patties		Coffee		Carrots and peas (small serving)	2
Buns		Chocolate cake		Milk	1
Pickles				Strawberries & cream	3
1 glass milk	1				
Pineapple pie					
Coffee					
		Applesauce	1		
		Bread			
Total score	7	Total score	8	Total score	14

L.S.; continued

Summary of Results for Each Day

Date	Total Volume of Urine	Total Mgm. ascorbic acid excreted	Average Mgm. ascorbic acid per ml. urine	Average minutes before titrating	Vitamin C score of diet
5/6	1017	13.0591	0.01284	113	7
5/26	554	34.7217	0.06267	?	8
6/3	997	31.4562	0.03155	?	14
Average	856.0	26.4123	0.03569		9.7

Identification

M.S.; senior; Ate at restaurant
21 yrs., age; 63 inches, height; 106 pounds, weight
-13.1% of ideal weight; 1 cold during past winter

Diet Record and Vitamin C Score for Each Day

June 9 Foods	Score	June 10 Foods	Score	June 11 Foods	Score
No breakfast		No breakfast		No breakfast	
Cream of tomato soup	1	Egg salad sandwich		½ cup grapefruit juice	3
Whole wheat bread		Milk	1	Scrambled eggs	
Creamed ham on toast		Butterscotch sundae		Pecan roll	
3 slices tomato	2			Orange marmalade	½
Steamed pudding with hard sauce				Milk	1
Milk	1				
Tomato juice	3	Baked ham		Chocolate milk shake	1
Creamed chicken in patty shells		Creamed potatoes	2		
French fried potatoes	2	2 slices tomato	2		
Spinach	2	Creamed corn	1	Pecan roll	
Roll - butter		Roll & butter		2 glasses milk	2
Lemon cream pie		Milk	1		
		Ice cream and cake			
Chocolate sundae		Cookies		Hamburger	
				Chocolate milk shake	1
Total score	11	Total score	7	Total score	8½

M.S.; continued

Summary of Results for Each Day

Date	Total Volume of Urine	Total mg. ascorbic acid excreted	Average mg. ascorbic acid per ml. urine	Average minutes before titrating	Vitamin C score of diet
6/9	967	25.0923	0.02595	22	11
6/10	703	14.0949	0.02038	33	7
6/11	835	19.3451	0.02317	33	8.5
Average	835.0	19.5754	0.02315	29.3	8.8

Identification

M.S.; senior Ate meals at home
22 yrs., age 63 inches, height 118 pounds, weight
-4.1% of ideal weight no colds during past winter

Diet Record and Vitamin C Score for Each Day

May 26 Foods	Score	May 31 Foods	Score	June 4 Foods	Score
No breakfast		No breakfast		No breakfast	
Liverwurst sandwich Banana	2	Tuna fish sandwich Fried cake Orange	3	Tuna fish sandwich Orange	3
Tuna fish a la king Potatoes	2	Ham salad sandwich Fudge sundae		Tomato juice	3
Asparagus	2			Veal steak	
Raw vegetable-gelatine salad	2			Sweet potato	2
Ginger ale float-ice cream				Green beans	2
Cookies				Orange Ice	1
				Strawberry short-cake	1
Chili con carne Wilted lettuce	1	Beef roast Cabbage salad	3
		Bread	
Total score	9	Total score	6	Total score	12

Summary of Results for Each Day

Date	Total Volume of Urine	Total mgm. ascorbic acid excreted	Average mgm. ascorbic acid per ml. urine	Average minutes before titrating	Vitamin C score of diet
5/26	689	18.4976	0.02685	33	9
5/31	565	28.7183	0.05083	29	6
6/4	987	37.3182	0.03781	31	12
Average	747.0	28.1780	0.03850	31	9

Identification

O.S.; senior (ate at boarding house
21 yrs., age 64 inches, height (May 5 ate at home
+15.4% of ideal weight (management house
142 pounds, weight
m. colds during past winter

Diet record and Vitamin C score for Each Day

May 5 Foods	Score	May 19 Foods	Score	May 22 Foods	Score
Poached egg Canned grapefruit--3 Toast 1½ cups cocoa-----1½		½ banana----------1 Toast - jam Coffee		Fresh pineapple----2 Grapenuts Toast - jam	
Rye bread Cold meat		Meat ball Bread Carrot-lettuce) salad-------1		Spaghetti-cheese) green pepper-----½ Bread Banana, fresh) pineapple--------2	
Escalloped corn----1 Bran muffins Grapefruit-apple) salad (small)-----2 Chocolate wafers 1 glass milk-------1		Canned plums-------1 White cake Milk----------1		Cake Ice cream cone	
1 carrot) Small serving)-----1 onions) Roll Canned apricot-----1		Baked ham Creamed potatoes---2 Asparagus----------2 Tomato salad-------2 Cinnamon rolls Fruit pudding Cake		Breaded veal chops 1 small potato-----2 Tomato-gelatine) devilled egg salad-1 Cooked cabbage) carrots----------1 Rhubarb pie---------1	
Total score 10½		Total score 10		Total score 9½	

Summary of Results for Each Day

Date	Total Volume of Urine	Total mgm. ascorbic acid excreted	Average mgm. ascorbic acid per ml. urine	Average minutes before titrating	Vitamin C score of diet
5/5	1389	26.9613	0.01941	56	10.5
5/19	1142	28.3609	0.02483	64	10
5/20	803	28.9350	0.03610	33	9.5
Average	1111.3	28.1024	0.02678	51	10

