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The Vitamin C Content of the Russet Burbank Potato of Idaho

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SUMMARY

A biological study of boiled Netted Gem potatoes as a source of vitamin C gave results which point to the following conclusions:

1. Boiled Netted Gem potatoes are a good source of vitamin C and in generous amounts will prevent scurvy.
2. New immature potatoes contain at least twice as much of the vitamin as do fresh mature potatoes.
3. Common storage of the mature potato from three to eight months does not change the vitamin C content to any marked degree.
4. Further evidence has been obtained that marked tissue changes may have taken place due to vitamin C deficiency before outward signs are manifest.
5. Potatoes may suffice as a source of vitamin C in the diet in an emergency but should be supplemented with other sources of the vitamin for best health and development.

The Vitamin C Content of the Russet Burbank Potato of Idaho.

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ELLA WOODS*

Introduction

VITAMIN C is the name given to the substance found in foods which prevents or cures scurvy. In 1930, after the study here reported was begun, King and Waugh (9) found that a hexuronic acid contained in lemon juice had antiscorbutic properties. Since that time this acid has been isolated; its formula has been identified; and the active substance has been synthesized. Ascorbic acid is the chemical name that has been given to it. Undoubtedly, the pure compound will find a place in medicine, but for the present, at least, people will continue to depend upon food for their supply of vitamin C.

NOTES ON THE RELATION OF VITAMIN C TO HEALTH

For centuries scurvy appeared as epidemics, and although more prevalent in countries having short summers, no part of the world seems to have been entirely free. It was especially severe on the sailing vessels during the 15th and 16th centuries, and it seems to have appeared in the armies of every war, including the World War. It has occurred among inmates of many kinds of institutions, and formerly was common among artificially fed infants. Hess (7) has given a very interesting account of the history of this disease in his book, *Scurvy, Past and Present.*

The fact that fresh fruits and vegetables were valuable as a cure for scurvy seems to have been very generally known for considerably more than 100 years before the disease was produced experimentally in guinea pigs.

In 1912, two Norwegian investigators published the results of experiments in which they had produced and cured scurvy in guinea pigs by simple changes in the diet of the animals. This announcement made possible the laboratory study of the disease, its cause and cure, and the changes in animal tissues which characterize the dietary deficiency. The reports of experimental work which occurred in the literature prior to 1930, are very carefully reviewed and summarized by Sherman and Smith (16).

The teeth appear to be among the first tissues to show the effect of the lack of vitamin C. So consistent is this defect that some

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laboratories have used the microscopic examination of a cross section of guinea pig teeth as the basis for a quantitative method of studying the vitamin C values of food materials. Results from such laboratories indicate that at least twice as much of the vitamin is needed to prevent signs of scurvy in the teeth as is needed to prevent the more generally known signs of scurvy. It is not to be understood from this that vitamin C can take the place of any of the other constituents of the diet required for good tooth building, such as calcium, phosphorus, or vitamin D, but that it has its own important function to perform in addition. Hanke (6) has published in great detail the results of observations of a large number of patients, some of whom gave a very striking response to increased vitamin C intake. These responses could be seen in the arrest of dental caries, in the tightening of loose teeth, and in the general improvement of gums.

In scurvy the bones become very fragile, and in the experimental laboratories it has been found that artificial bone wounds will not heal until vitamin C is included in the food supply. This fragility frequently exists while the animal is gaining and the usual signs of scurvy are absent.

In the blood, too, changes are to be noted, due to the lack of this important food constituent. Hess says (p. 209), "Scurvy is associated with an alteration of both the blood and the blood vessels." Anemia with diminished hemoglobin accompanies scurvy and there is diminished resistance in the capillary arteries with resulting hemorrhages. This condition in the skin capillaries has been used recently in a pressure test to detect cases in which the vitamin C is high enough to prevent acute scurvy, but too low to permit the best health. Göthlin (5) reported after using this test with Swedish school children that even among healthy appearing children, one in every four may show the effects of too little vitamin C. Gedda (3) found the skin capillaries of Upsala students to be much stronger in September than in May, and Dalldorf (2) in this country has reported that a large percentage of children from poor homes show a capillary resistance which is indicative of too low a vitamin C intake.

Hess pointed out that in his experience very frequently children showing merely retardation of growth, irritability, and pallor respond promptly to an increase in the amount of antiscorbutic food, even when there were no definite signs of scurvy.

From experimental work as well as from clinical observations, it appears that vitamin C is a very important factor in normal nutrition, and that there may be a zone of undernourishment in regard to this factor between actual scurvy and the best degree of health.

The most important source of this vitamin for the dietary is fresh fruits and vegetables. The introduction of the potato into

Europe after the discovery of America did very much to reduce the incidence of scurvy on that continent and on long journeys by sea.

In 1920, Hess wrote (pp. 161), "The civilized world is dependent for its quota of antiscorbutic foodstuff largely upon the potato." He cited as an example the fact that scurvy had occurred in many institutions in this country in the spring of 1916, following a season in which the potato crop had been below normal. In one institution where the amount of potatoes received was far below the amount requisitioned there had been 200 cases of scurvy by the beginning of April. In the years since 1920, there has been a great increase in the use of other vegetables and of fresh fruits, but the potato still holds an important place in the dietary, especially in the rural sections during the winter months.

REVIEW OF LITERATURE.

Holst and Fröhlich (8) from their first studies with experimental scurvy reported that 20 grams of potatoes cooked by steaming for 30 minutes at 100° C. fully protected a guinea pig from scurvy. Givens and McClugage (4) found that 10 grams of raw potato was sufficient to protect a guinea pig for 129 days. They also reported that cooking the potatoes for 15 minutes at 100° C. only slightly reduced its value, but that cooking for one hour at that temperature so reduced the value that 15 grams failed of protection. Dried potatoes seemed to lengthen the survival period somewhat, but an amount equivalent to 20 grams of fresh potato did not protect the animal from scurvy.

Scheunert (14) found old potatoes to be somewhat lower in vitamin C than new potatoes. When he fed raw new potatoes in amounts of 3 grams daily, or potatoes cooked with or without skins in 4 gram amounts, he had good development in guinea pigs. He found that even 12-14 minutes pressure cooking was more destructive of vitamin C than steaming or ordinary boiling.

Richardson and Douglass (11) found that potatoes stored in a cellar at temperatures of from 53° to 60° F. had a higher content of vitamin C both raw and cooked than the same variety stored in a more humid atmosphere at 40° F. Richardson, Douglass, and Mayfield (12) found that, when fed raw, 5 and 10 grams of the variety known as Bliss Triumph gave better protection to guinea pigs than equivalent amounts of Netted Gem potatoes. When boiled for 25 minutes, however, the Bliss Triumph variety lost some of its potency and the Netted Gem gained some so that cooked as for human consumption the Netted Gem ranked higher than Bliss Triumph as a source of vitamin C.

Richardson and Mayfield (13) reported their results on the effect of storage on vitamin C under two headings, one, the scurvy-preventing value, and the other, the growth promoting value. Using as a basis the results from potatoes fed in the fall

they reported that in cool, damp storage for six months the scurvy-preventing value does not change for the raw potato, but is decreased for the cooked. If the storage is under warm and drier conditions, the antiscorbutic factor is still decreased in the cooked potato, but is increased in the raw. The growth promoting factor on the other hand is increased for both raw and cooked under both conditions of storage.

McKitterick and Thiessen (10) report that approximately 5 grams of the Bliss Triumph in the fall was the minimum protective dose and that cooking did not destroy the vitamin but that there was some loss from storage after 6 to 8 months. The stored potatoes seemed to be more potent cooked than raw. They also found that potatoes that had been grown under irrigation seemed to retain their vitamin C during storage better than those without irrigation.

