THE VITAMIN A CONTENT OF DEHYDRATED SWEET POTATO MADE FROM THE FRESHLY HARVESTED PUERTO RICO VARIETY

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CHAPTER I

INTRODUCTION

Investigations have been made to determine the vitamin A content of sweet potatoes by both chemical and biological assay methods on fresh and dried samples. Several factors affect the vitamin content of these, such as the type of soil, climatic conditions, and variety of potato. Hessler and Cole, 1932, in Missouri found only 8 Sherman-Munsell units per gram in the Nancy Hall sweet potato,[1] while McLeod, Tolbert, and Toole, 1932, in Tennessee found 30 Sherman-Munsell units per gram in the same variety of potato.[2] Steenbock and Sell, 1922, studied three varieties of sweet potatoes and found that the amount of vitamin A varied with the depth in color.[3] McLeod, Armstrong, Heap, and Tolbert, 1935, studied the vitamin A content of five varieties of sweet potatoes and

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[1] M. C. Hessler and Blanche Cole, "The Vitamin Content of Nancy Hall Sweet Potatoes," Missouri Agriculture Experiment Station Bulletin No. 310, (1932), 40.

[2] F. L. McLeod, Aileen Tolbert, and L. E. Toole, "The Vitamin A and B Content of Nancy Hall Sweet Potato," Journal of Home Economics, XXIV (1932), 928-929.

[3] H. Steenbock and M. T. Sell, "Fat-Soluble Vitamin A. Further Observations on the Occurrence of the Fat-Soluble Vitamin With Yellow Plant Pigments," Journal Biological Chemistry, LI (1922), 63-76.

obtained results showing that the deeply pigmented varieties, Nancy Hall, Yellow Jersey, and Puerto Rico, contained from 10 to 30 Sherman-Munsell units per gram immediately after harvesting, and from 30 to 65 units per gram after two months' storage, while the Triumph and Southern Queen, light-colored varieties, did not support growth in test animals when fresh, and contained only 2 to 4 units per gram after two months storage.[4] All these varieties were grown on the Tennessee Experiment Farm. Swanson, Stevenson, Haber, and Nelson, 1940, in Iowa determined the average vitamin A concentration of the Prolific variety as 23 International Units or 56 Sherman-Munsell units per gram, probably due to the deep yellow orange color of the flesh.[5]

Fraps and Treichler, 1933, tested the Puerto Rico variety of potato for loss of vitamin A during drying, and found that the destruction of the vitamin appeared to be approximately 29 per cent, as compared with an 80 per cent loss in dried carrots, and a 65 per cent loss in dried spinach.[6]

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[4]F. L. McLeod, M. R. Armstrong, M. E. Heap, and L. A. Tolbert, "Vitamin A Content of Five Varieties of Sweet Potatoes," Journal of Agricultural Research, L (1935), 181-187.

[5]Pearl Swanson, Gladys Stevenson, E. S. Haber, and P. Mabel Nelson, "Effect of Fertilizing Treatment on Vitamin A Content of Sweet Potatoes," Food Research, V (1940), 431-438.

[6]C. S. Fraps and Ray Treichler, "Losses of Vitamin A in Drying Fresh Raw Carrots and Sweet Potatoes and Canned Spinach," Journal of Agricultural Research, XLVII (1933), 539.

The same workers in another experiment determined the content of Puerto Rico variety of sweet potatoes as 20 to 40 Sherman-Munsell units per gram.[7] Munsell, 1938, stated that dried or dehydrated foods show considerable loss in vitamin A content due to oxidation during the drying process.[8] Wilson and Masters found the vitamin A content of dehydrated Puerto Rico sweet potato to range from 120 to 160 International Units per gram when Snell's antimony trichloride colorimetric method of analysis was used.[9]

The purpose of this study was to determine by biological method of assay the vitamin A content of Puerto Rico sweet potatoes which were dehydrated immediately after harvesting.

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[7]G. S. Fraps and Ray Treichler, "Vitamin A Content of Foods and Feeds," Texas Agriculture Experiment Station Bulletin No. 477 (1933).