Identification

P.S.;	senior	Ate at sorority house
21 yrs., age	65 inches, height	117 pounds, weight
-8.6% of ideal weight	2 colds during past winter	

Diet Record and Vitamin C Score for Each Day

May 11 Foods	Score	May 27 Foods	Score	May 31 Foods	Score
1 glass milk	1	¾ cup fresh pineapple	3	Bran flakes	
Sweet roll		1 glass milk	1	1 glass milk	1
		Toast			
Potato souffle	1	½ cup tomato juice	3	Meat loaf	
Creamed peas & carrots	2			Cucumber sandwich	1
½ tablespoon cottage cheese-		Bacon		4 slices tomato	3
Graham bread		Creamed potatoes & fresh peas	2	2 eggs	
Chocolate pudding with wh. cream		Cabbage-carrot salad	2	½ pt. chocolate milk	1
		1 glass milk	1	2 slices ice cream-	
				½ fruit cocktail with pineapple, apricot, cherries	1
Chop suey	1	½ stuffed baked potato	1	Roast beef	
Rice		Veal croquette		Mashed potato	2
Roll		Creamed canned peas	1	½ cup diced beets	1
Peach marmalade		3 slices tomato	2	½ cup creamed asparagus	1
2 glasses milk	2	Roll		Tomato-cucumber salad -	2
Marble cake		1 glass milk	1	Strawberry short-cake	1
				½ cup tomato juice	3
Total score	7	Total score	17	Total score	17

P.S.; continued

Summary of Results for Each Day

Date	Total Volume of Urine	Total mgm. ascorbic acid excreted	Average mgm. ascortic acid per ml. urine	Average minutes before titrating	Vitamin C score of diet
5/11	1008	15.3986	0.01528	33	7
5/27	900	17.8426	0.01983	28	17
5/21	1321	19.1656	0.01451	24	17
Average	1076.3	17.4689	0.01654	28.3	13.7

Identification

G.S.;	senior	Ate at sorority house
21 yrs., age	70 inches, height	6/2 ate at home management house
+8.8% of ideal weight		160 pounds, weight
	1 cold during past winter	

Diet Record and Vitamin C Score for Each Day

May 6 Foods	Score	May 11 Foods	Score	June 2 Foods	Score
Prunes		Tomato juice	3	Prunes	
Toast		Kalston		Cornmeal	
Coffee		Cinnamon toast		Toast	
		Cocoa	1	Milk	1
Potato salad	2	Creamed eggs on) muffets		Carrot-cabbage) salad	2
Baking powder) biscuits		Fruit salad with) orange, banana, apple	3	Whole wheat bread	
Honey				Apricots	1
Fresh pineapple	2			Milk	1
Milk	1				
Tea				Salmon loaf	
Tea cake				Baked potato	2
				Tomatoes	3
				Fresh pineapple & strawberries	3
Roast beef		Pot roast			
Browned potatoes	2	Potato	2		
Tomato salad	2	Buttered carrots	1		
Carrots	1	Celery		Fresh strawberry sundae	½
Chocolate cake		Fresh pineapple	2		
Coffee		Crackers			
Total score	10	Total score	12	Total score	13½

Q.S.; continued

Summary of Results for Each Day

Date	Total Volume of Urine	Total mgm. ascorbic acid excreted	Average mgm. ascorbic acid per ml. urine	Average minutes before titrating	Vitamin C score of diet
5/6	517	8.3712	0.01619	101	10
5/11	428	15.8477	0.03703	40	12
6/2	854	21.9932	0.02575	49	13.5
Average	599.7	15.4040	0.02632	63.3	11.8

Identification

R.S.;22 yrs., age	senior	Ate at sorority house
+4.2% of ideal weight	62 inches, height	125 pounds, weight
	2 colds during past winter	

Diet Record and Vitamin C Score for Each Day

May 18 Foods	Score	May 24 Foods	Score	June 1 Foods	Score
¾ cup orange juice	4	¾ cup orange juice	4	½ grapefruit	3
Spaghetti and meat		Bacon-tomato-cheese sandwich	2	Mashed potato with meat & gravy	2
Muffin		Banana, peach, strawberry, grapefruit salad	3	Fresh rhubarb	1
Medium apple	2	1 glass milk	1	1 glass milk	1
Milk	1	½ doughnut			
Lettuce & beet salad	1	Fudge		Veal	
				Peas & carrots	2
Veal		Creamed veal & celery		Lima beans	1
Au gratin potatoes	2	1 medium potato	1	Butterscotch pie	
Fresh peas	3	Small fresh tomato	2	Iced tea	
Gelatine-carrot salad	1	Cake		Coca cola	
Cake		Coffee		Cake	
Coffee		Cake			
Coca cola					
Total score	14	Total score	13	Total score	10

Summary of Results for Each Day

Date	Total Volume of Urine	Total mg. ascorbic acid excreted	Average mg. ascorbic acid per ml. urine	Average minutes before titrating	Vitamin C score of diet
5/18	1053	105.1204	0.09983	35	14
5/24	921	83.3398	0.09049	35	13
6/1	803	33.9179	0.04224	45	10
Average	925.7	74.1260	0.07752	38.3	12.3