Yonovska (20) has reported that 5 grams is a minimum protective dose of fresh potatoes cooked in steam, but that it requires 20 grams of stored potatoes cooked in the same manner to protect guinea pigs from scurvy.

Bessey and King (1), using the 2, 6-dichlorophenolindophenol reaction for vitamin C reported that new potatoes contained 0.17 mgm. per gram and old ones only 0.08 mgm. per gram. This would indicate that new potatoes have at least twice as much antiscorbutic value as old ones.

Steibling and Ward (18) recommend the use of 14 pounds of potatoes per week in minimum cost diets for families consisting of two adults and three children with moderately active adults and 17 pounds when the adults are very active.

Talbot (19), studying the food habits of Idaho families, found that even during summer months when other vegetables are plentiful that the average consumption for the average family of her study (4.1 adult male units) was 16.5 pounds and in winter it was 21 pounds.

The variety of potato which is used most extensively in Idaho is the Russet Burbank, commonly called the Netted Gem. This potato is grown commercially, not only in Idaho but in other western states, and has a wide distribution for consumption.

Inasmuch as this variety of potato has such an important place in the dietary of a large number of people it seemed of interest to study the changes, if any, which take place in its value as an antiscorbutic, as it passes through the various stages of maturity and storage.

EXPERIMENTAL PROCEDURE.

Potatoes

The Russet Burbank potato of Idaho, commonly called the Netted Gem, was used for these experiments. All of the "new" potatoes and the others except as specially noted were grown on the Uni-

versity Farm at Moscow under non-irrigated conditions. The 1929 crop of potatoes except for the "new" ones were grown at the Aberdeen Substation in southern Idaho under irrigation. The mature and stored potatoes of the 1931 crop came from Lewiston and were grown under irrigation. These potatoes matured earlier in the calendar year than those from the University Farm or the Substation. The potatoes which were used for the comparison between baked and boiled were obtained from a retail store in Moscow and were grown under conditions similar to those of the University Farm.

"New" potatoes were taken from growing vines and were immature. They were brought to the laboratory fresh twice a week. Those designated as mature were potatoes which were fed the first eight weeks after digging and were such as are regularly stored for winter use.

The stored potatoes were kept in the vegetable storage house of the Department of Horticulture* on the University Farm and were brought to the laboratory once a week for feeding. This storage house approximates the conditions of storage of potatoes on the farms of Idaho. Potatoes kept there were in edible condition until the middle of June. A thermographic record kept from December 1, 1927 to April 30, 1928 showed a fairly uniform temperature between 40° and 50° F. For the winter months of December, January, and February the temperature remained nearer 42° F. but for April the temperature was about 48° F.

In marketing potatoes and in using them on the farm, they are usually taken from the regular storage house and kept for varying lengths of time at temperatures somewhat higher than those for long-time storage. It seemed worthwhile to study the effect of this treatment upon the vitamin C value of this potato. Two series of tests were made in this study. In the first, the potatoes had been in storage for about three months when enough to last for feeding about a week or ten days were taken from storage divided into two portions as nearly identical as possible in shape, size, and general appearance. One portion was put in the laboratory refrigerator where the temperature varied from about 38° to 48° F., and the other in a closed container in the laboratory where the temperature varied from 70° to 80° F.

These conditions were maintained for ten days before feeding began, and new supplies were added at intervals of one week during the test period. In this way all potatoes fed had been held under the special temperature conditions for from ten to twenty days before feeding.

Those in the refrigerator were under temperature conditions approximating those of the coldest part of winter, and no sprouts

* The Author wishes to acknowledge the helpful cooperation of the members of the Department of Horticulture, University of Idaho.

appeared. Those kept in the laboratory developed sprouts from about ¼ to ½ inch in length, and while the tubers were not so hard and crisp as those in the ice box they were firm and in good condition.

The same procedure was followed in a later test using potatoes which had been in storage for at least six months. Here the potatoes were beginning to show short sprouts when brought out of the store house. These sprouts withered when kept in the refrigerator, and developed to an inch or two in length when the potatoes were kept in the laboratory.

Except for the Aberdeen potatoes which were large and were cooked 50 minutes, the potatoes were cooked in 200 cc. of distilled water on an electric plate for 30 minutes. They were put in water of room temperature and required about 7 minutes to bring to boil with the current on "high". When the water was boiling the switch was turned to "low" and the boiling continued for the remainder of the 30 minutes. For the most part this treatment resulted in a potato which was soft but which was still intact. At first the potato was cooked in the skin which was removed at once after cooking. After some trials cooking the potatoes with and without the skin in which the experimental results did not seem to show any difference the potatoes were cooked after peeling. Less difficulty was encountered in getting the animals to eat the potatoes when they were cooked without the skin.

When the potatoes were removed from the cooking water they were put through a ricer and individual doses were weighed out and fed as promptly as possible. Doses were given six times a week.

Selection and Care of the Animals.

For the first three years all the guinea pigs used were purchased from a commercial dealer and weight was the chief factor in selection for only approximate age was known. All the later animals were obtained from a private grower so that age and relationship were known as well as weight.

During the tests the guinea pigs were kept in individual wire netting cages and were given weighed amounts of basal diet and fresh distilled water daily. The animals were weighed every other day and observations for signs of scurvy were made daily.

In the first tests the experimental period was 60 days but in the later ones it was 56 days. A very few studies were made using only 42 days. All animals were chloroformed at the end of the test period and post mortem examination made for enlargement of joints at the wrists, knees, and on the ribs; for fragility of the jaw; and for hemorrhages on the wrists, knees, ribs, ventral trunk muscles, and the intestines. The severity of these signs of scurvy were given "plus" signs to indicate mild but definite, moderate, and severe. The total number of these signs is called the scurvy score and may range from 0 to 24.

Basal Diet.

The basal diet used was a modification of that of Sherman, LaMer and Campbell (15) and was made up of heated skimmed milk powder 30, butterfat 10, rolled oats 39, bran 20, and table salt 1 per cent. The skimmed milk powder was heated in shallow pyrex trays for four hours at 110° C. in a Freas constant temperature oven to free it of any trace of vitamin C. In a few tests cod liver oil was given separately but the animals grew well on the basal diet without cod liver oil when it was supplemented with an anti-scorbutic food.

EXPERIMENTAL RESULTS.

Only the records of those guinea pigs which ate the potato doses well have been included in the results here reported. It was necessary to discard 26 guinea pigs because they consistently refused to eat the potato.

The records of 20 guinea pigs have been omitted in reporting this investigation because of a complicating intestinal condition. In these animals the feces were light in color, soft, and unformed. The contents of the alimentary tract seemed to move very slowly resulting in distention and with several cases, in a ruptured intestinal wall and death. This condition is not specific for potato feeding for it has occurred in this laboratory with a number of supplements, including 1 cc. of lemon juice. It may, or may not, be caused by a low vitamin C intake but scurvy invariably follows as if the vitamin were not completely available.

Fifteen animals were offered raw potatoes but 4 refused to eat them and 5 died suddenly, apparently from the effects of the raw potato. All of them had the same symptoms and none of the guinea pigs on cooked potato developed anything similar. The six records which are complete are no better than the average for the same dose and kind of cooked potato and have been omitted from the report.

Individual records of guinea pigs fed new, mature, and stored potatoes from four consecutive crops are given in Table I. Similar records for these animals which were continued on the basal diet only as negative controls are shown in Table II. The average results of these studies are summarized in Table III.

The 23 animals used as negative controls survived an average of 26 days and lost an average of 117 grams before death. The post mortem scurvy score for these animals averaged 18.5. This performance indicates that the basal diet was free from measurable amounts of vitamin C.