[8]H. E. Munsell, "Vitamin A Methods of Assay and Sources in Food," Journal of American Medical Association, CXI (1938), 245-252.

[9]G. C. Wilson and W. N. Masters, "Sweet Potato Dehydration," Chemurgic Series, Bulletin No. 2 (August, 1940), Published by North Texas State Teachers College.

CHAPTER II

PROCEDURE

Barthen and Leonard, 1937, compared results obtained with the spectrophotometric and biological methods of assay for vitamin A of fish liver oils.[1] Their data were sufficient to warrant the adoption by the United States Pharmacopoeia of the spectrophotometric method as an alternative for the biological method in testing for vitamin A. Datta and Banerjee[2] found that the biological values of fresh water fish oils were in fairly good agreement with the 'blue values,' antimony trichloride method, of the oil, while Black, Green, Sassaman, and Sabo[3] believe that certain unaccounted for discrepancies beyond the limits of error in their experiments restrict the substitution of any chemical or physical test for biological

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[1] C. L. Barthen and C. S. Leonard, "A Comparison of Spectrophotometric and Biological Assays for Vitamin A," Journal of American Pharmaceutical Association, XXVI (1937), 515-524.

[2] N. C. Datta and B. N. Banerjee, "Biological and Colorimetric Assay of Vitamin A in Some Indian Fresh-Water Fish Oils," Indian Journal of Medical Research, XXI (1934), 535-544, abstracted in Nutrition Abstracts and Reviews, IV (July, 1934), 45.

[3] A. Black, R. D. Green, H. L. Sassaman, and C. Sabo, "A Comparative Study of the Colorimetric, Vitameter and Biological Tests for Vitamin A," Journal of American Pharmaceutical Association, XXVII (1938), 199-205.

assay. Coward, Dyer, Morton, and Goddum, 1931, found that disagreements between the physical and biological measurements are much larger than the known sampling error of the biological test.[4] Morgan, Edisbury, and Morton, 1935, determined that vitamin A in cod liver oil gave higher biological assay results due to an associated biologically active substance which resulted in increased growth.[5] The method of biological assay was used in the present study to determine the vitamin A content of dehydrated sweet potato.

Albino rats of known nutritional history[6] were used in this experiment. The dehydrated sweet potato fed was prepared from the fresh fall crop of Puerto Rico sweet potatoes by the sulphur dioxide process.[7] A total of 56 rats was used from October, 1940, to July, 1941, in determining the vitamin A content of this product. The

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[4]K. H. Coward, F. J. Dyer, R. S. Morton, and J. H. Goddum, "CXXVI. Determination of Vitamin in Cod Liver Oils (a) Biologically, (b) Chemically, (c) Physically, With a Statistical Examination of Results," Biochemical Journal, XXV (1931), 1102.

[5]R. C. Morgan, J. R. Edisbury, and R. A. Morton, "CXCVIII. A Discrepancy Between Biological Assays and Other Methods of Determining Vitamin A," Biochemical Journal, XXIX (1935), 1645-1660.

[6]Original stock colony was secured from Dr. Jett Winters of the University of Texas.

[7]Prepared according to the method originated by Gilbert C. Wilson.

technique used was that originally outlined by Sherman and Munsell, 1925,[8] later described by Swanson, Stevenson, and Nelson, 1938,[9] and used by Swanson, Stevenson, Haber, and Nelson, 1940.[10]

The stock diet consisted of

Ground whole wheat, 600 grams
Whole milk powder, 250 grams
Meat concentrate, 140 grams
Salt, 5 grams
$CaCO_3$, 5 grams.

No female rat was bred without a three weeks' rest period after the previous lactation. The stock diet for lactation included

Ground whole wheat, 500 grams
Whole milk powder, 250 grams
Meat concentrate, 140 grams
Yeast--A, B, strain C, 100 grams
Salt, 5 grams
$CaCO_3$, 5 grams.