Examination of the results of feeding new potatoes shows that both animals receiving one gram daily of boiled Netted Gem potatoes lived through the 60-day test period and made some gain, but the average scurvy score was no lower than for the basal diet only. Increased doses of the new potato resulted in increased

gains and decreased scurvy scores, but the change is small for doses above 3 grams daily. These changes in score and in gains for multiple doses of potato are shown graphically in Figures 1 and 2.

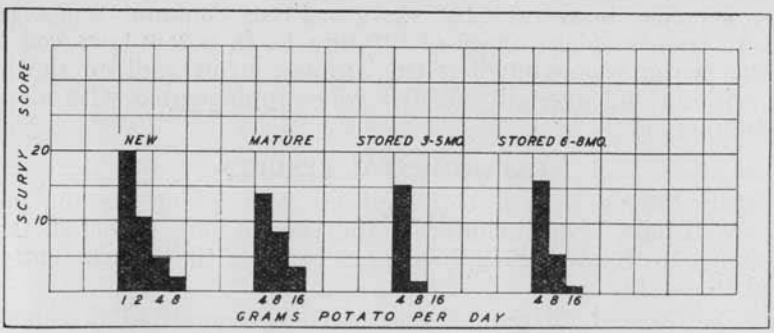

Fig. 1.—Increased doses of potato resulted in decreased average scurvy scores.

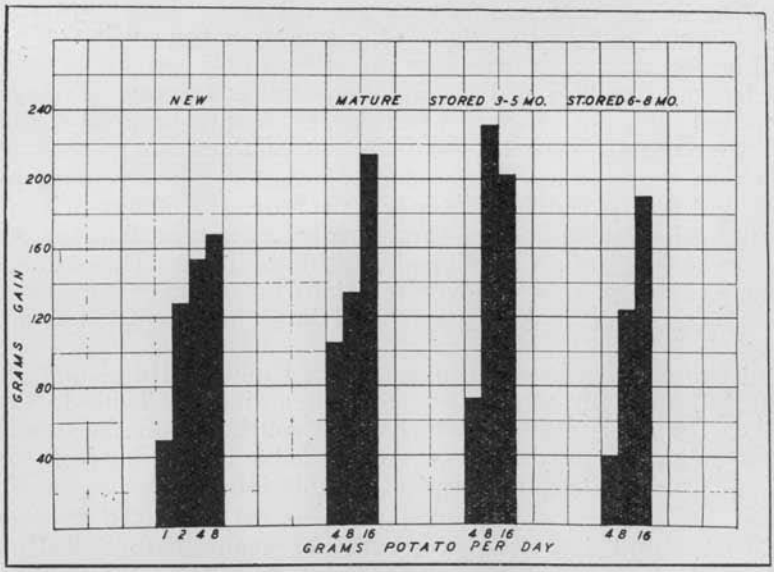

Fig. 2.—Increased doses of potato gave increased average gains.

Comparing the results of the mature potatoes with new ones at the same level of feeding all scurvy scores are higher and all gains are less for the mature than for the new. It will be noted that the gain (154±18) and score (5.3) from 4 grams of new potatoes are as favorable as those from 8 grams (135±29 and 8.3) of mature potato.

From the feeding of stored potatoes there is increasing gain and decreasing severity of scurvy scores as the doses of potatoes are increased, whether the storage is three to five months or six to eight months. When the same levels of feeding are compared there appears to be very little difference in scurvy scores, and the gains are somewhat irregular. At the 4-gram level there is indication of some lowering in value, both for growth and for scurvy protection. At 6- and 8-gram levels, no general trend is seen, while at 16 there is decreasing growth and a decreasing score. For the 6 to 8 month storage at the 4-gram level and for all the stored po-

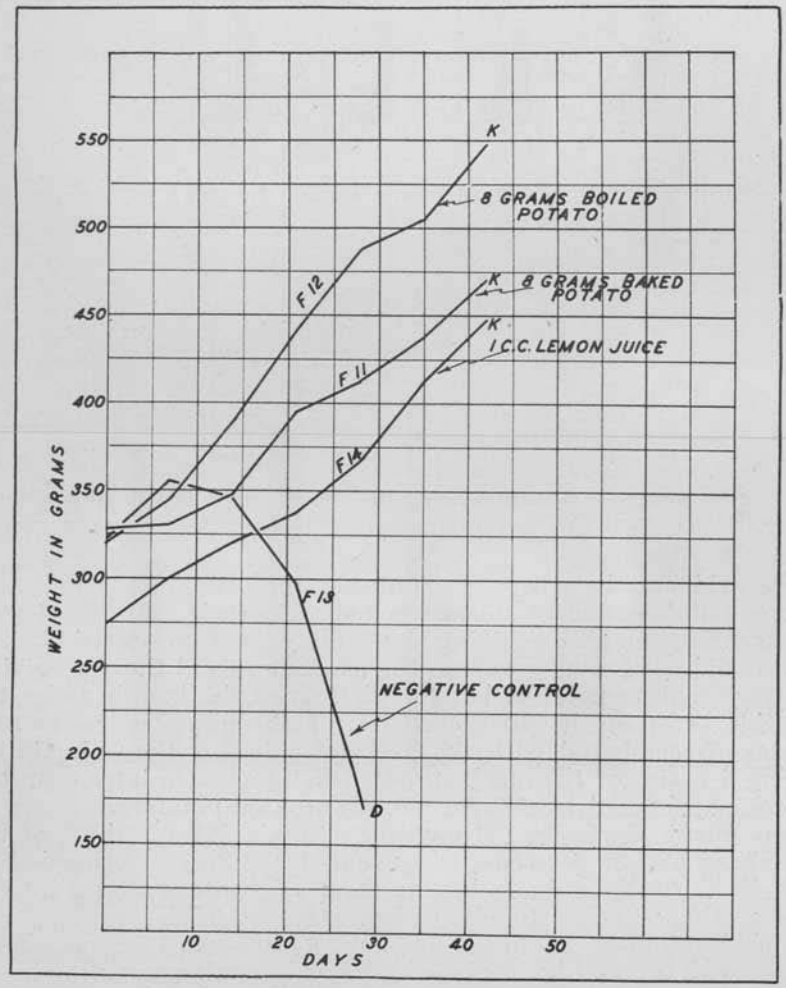

Fig. 3.—Guinea pigs fed cooked potatoes made gains equal to litter mate on 1 cc. lemon juice.

tatoes at the 16-gram level there is only one record each, too small a number from which to make definite conclusions.

The individual records of guinea pigs used in the study of the effect of change in temperature after storage are shown in Tables IV and V and a summary of the results is given in Table VI. In Table VI the average gain is given as gain per week in order that some comparison may be made between the two series. The first one was continued for six weeks and the second one for eight weeks. Table VII shows the individual records of guinea pigs fed much sprouted potatoes from the 1932 crop and the summary figures are found in Table VIII.

The final series reported is one in which boiled potatoes are compared with baked and with 1 cc. of lemon juice. The potatoes were all fed at the 8-gram level. The results are shown in Table IX and the performance of a typical litter on the several doses is shown in Figure 3.

It should be noted that in only one series of tests was the average gain negative. This occurred in the tests with the potatoes kept in the refrigerator after storage of 3 to 5 months.

DISCUSSION

The experimental results of this study give good evidence that new immature potatoes when boiled are a better antiscorbutic than are fresh, mature, or stored potatoes, cooked the same way. This is in agreement with the report of Scheunert working with guinea pigs and with the results indicated by the chemical tests of Bessey and King. When the averages from tests with comparable numbers of animals are considered, new potatoes are seen to be at least twice as potent in the antiscorbutic property as the mature potatoes.

The evidence that there is change in the vitamin C content of mature potatoes due to storage is not so certain. In the 4-year average the animals receiving 4 grams of potato stored 3 to 5 months did not grow so well on the average as did those receiving the fresh mature potatoes but the difference, 36, is only twice the probable error of the difference, 18. If the gain on the mature potatoes is compared with the average gain for the animals receiving 4 grams of the much sprouted potatoes of a later crop the difference (6 gms.) is in favor of the sprouted potatoes.

The scurvy scores are not any more convincing for those of the animals receiving 4 grams of sprouted potatoes averaged 10.3 while those for the animals having the fresh mature were 14.0 and those getting potatoes stored 3 to 5 months was 15.2.

Consideration of results from a daily dose of 8 grams shows that growth is on a higher plane but is as irregular as on the lower dose. The greatest average gain on this level was obtained from potatoes stored 3 to 5 months where the lowest is found on the 4-gram dose. The much sprouted potatoes produced better gains

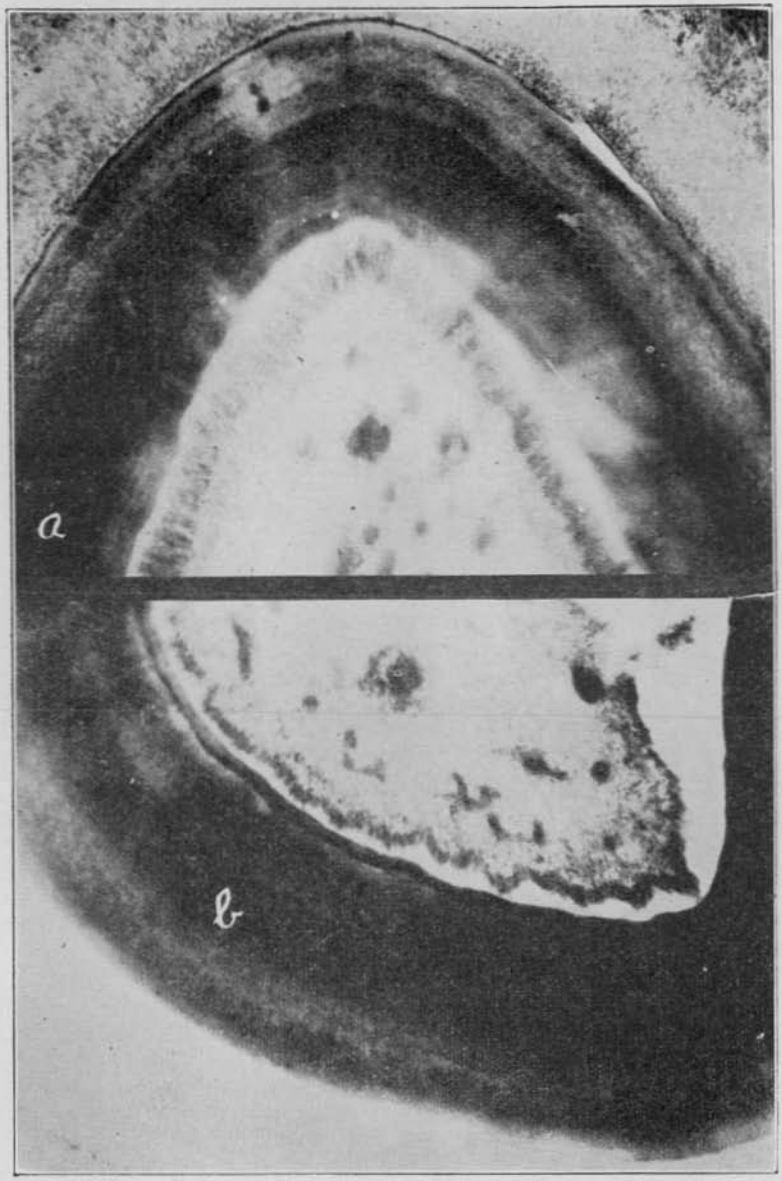

Fig. 4.—Photomicrographs show changes in tooth structure due to low vitamin C in the diet.

(a) Cross section of normal tooth.
(b) Cross section of tooth when scurvy symptoms appeared.

(163±20) at this level than did the mature ones (135±29) and the average scurvy scores are 6.7 and 8.3 respectively.

Perhaps it should be pointed out that the animals used for the study of the sprouted potatoes were of uniform age and of close relationship and seem to give more consistent results than were given in the earlier tests. The survival periods for the two negative control animals are 27 and 30 days—not very different from an average of 26 days for 23 animals of the earlier series.

The evidence offered by the negative gains of animals from both the 4-gram and the 8-gram doses of potatoes, which were taken from storage in midwinter and kept in the refrigerator until cooked, is suggestive that the low temperature may inhibit a growth promoting property of the potato as a supplement of the basal diet used in these experiments. The numbers are too few to make conclusions definite.

It seems worth while to call attention to the fact that where any considerable number of animals were included in a group no doses used completely protected all the animals of the group. In those groups which developed no symptoms while alive, post mortem observations revealed signs of deficiency in teeth, bones, or blood vessels in some of the animals.

Figure 4 shows very well the difference between the cross sections of a tooth from a normal guinea pig and one from a guinea pig just beginning to show symptoms of scurvy. In (a) the dentine is regular and the layer of cells lying against the inner wall of the dentine is compact and symmetrical. In (b) these cells are irregularly placed and much shorter, and the imperfectly formed dentine is already evident.

Guinea pig C56, shown in Figure 5 had an interesting record. This pig developed scurvy on 12 grams of potato stored about three months and the doses were increased day by day as she would eat all of the potato. Thirty grams were finally offered but this amount was not all eaten and the dose was reduced to 24 grams six times a week. This amount was eaten for a year and was the only source of vitamin C in her diet. No immature potatoes were fed.

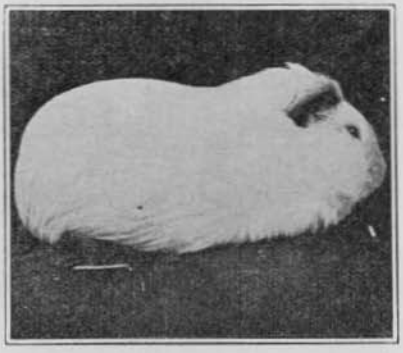

Fig. 5.—Guinea pig after one year with vitamin C from potatoes.

She grew well and appeared in good condition most of the year. At four different times, however, she was noticeably lame and in January one ankle joint became considerably enlarged.

Sherman (17 p. 2) says, "We are now beginning to think much more clearly than ever before in terms of the reality of degrees of

health, or of positive health as something more than mere freedom from disease." Vitamin C is one of the nutritive factors which must be taken into consideration if the health of the individual is

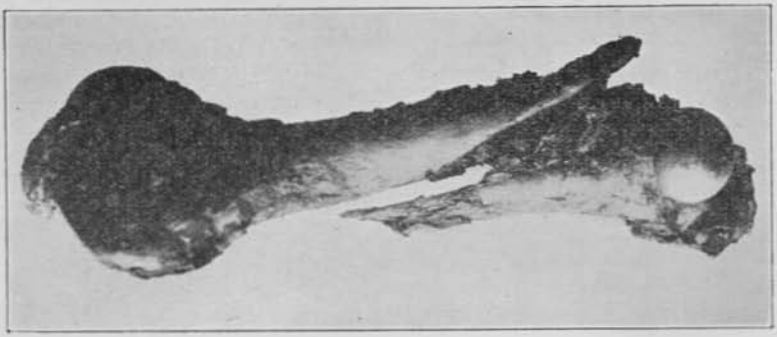

Fig. 6.—Low vitamin C in the diet makes bones fragile.

to be raised to a high standard. From the results of this investigation it seems that potatoes while capable of protecting from scurvy should be supplemented with other sources of the vitamin in the diet if the best possible protection to all the body tissues is to be afforded.