Lettuce was fed daily to stock animals and during breeding and lactation. The young animals were allowed a lactation period of twenty-one days or until their weight reached thirty grams, which never exceeded twenty-six days. The weaning weights ranged from thirty-one to fifty-seven grams,

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[8] H. C. Sherman and H. E. Munsell, "The Quantative Determination of Vitamin A," Journal of American Chemical Society, XLVII (1925), 1639-1646.

[9] P. Swanson, G. Stevenson, and P. M. Nelson, "A Method of Increasing Precision in Vitamin A Assay," Journal of Nutrition, XV (1938), 103-123.

[10] P. Swanson, G. Stevenson, E. S. Haber, and P. M. Nelson, "Effect of Fertilizing Treatment on Vitamin A Content of Sweet Potatoes," Food Research, V (1940), 431-438.

with eleven animals having weights exceeding fifty grams. The animals were separated and put into individual cages made of 3/16 inch mesh wire with raised bottoms. Distilled water was available at all times to the animals. The basal ration used during the depletion period consisted of

Casein (vitamin-A free), 18 per cent
Hydrogenated lard,[11] 22 per cent
Cornstarch, 56 per cent
Salt mixture,[12] 4 per cent
Yeast (1/5 irradiated), 0.5 grams per rat per day, or 8 per cent of the diet (1/5 irradiated).[13]

The animals were allowed to eat this diet ad libitum. A depletion period of twenty-eight days was allowed, which exceeds by four days the time Swanson, Stevenson, and Nelson recommended on the basis of the appearance and persistence of cornified cells in vaginal smears.[14] Munsell, 1938, found that xerophthalmia may or may not be present along with the stationary or declining weight which signifies the end of the depletion period.[15]

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[11] Clix, courtesy of Cudahy Company.

[12] Osborne and Mendel salt mixture [described in Journal of Biological Chemistry, XXXII (1917), 309].

[13] P. Swanson, G. Stevenson, and P. M. Nelson, "A Method of Increasing Precision in Vitamin A Assay," Journal of Nutrition, XV (1938), 105.

[14] Ibid., p. 106.

[15] H. E. Munsell, "Vitamin A--Methods of Assay and Sources in Food," Journal of American Medical Association, CXI (1938), 245-252.

The animals were separated into groups of six, three males and three females, for each of the five levels of reference oil and the four levels of dehydrated sweet potato which was given. The supplementary feedings were given each animal in separate feeding cups. Samples of dehydrated sweet potato were fed weekly to the animals at four levels ranging from 0.5 gram to 1.5 grams each feeding. Cod liver oil, standardized by the United States Pharmacopoeia[16] and received in November, 1940, was fed at levels ranging from 55.1 International Units to 165.2 International Units. Two animals were kept on the basal ration from the time of weaning throughout the experimental period without any supplementary feeding, a total of ten weeks, to serve as negative controls.

The assay period covered five weeks, during which time the rats were weighed daily, six days a week, because Swanson et al[17] found that the results of the five weeks' and eight weeks' periods were not significantly different, but that on the whole, the results of the five weeks' test period were less variable, and consequently this study of supplements was terminated at the end of five weeks.

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[16] Secured from United States Pharmacopoeia Convention, 43rd and Woodland Avenue, Philadelphia, Pennsylvania.

[17] Swanson, Stevenson, Haber, and Nelson, op. cit., p. 438.

CHAPTER III

DISCUSSION OF RESULTS

Figure 1 shows the average daily weights of males and females from the time of weaning, when the animals were put on a vitamin A-free basal ration, to the end of the twenty-eight days' depletion period. The weaning weights of the females range from 32 grams to 55 grams, giving an average weight of 39.7 grams, while the males range from 31 grams to 57 grams, with an average of 43.4 grams. The weights of the females at the end of the twenty-eight days' depletion period range from 66 grams to 110 grams, with an average of 83.2 grams, whereas the range of the males is from 79 grams to 163 grams, or an average of 100.8 grams. The average gain for the females is 43.5 grams, and it is 57.4 grams for the males.