CONCLUSIONS

A biological study of boiled Netted Gem potatoes as a source of vitamin C gave results which point to the following conclusions:

1. Boiled Netted Gem potatoes are a good source of vitamin C and in generous amounts will prevent scurvy.
2. New immature potatoes contain at least twice as much of the vitamin as do fresh mature potatoes.
3. Common storage of the mature potato from three to eight months does not change the vitamin C content to any marked degree.
4. Further evidence has been obtained that marked tissue changes may have taken place due to vitamin C deficiency before outward signs are manifest.
5. Potatoes may suffice as a source of vitamin C in the diet in an emergency but should be supplemented with other sources of the vitamin for best health and development.

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TABLE I

Individual Records of Guinea Pigs Fed Boiled Netted Gem Potatoes From Four Crops as a Source of Vitamin C (1928-1931)

Guinea Pig No.	Supplement	Length of Experimental Period	Weights			Health	Time before onset of scurvy	Post Mortem Observations								Scurvy score
								Bone Changes				Hemorrhages				
			Initial	Final	Gain			Joints	Teeth	Jaws	Ribs	Joints	Muscles	Ribs	Intestines	
	1928	dys.	gm.	gm.	gm.		dys.									
25	8 gms. "new" potatoes	60	283	430	147	No scurvy		—	—	—	—	—	—	—	—	0
27	2 " " "	60	257	448	191	Doubtful scurvy		—	++	—	+	—	—	—	—	3
28	4 " " "	60	264	509	245	No scurvy		—	—	—	—	—	—	—	—	0
29	3 " " "	60	267	397	130	No scurvy		—	—	—	—	—	—	—	—	0
30	2 " " "	60	255	433	178	No scurvy		—	—	—	—	—	—	—	—	0
31	2 " " "	60	265	402	137	Moderate scurvy	59	—	++	++	+	+++	+++	—	—	11
35	4 " " "	60	250	423	173	No scurvy		—	—	—	—	—	—	—	—	0
36	6 " " "	60	257	509	252	No scurvy		—	—	—	—	—	—	—	—	0
40	3 " " "	60	256	499	243	Doubtful scurvy		—	+	+	—	—	—	—	—	2
42	4 " " "	60	271	525	254	No scurvy		—	—	—	—	—	—	—	—	0
43	1 " " "	60	252	314	62	Severe scurvy	27	+++	+++	+++	++	+++	+++	++	—	19
44	1 " " "	60	253	285	32	Severe scurvy	15	+++	+++	+++	+++	+++	+++	++	—	21
46	6 " " "	60	251	428	177	No scurvy		—	—	—	—	—	—	—	—	0
47	3 " " "	60	257	430	173	No scurvy		—	—	—	—	—	—	—	—	0
77	2 gms. potatoes stored 3-5 mos.	60	339	311	—28	Severe scurvy	19	+++	+	+++	—	+++	+++	++	+++	21
78	8 " " " " " "	60	324	483	159	No scurvy		—	—	—	—	—	—	—	—	0
82	3 " " " " " "	33*	302	409	107	Severe scurvy	17	+++	—	+++	—	+++	++	++	—	17
83	3 " " " " " "	60	277	340	63	Severe scurvy	22	++	+++	+++	+++	+++	++	++	—	20
86	4 " " " " " "	60	301	323	22	Moderate scurvy	22	+++	+	+++	++	+++	++	+	+++	16
87	4 " " " " " "	60	252	353	101	Moderate scurvy	21	+++	++	+++	++	+++	++	+	—	14
88	3 " " " " " "	60	301	227	—74	Severe scurvy	17	++	+++	+++	++	+++	++	+	+++	22
89	6 " " " " " "	60	302	456	154	Mild scurvy	56	+	—	—	—	+	+	+	—	4
90	4 " " " " " "	60	258	390	132	Moderate scurvy	21	+++	++	++	+	+++	—	+	—	13
91	6 " " " " " "	60	255	347	92	Mild scurvy	30	++	+	++	+	+	+	+	—	9
92	2 " " " " " "	53*	310	161	—149	Severe scurvy	26	++	+++	+++	+++	+++	+++	++	+++	23
93	3 " " " " " "	60	249	344	95	Moderate scurvy	32	++	++	+++	—	+++	+	—	—	11
94	3 " " " " " "	60	302	226	—76	Severe scurvy	21	+++	+++	+++	++	+	+++	+	++	19
95	6 " " " 6-8 "	60	313	465	152	Mild scurvy	23	++	+	+	—	++	+	—	—	9
99	8 " " " " "	60	307	484	177	Doubtful scurvy	11	+	+	+	—	—	—	—	—	2
100	6 " " " " "	60	307	438	131	Mild scurvy	13	+++	++	+	—	+	+	—	—	9
104	8 " " " " "	60	308	438	130	No scurvy	53	—	—	+	—	—	—	—	—	0
108	8.7 " " " " "	60	333	404	71	Mild scurvy	15	+++	++	+	+	++	—	+	—	10
	1929															
B3	3.4 gms. "new" potatoes	60	346	467	121	Doubtful scurvy	38	+	+++	—	—	—	—	—	—	4
B4	4.4 " " "	60	334	496	162	Mild scurvy	60	+	+	+	—	+	+	—	+	7
B9	8 " " "	60	306	486	180	Doubtful scurvy		—	+++	+	—	—	—	—	+	4
B11	3 " " "	60	303	472	169	Mild scurvy	26	++	++	+	—	+	+	—	—	7

* Died.

TABLE I (Cont.

Guinea Pig No.	Supplement	Length of Experimental Period	Weights			Health	Time before onset of scurvy	Post Mortem Observations								Scurvy score
								Bone Changes				Hemorrhages				
			Initial	Final	Gain			Joints	Teeth	Jaws	Ribs	Joints	Muscles	Ribs	Intestines	
		dys.	gm.	gm.	gm.		dys.									
B12	4 " " "	60	300	449	149	Doubtful scurvy										5
B13	6 " " "	60	300	413	113	Doubtful scurvy										3
B14	8.2 " " "	60	310	417	107	No scurvy										1
B17	1.9 " " "	60	287	379	92	Moderate scurvy	28									12
B22	6 " " "	60	258	395	137	Doubtful scurvy										5
B23	3 " " "	60	252	373	121	Mild scurvy	20									8
B24	2 " " "	60	252	365	113	Moderate scurvy	22									13
B27	3 " mature potatoes	56	315	235	—80	Severe scurvy	11									19
B28	6 " " "	56	312	463	151	Mild scurvy										6
B29	8 " " "	56	310	328	18	Severe scurvy	16									15
B31	6 " " "	56	305	325	20	Severe scurvy	16									17
B35	2.9 " " "	56	291	408	117	Moderate scurvy	54									17
B36	5.8 " " "	56	288	377	89	Mild scurvy										8
B38	7.6 " " "	46*	286	181	—105	Moderate scurvy	15									15
B39	2.8 " " "	56	275	276	1	Severe scurvy	22									21
B40	5.4 " " "	56	272	283	11	Mild scurvy	39									7
B41	10.8 " " "	56	271	234	—47	Severe scurvy	22									19
B44	8 " " "	56	253	316	63	Moderate scurvy	14									15
B45	6 " " "	56	253	332	79	Mild scurvy										6
B46	3 " " "	56	252	245	—7	Severe scurvy	16									20
B47	5.7 " " "	56	244	275	31	Moderate scurvy	20									12
B50	6 gms. potatoes stored 3-5 mos.	56	316	455	139	Mild scurvy	45									9
B51	8 " " " " "	56	281	456	175	No scurvy										0
B52	4 " " " " "	56	304	335	31	Severe scurvy	28									16
B58	4 " " " " "	56	300	307	7	Severe scurvy	14									18
B63	8 " " " " "	56	302	542	240	Doubtful scurvy										4
B72	6 " " " 6-8 "	56	346	286	—60	Severe scurvy	13									18
B75	10 " " " " "	43*	317	406	89	Severe scurvy	40									19
B86	8 " " " " "	56	300	322	22	Moderate scurvy	14									13
B87	6 " " " " "	56	307	396	89	Moderate scurvy	16									10
	1930															
C3	4 gms. "new" potatoes	56	304	571	267	No scurvy										1
C4	4 " " "	56	304	532	228	No scurvy										0
C5	6 " " "	56	300	423	123	Doubtful scurvy										5
C6	6 " " "	56	300	485	185	Doubtful scurvy										4
C7	8 " " "	56	299	595	296	Doubtful scurvy										3
C9	2 " " "	56	312	425	113	Moderate scurvy	51									15
C10	2 " " "	56	306	365	59	Severe scurvy	21									19
C11	4 " " "	56	302	321	19	Severe scurvy	28									17

* Died.

TABLE I (Cont.

Guinea Pig No.	Supplement	Length of Experimental Period	Weights			Health	Time before onset of scurvy	Post Mortem Observations								Scurvy score
								Bone Changes				Hemorrhages				
			Initial	Final	Gain			Joints	Teeth	Jaws	Ribs	Joints	Muscles	Ribs	Intestines	
		dys.	gm.	gm.	gm.		dys.									
C12	4 gms. "new" potatoes	56	304	543	239	Doubtful scurvy		—	+++	—	—	—	—	—	—	3
C13	8 " " "	56	300	445	145	Doubtful scurvy		—	+++	—	—	—	—	—	—	2
C18	6 " " "	56	315	378	63	Moderate scurvy	32	++	+++	++	++	++	++	++	—	18
C19	6 " " "	56	303	459	156	Doubtful scurvy		—	+++	+	—	—	—	—	—	4
C20	4 " " "	56	340	321	—19	Moderate scurvy	48	++	+	+	+	++	++	++	+	15
C21	4 " " "	56	305	406	101	Mild scurvy	51	+	+	++	—	++	+	—	+	9
C22	4 " " "	56	310	418	100	Mild scurvy	54	—	+++	+	—	++	+	—	+	7
C27	4 " " "	56	287	308	21	Severe scurvy	20	+++	+	++	++	++	++	++	+	20
C28	6 " " "	56	285	272	—13	Moderate scurvy	16	++	+	+	++	++	+	+	++	12
C29	8 " " "	56	281	330	49	Moderate scurvy	17	+++	+	++	++	++	+	+	+	13
C44	4 gms. potatoes stored 3-5 mos.	56	310	240	—70	Severe scurvy	18	+++	+++	++	++	+	++	+	+	17
C45	6 " " " " "	56	312	382	70	Moderate scurvy	18	+	+++	++	++	+	+	++	+	13
C46	6 " " " " "	56	313	349	36	Moderate scurvy	16	+++	+++	++	++	+++	+	++	+	16
C49	12 " " " " "	56	323	534	211	Doubtful scurvy	19	+	+	+	—	+	—	—	—	4
C66	10 " " " " "	56	313	404	91	Moderate scurvy	22	+++	++	++	+	+++	++	+	—	14
C67	10 " " " " "	56	322	457	135	Mild scurvy		+	+	—	+	+	+	+	+	7
C68	16 " " " 6-8 "	56	316	506	190	Doubtful scurvy		—	+	—	—	—	—	—	—	1
C78	8 " " " " "	56	304	521	217	Doubtful scurvy		—	++	—	—	—	—	—	—	2
C80	24 " " " " "	56	303	370	67	Moderate scurvy	14	+++	++	+	—	+	—	—	++	10
C81	4 " " " " "	56	308	348	40	Severe scurvy	18	+++	++	++	+++	+++	++	—	+	16
	1931															
D1	4 gms. mature potatoes	56	327	467	140	Mild scurvy	22	—	++	+	—	+	—	+	—	5
D3	8 " " "	56	311	640	329	Doubtful scurvy		—	++	—	+	—	—	—	+	5
D5	16 " " "	56	304	589	285	Doubtful scurvy		—	++	—	—	—	—	—	—	2
D7	4 " " "	56	310	417	107	Moderate scurvy	22	++	++	+	+	++	+	+	—	10
D8	4 " " "	56	321	550	229	Doubtful scurvy		—	++	+	+	+	—	+	—	4
D9	8 " " "	56	309	395	86	Mild scurvy	38	—	+++	+	+	+	—	+	+	7
D10	16 " " "	56	300	381	81	Mild scurvy	46	++	+	+	+	++	—	+	—	8
D11	8 " " "	56	300	437	137	Doubtful scurvy		—	++	++	—	—	—	—	—	4
D12	16 " " "	56	300	473	173	Doubtful scurvy		—	+	+	—	++	—	—	—	6
D14	4 " " "	56	284	379	95	Severe scurvy	20	+++	++	++	++	++	++	++	+	19
D15	4 " " "	56	309	376	67	Severe scurvy	16	+++	++	++	+++	++	++	++	+	21
D16	8 " " "	56	311	531	220	Doubtful scurvy		—	+	+	—	—	+	—	—	3
D17	8 " " "	56	335	589	254	Doubtful scurvy		—	+	+	—	—	—	—	—	3
D19	16 " " "	56	296	483	187	No scurvy		—	—	—	—	—	—	—	—	0
D21	4 " " "	56	310	387	77	Severe scurvy	18	+++	++	++	++	++	++	++	++	19
D22	8 " " "	56	314	611	297	Doubtful scurvy		—	++	—	—	+	—	—	—	3
D24	16 " " "	56	325	668	343	Doubtful scurvy		—	—	—	—	—	—	—	—	2
D26	4 gms. potatoes stored 3-5 mos.	56	292	493	201	Moderate scurvy	14	+++	++	+	+	++	+	+	—	11
D27	8 " " " " "	56	318	664	346	Doubtful scurvy		—	+	—	-	+	—	—	—	2
D28	16 " " " " "	56	292	494	202	No scurvy		—	—	—	—	—	—	—	—	0
D29	4 " " " " "	56	257	385	128	Severe scurvy	24	+++	++	-	+++	+++	+	++	++	17

TABLE II
Individual Records of Negative Control Guinea Pigs (1928-1931)

Guinea Pig No.	Supplement	Length of Survival Period	Weights			Health	Time before onset of scurvy	Post Mortem Observations								Scurvy score
								Bone Changes				Hemorrhages				
			Initial	Final	Gain			Joints	Teeth	Jaws	Ribs	Joints	Muscles	Ribs	Intestines	
		days	gms.	gms.	gms.		dys.									
32	Basal diet only	24	283	157	—126	Severe scurvy	13	+	+++	+++	++	+	+	++	—	13
50	" " "	28	263	157	—105	Severe scurvy	24	+	+++	+++	++	+	+	—	+++	14
65	" " "	20	248	187	—61	Severe scurvy	16	+++	+++	+++	+++	+	+	+	+++	18
81	" " "	22	321	200	—121	Severe scurvy	12	++	+++	++	+	+	+	+	+++	14
98	" " "	21	303	152	—151	Severe scurvy	7	+++	+++	+++	+++	++	++	+++	++	21
106	" " "	22	321	154	—167	Severe scurvy	14	+++	+++	+++	++	++	++	+++	+++	21
114	" " "	29	301	176	—125	Severe scurvy	9	+++	+++	+++	+++	+++	+++	+++	++	23
B1	" " "	28	362	217	—145	Severe scurvy	21	++	+++	+++	++	+	—	++	+++	16
B25	" " "	24	297	197	—100	Severe scurvy	14	+++	+++	+++	+++	+++	+++	+++	+++	24
B26	" " "	35	338	204	—134	Severe scurvy	13	+++	+++	+++	+++	+++	++	+++	+++	23
B42	" " "	18	268	186	—82	Severe scurvy	13	+++	+++	+++	+	+++	+++	+	+	18
B79	" " "	24	309	208	—101	Severe scurvy	16	+++	+++	+++	++	++	++	++	+++	20
B89	" " "	27	340	182	—158	Moderate scurvy	24	++	+++	+++	+	++	++	+	+++	17
C2	" " "	24	310	192	—118	Severe scurvy	13	++	+++	+++	+++	+	++	++	+++	19
C23	" " "	27	336	192	—144	Severe scurvy	15	+++	+++	+++	+++	+++	+++	+++	+++	24
C51	" " "	26	320	217	—103	Severe scurvy	14	+++	+++	+++	++	—	+++	++	+++	19
C92	" " "	37	317	191	—126	Severe scurvy	19	++	+++	+++	++	+++	+++	++	+++	21
D4	" " "	25	289	185	—104	Severe scurvy	10	+++	+++	+++	+++	++	+++	++	+++	22
D6	" " "	15	316	184	—132	No scurvy	—	++	+++	—	—	++	++	—	+	10
D13	" " "	26	294	206	—88	Moderate scurvy	18	++	+++	+++	+	+	+	+	+++	15
D23	" " "	29	363	267	—96	Severe scurvy	22	++	+++	++	+	+++	+++	++	+++	19
D25	" " "	31	261	164	—97	Severe scurvy	20	++	+++	+++	+++	+	++	++	+++	19
D31	" " "	33	308	193	—115	Severe scurvy	20	+++	+++	+++	+	++	++	+	+++	18
	Average	26			—117											18.5