The males show a difference in rate of gain when compared with the females. These results are substantiated by records of rat growth determined by Donaldson,[1] who gives the average weight at the end of 30 days for males as 48.5 and for females as 45.7. In the present study the technique

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[1]Henry Donaldson, The Rat-Data and Reference Tables, Edited by H. Donaldson, Philadelphia, Pennsylvania (1924), p. 177.

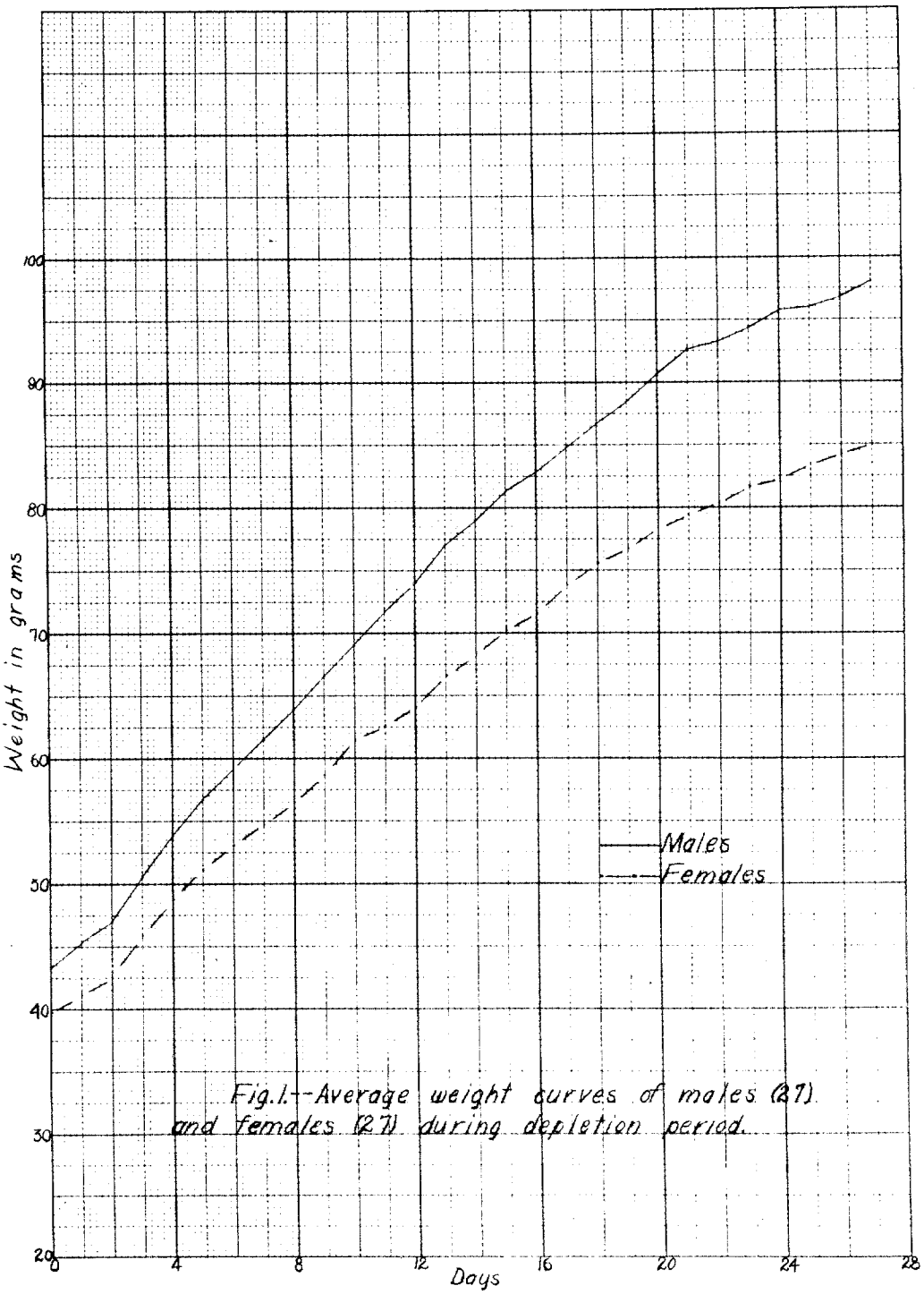

Fig. 1.--Average weight curves of males (27) and females (27) during depletion period.

employed represents the accepted one used in the bio-assay of vitamin A. This method weans the animals earlier, that is, between the ages of 21 and 28 days, in order to obtain animals that weigh not less than 30 grams nor more than 56 grams. Consequently, the actual weaning weights are different from Donaldson's, but follow the same sex difference obtained by him. The difference in size of the litters and the time of year when the animals were born may affect the gains in weight obtained during the depletion period since Donaldson[2] found that albino rats born during the spring months tend to be more vigorous.

At the end of the depletion period, the weights are practically stationary or declining slightly, which is the criterion set up by Swanson, Stevenson and Nelson,[3] 1938, as indicating the depletion of vitamin A stores in the body of the test animal and the time to begin the administration of vitamin A supplementary feeding. Males and females from each litter are distributed in the various levels of supplementary feeding to make the test groups of six animals each as representative as possible.

The newer technique in biological method of assay for vitamin A is based on a comparison of the growth obtained by feeding a test substance with the growth obtained from

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[2]Donaldson, op. cit., p. 15.

[3]Swanson, Stevenson, and Nelson, op. cit., p. 103.

a known quantity of a standard substance. Reference cod liver oil, standardized by the United States Pharmacopoeia method, is an accepted standard to be used in such studies. In the present study, cod liver oil was fed in five levels: 55.1 International Units,* 82.6 International Units, 100.2 International Units, 130.2 International Units, and 165.2 International Units. Table 1 gives the gains in weight during the 35 days of these supplementary feedings. The average gain per day is given for each level of vitamin A fed. When comparing the males and females in each group, it is evident that the range is somewhat similar and that the maximum weight increases in proportion to the amount of vitamin A fed, but as a rule the males make greater gains per unit of supplement fed than the females; that is, both males and females receiving 165.2 International Units gained more per day than those receiving 130.2 International Units. One hundred and thirty and two tenths International Units produced more growth than 100.2 International Units, and 100.2 International Units produced more than 82.6 with a minimum growth at the 55.1 International Units level.

The growth of the animals that are fed the substance to be tested for vitamin A content, dehydrated sweet potato, is shown in Table 2. When the test substance is fed at four

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*International Unit equals the United States Pharmacopoeia unit of .6 microgram beta-carotene.

TABLE 1

THE WEANING WEIGHT; THE WEIGHT AT THE END OF DEPLETION PERIOD; THE WEIGHT AT THE END OF THIRTY-FIVE DAYS AFTER DEPLETION PERIOD; THE TOTAL GAIN AND THE AVERAGE GAIN OF EACH ANIMAL IN EACH GROUP WHEN FED A CERTAIN NUMBER OF INTERNATIONAL UNITS OF REFERENCE OIL*

Amount of Reference Oil* Fed	Number of Animal	Weaning Weight in Grams	Weight at End of 28 Day Depletion Period in Grams	Supplementary Vitamin A Feeding		
				Weight in Grams at End of 35 Days	Total Gain in Grams	Average Gain in Grams Per Day
Group I						
55.1 I. U.**	1♂	40	82	102	20	0.57
	2♂	56	115	145	30	0.88
	3♂	52	102	129	27	0.77
	4♀	52	102	124	22	0.62
	5♀	49	90	115	25	0.71
	6♀	43	85	112	27	0.77
Group II						
82.6 I. U.	1♂	48	95	128	33	0.94
	2♂	44	96	130	34	0.98
	3♂	39	82	117	35	1.00
	4♀	55	95	123	28	0.80
	5♀	54	95	126	31	0.90
	6♀	34	88	121	33	0.95
Group III						
100.2 I. U.	1♂	43	85	125	40	1.14
	2♂	44	96	132	36	1.03
	3♂	47	104	140	36	1.03
	4♀	36	71	108	37	1.05