TABLE III
Summary of Results With Boiled Potatoes From Four Crops as Source of Vitamin C.

Supplement	Dose	No. Animals	No. Animals getting scurvy	Average gain gms.	Average scurvy score	Average survival days
None	Basal diet only	23	23	−117	18.5	26
New potatoes	1 gram	2	2	49	20.0	
Mature potatoes		....	....	....	....	
Stored 3-5 mos.		....	....	....	....	
Stored 6-8 mos.		....	....	....	....	
New potatoes	2 grams	7	5	127 ±13	10.4	
Mature potatoes		....	....	....	....	
Stored 3-5 mos.		2	2	−82	22.0	
Stored 6-8 mos.		....	....	....	....	
New potatoes	3 grams	6	2	149 ±13	3.3	
Mature potatoes		4	4	8	19.2	
Stored 3-5 mos.		5	5	31	17.8	
Stored 6-8 mos.		....	....	....	....	
New potatoes	4 grams	12	5	154 ±18	5.3	
Mature potatoes		7	6	105 ±17	14.0	
Stored 3-5 mos.		8	8	69 ±21	15.2	
Stored 6-8 mos.		1	1	40	16.0	
New potatoes	6 grams	6	2	160 ±14	2.8	
Mature potatoes		7	7	53 ±14	9.7	
Stored 3-5 mos.		5	5	96 ±14	9.6	
Stored 6-8 mos.		4	4	70	11.5	
New potatoes	8 grams	5	0	167 ±24	2.0	
Mature potatoes		10	5	135 ±29	8.3	
Stored 3-5 mos.		4	0	231	1.5	
Stored 6-8 mos.		5	2	125 ±22	5.4	
New potatoes	16 grams	....	....	....	....	
Mature potatoes		5	1	214	3.6	
Stored 3-5 mos.		1	0	202	0.0	
Stored 6-8 mos.		1	0	190	1.0	

TABLE IV

Individual Records of Guinea Pigs Fed Potatoes Which Had Been Subjected to Change in Temperature After 3-5 Months Storage

Guinea Pig No.	Supplement: Change to Temperature	Supplement: Dose	Length of Experimental Period	Weights: Initial	Weights: Final	Weights: Gain	Health	Time before onset of scurvy	Post Mortem Observations: Bone Changes: Joints	Bone Changes: Teeth	Bone Changes: Jaws	Bone Changes: Ribs	Hemorrhages: Joints	Hemorrhages: Muscles	Hemorrhages: Ribs	Hemorrhages: Intestines	Scurvy score
	°F	gms.	days	gms.	gms.	gms.		dys.									
D35	70-80	4	42	350	280	—70	Severe scurvy	32	+++	+++	++	+++	+++	+	++	+	16
D36	38-48	4	42	346	249	—97	Severe scurvy	12	+++	+++	++	+++	++	+	++	+	16
D37	Basal diet only		34*	301	185	—116	Severe scurvy	17	++	+++	+++	+++	++	++	++	++	20
D38	70-80	8	42	316	420	104	Doubtful scurvy		—	+	—	—	—	—	—	—	2
D39	38-48	8	42	298	408	110	Doubtful scurvy		—	+	—	—	—	—	—	—	2
D40	70-80	4	42	322	441	119	Moderate scurvy	25	++	+	+	++	++	—	++	—	10
D41	38-48	4	42	359	349	—10	Moderate scurvy	18	++	+	+	++	++	—	+	—	13
D42	70-80	8	42	307	319	12	Moderate scurvy	19	++	+	+	+	+	++	—	—	10
D43	Basal diet only		32*	311	183	—128	Severe scurvy	18	+	+	+	++	++	++	++	++	21
D44	38-48	8	42	306	241	—65	Moderate scurvy	14	++	+	+	++	+	+	++	—	11
D45	70-80	4	42	355	325	—30	Moderate scurvy	18	+	+	+	+	+	+	++	—	15
D46	38-48	4	42	348	246	—102	Severe scurvy	19	+	+	+	++	+	++	+	+	17
D47	70-80	8	42	374	295	—79	Moderate scurvy	20	+	+	+	++	+	++	++	—	14
D48	38-48	8	42	329	267	—62	Severe scurvy	16	++	+	+	++	+	+	+	+	16
D49	70-80	4	42	268	282	14	Severe scurvy	26	++	+	+	++	++	+	+	+	17
D51	70-80	8	42	246	433	187	No scurvy		—	+	—	—	—	—	—	—	0
D52	70-80	4	42	218	379	151	Moderate scurvy	30	+	++	+	+	++	—	+	—	11
D53	38-48	4	42	198	237	39	Moderate scurvy	24	++	++	+	+	++	—	+	—	14
D54	Basal diet only		31*	235	155	—80	Severe scurvy	17	++	++	++	++	++	++	++	++	23

* Died

TABLE V

Individual Records of Guinea Pigs Fed Potatoes Which Had Been Subjected to Change in Temperature After 6-8 Months Storage

Guinea Pig No.	Supplement: Change to Temperature	Supplement: Dose	Length of Experimental Period	Weights: Initial	Weights: Final	Weights: Gain	Health	Time before onset of scurvy	Post Mortem Observations: Bone Changes: Joints	Teeth	Jaws	Ribs	Hemorrhages: Joints	Muscles	Ribs	Intestines	Scurvy score
	°F	gms.	days	gms.	gms.	gms.		dys.									
D55	70-80	4	56	300	266	—34	Severe scurvy	18	++	+++	+++	+++	++	++	+++	—	18
D56	38-48	4	56	264	323	59	Moderate scurvy	19	+++	+++	+++	+	+	+	+	—	15
D57	70-80	4	56	264	272	8	Moderate scurvy	18	+	+	+	+	+	++	+	—	13
D58	38-48	4	56	270	236	—34	Moderate scurvy	20	+	+	+	+	++	+	+	—	15
D59	70-80	4	56	303	350	47	Moderate scurvy	16	+	+	+	+	+	+	+	—	10
D60	38-48	4	56	304	318	14	Severe scurvy	20	+++	+	+	++	++	++	+++	—	19
D61	70-80	8	56	286	427	141	Mild scurvy	22	+	+	+	+	+	+	+	—	7
D63	70-80	4	56	242	203	—39	Severe scurvy	20	+++	+++	+++	++	+	+	++	—	16
D64	38-48	4	56	257	300	43	Moderate scurvy	20	+++	+	+	+	+	+	+	—	12
D66	38-48	4	56	269	349	80	Moderate scurvy	14	+	+	+	+	+	+	+	—	13
D67	Basal diet only		28*	248	174	—74	Severe scurvy	12	+	+	+	+	+	+	+	—	13
D69	38-48	4	56	258	322	64	Moderate scurvy	16	+	+	+	+	+	+	+	++	20
D70	70-80	4	56	302	257	—45	Severe scurvy	22	+++	+	+	+	+	+	+	—	14
D71	38-48	4	56	250	288	38	Moderate scurvy	18	+	+	+	+	+	+	+	—	17
D72	70-80	4	56	260	375	115	Moderate scurvy	22	+	+	+	+	+	+	+	—	15
D73	38-48	4	56	276	276	0	Severe scurvy	16	+++	+++	+	+	+	+	+	+	16
																	17

* Died.

TABLE VI

Average Results From Potatoes Subjected to Temperature Changes.

Supplement			No. of Animals	No. of Animals getting scurvy	Average gain per week gms.	Average scurvy score
Previous storage Mos.	Temperature °F.	Dose Gms.				
3-5	70-80	4	5	5	6.0	13.8
3-5	70-80	8	4	2	9.0	6.5
3-5	38-48	4	4	4	—7.0	15.0
3-5	38-48	8	3	2	—1.5	9.7
6-8	70-80	4	6	6	0.9	15.0
6-8	70-80	8	1	1	18.0	7.0
6-8	38-48	4	8	8	4.0	15.0
None			4	4	—22.0*	21.0

* Average survival 31 days.

TABLE VII

Individual Records of Guinea Pigs Fed Boiled Netted Gem Potatoes Which Had Grown Long Sprouts (1932 Crop)

Guinea Pig No.	Supplement	Length of Experimental Period	Weights			Health	Time before onset of scurvy	Post Mortem Observations								Scurvy score
								Bone Changes				Hemorrhages				
			Initial	Final	Gain			Joints	Teeth	Jaws	Ribs	Joints	Muscles	Ribs	Intestines	
		days	gms.	gms.	gms.		dys.									
E 1	4 gm. potatoes	56	335	505	170	Doubtful scurvy	26	—	++	—	—	+	—	+	—	4
E 2	" " "	56	311	558	247	Mild scurvy	26	—	++	—	+	++	—	+	+	7
E 3	8 " "	56	308	572	264	No scurvy		—	—	—	—	—	—	—	—	0
E 4	8 " "	56	302	594	292	Doubtful scurvy	16	—	++	—	—	+	—	—	—	3
E 5	8 " "	56	335	386	51	Moderate scurvy	16	++	++	+	+	++	+	+	—	11
E 6	8 " "	56	325	578	253	Doubtful scurvy	26	—	—	—	+	—	—	—	—	0
E 7	8 " "	56	347	488	141	Mild scurvy	18	++	++	—	+	+	—	+	—	5
E 8	8 " "	56	267	406	139	Moderate scurvy	18	++	+++	+	+	++	+	—	—	10
E 9	8 " "	56	270	438	168	Mild scurvy	20	+	++	—	—	+	—	—	—	6
E 10	8 " "	56	269	342	73	Mild scurvy	20	+	++	+	—	+	—	—	+	6
E 11	4 " "	56	279	336	57	Severe scurvy	12	+++	++	++	++	++	++	+	—	16
E 13	8 " "	56	295	397	102	Moderate scurvy	18	+++	++	++	—	+	++	++	—	11
E 14	4 " "	56	278	370	92	Moderate scurvy	14	+++	++	++	+	++	++	++	—	14
E 16	4 " "	56	297	340	43	Moderate scurvy	18	+++	++	+	+	+	—	—	—	11
E 17	No supplement	30*	297	171	—126	Severe scurvy	14	+++	+++	+++	++	++	++	++	++	22
E 18	4 gm. potatoes	56	270	357	87	Moderate scurvy	11	++	++	—	+	++	++	+	—	10
E 19	8 " "	56	266	464	198	Mild scurvy	24	—	++	+	—	—	—	—	—	4
E 20	8 " "	56	342	328	—14	Severe scurvy	19	+++	+++	++	++	++	++	+	—	17
E 21	8 " "	56	340	437	97	Mild scurvy	18	+++	++	+	+	+	—	+	+	9
E 22	8 " "	56	325	678	353	Doubtful scurvy		—	++	+	—	+	—	+	—	5
E 23	No supplement	27*	306	178	—128	Severe scurvy	12	+++	+++	+++	+++	+++	+++	+++	+++	24

* Died.

TABLE VIII

Average Results From Sprouted Potatoes 1932 Crop.

Dose	No. of animals	No. of animals getting scurvy	Average gain in 56 days	Average scurvy score
gms.			gms.	
4	6	6	116±21	10.3
8	13	11	116±20	6.7
None	2	2	—127*	23.0

* Average survival 28.5 days.

TABLE IX
Comparison of Netted Gem Potatoes With 1 cc. Lemon Juice

Guinea Pig No.	Supplement	Length of Experimental Period	Weights			Health	Time before onset of scurvy	Post Mortem Observations								Scurvy score
								Bone Changes				Hemorrhages				
			Initial	Final	Gain			Joints	Teeth	Jaws	Ribs	Joints	Muscles	Ribs	Intestines	
		days	gms.	gms.	gms.		dys.									
F 1	8 gm. baked potato	42	367	485	118	No scurvy		—	+	—	—	—	—	—	—	1
F 5	8 " " "	42	349	545	196	No scurvy		—	+	—	—	—	—	—	—	1
F 7	8 " " "	42	452	654	202	No scurvy		—	+	—	—	—	—	—	—	1
F 9	8 " " "	42	350	503	153	No scurvy		—	—	—	—	—	—	—	—	1
F 11	8 " " "	42	328	470	142	Doubtful scurvy		—	+	—	—	+	—	—	—	2
F 15	8 " " "	42	329	454	125	No scurvy		—	+	—	—	—	—	—	+	4
F 2	8 gm. boiled potato	42	398	672	274	No scurvy		—	+	—	—	—	—	—	—	2
F 6	8 " " "	42	334	618	284	Doubtful scurvy		—	+	—	—	—	—	+	—	3
F 8	8 " " "	42	371	501	130	No scurvy		—	+	+	—	—	—	—	—	3
F 12	8 " " "	42	319	548	229	No scurvy		+	+	+	+	+	—	—	—	6
F 16	8 " " "	42	323	450	127	No scurvy		—	+	—	—	—	—	+	+	3
F 4	1 cc. lemon juice	42	290	460	170	Doubtful scurvy	21	—	+	—	—	+	—	+	—	2
F 14	1 " " "	42	272	447	175	Mild scurvy	22	+	+	+	—	—	+	—	—	8
F 17	1 " " "	42	250	376	126	Mild scurvy	26	+	+	+	+	+	—	+	—	7
F 3	No supplement	31*	270	152	—118	Severe scurvy	14	+	+	+	+	+	+	+	+	17
F 13	No supplement	29*	323	172	—151	Severe scurvy	13	+	+	+	+	+	+	+	+	19

* Died.

TABLE X

Average Results of 8 grams Cooked Potatoes and 1 cc. Lemon Juice

Supplement	Dose	No. Animals	No. Animals getting scurvy	Average gain in 6 weeks	Average scurvy score
				gms.	
None	.....	2	2	—135*	18.0
Baked potato	8 gms.	6	0	156	2.0
Boiled potato	8 gms.	5	0	189	2.4
Lemon juice	1 cc.	3	2	157	5.7

* Average survival 30 days.