TABLE 1--Continued

Amount of Reference Oil* Fed	Number of Animal	Weaning Weight in Grams	Weight at End of 28 Day Depletion Period in Grams	Supplementary Vitamin A Feeding		
				Weight in Grams at End of 35 Days	Total Gain in Grams	Average Gain in Grams Per Day
	5♀	45	100	136	36	1.03
	6♀	36	72	108	36	1.03
			Group IV			
130.2 I. U.	1♂	43	84	127	43	1.22
	2♂	57	145	188	43	1.22
	3♂	40	90	143	53	1.51
	4♀	33	81	123	42	1.20
	5♀	34	79	125	46	1.31
	6♀	32	72	117	45	1.28
			Group V			
165.2 I. U.	1♂	35	101	155	54	1.54
	2♂	36	105	209	104	2.97
	3♂	35	121	207	86	2.45
	4♀	32	72	117	45	1.28
	5♀	39	96	173	77	2.20
	6♀	33	110	157	47	1.34

*Cod liver oil, standardized by United States Pharmacopoeia.
**I. U., International Unit.

levels, it gives daily increments in weight in proportion to the amount fed, the 0.5 gram group producing less gain than the 0.7 gram group, the 0.7 gram group less than the 1 gram group, and the 1 gram group less than the 1.5 gram

group. Again the male range in weight is consistently higher than that of the females within each group.

TABLE 2

THE WEANING WEIGHT; THE WEIGHT AT THE END OF DEPLETION PERIOD; THE WEIGHT AT THE END OF THIRTY-FIVE DAYS AFTER DEPLETION PERIOD; THE TOTAL GAIN AND THE AVERAGE GAIN OF EACH ANIMAL IN EACH GROUP WHEN FED A CERTAIN NUMBER OF GRAMS OF DEHYDRATED SWEET POTATO

Amount of d.s.p.* Fed	Number of Animal	Weaning Weight in Grams	Weight at End of 28 Day Depletion Period in Grams	Supplementary Vitamin A Feeding		
				Weight in Grams at End of 35 Days	Total Gain in Grams	Average Gain in Grams Per Day
			Group I			
0.5 gm.	1♂	54	110	124	14	0.40
	2♂	44	90	112	22	0.62
	3♂	52	110	138	28	0.80
	4♀	37	68	95	27	0.77
	5♀	42	83	108	25	0.71
	6♀	52	89	108	19	0.54
			Group II			
0.7 gm.	1♂	40	85	117	32	0.91
	2♂	46	102	137	35	1.00
	3♂	29	83	127	44	1.25
	4♀	32	81	114	33	0.94
	5♀	32	70	99	29	0.82
	6♀	34	66	105	39	1.11

TABLE 2--Continued

Amount of d.s.p.* Fed	Number of Animal	Weaning Weight in Grams	Weight at End of 28 Day Depletion Period in Grams	Supplementary Vitamin A Feeding		
				Weight in Grams at End of 35 Days	Total Gain in Grams	Average Gain in Grams Per Day
			Group III			
1.0 gm.	1♂	56	163	213	50	1.42
	2♂	31	90	162	72	2.05
	3♂	48	100	133	33	0.94
	4♀	51	107	153	46	1.31
	5♀	32	83	126	43	1.23
	6♀	44	98	139	41	1.17
			Group IV			
1.5 gm.	1♂	34	86	206	120	3.42
	2♂	43	98	182	84	2.40
	3♂	36	102	174	72	2.05
	4♀	34	84	144	60	1.71
	5♀	34	77	138	61	1.74
	6♀	39	82	140	58	1.65

*d.s.p., dehydrated sweet potato.

To prove that these increases in weight are due to the vitamin A in the reference oil and test substance, two animals are kept on the vitamin A-free basal ration throughout the entire period, ten weeks, as negative controls. Their weights follow closely the average weights of all other animals through the 28 days of depletion, but become practically stationary with only occasional gains in weight

during the period which corresponds to that of the administration of vitamin A to the other animals. Therefore, the consistent gains in weight of the animals receiving graded amounts of the supplements is due to the growth response of vitamin A present in them.

The average total gain in weight per day of each group of animals, described in Tables 1 and 2, is tabulated in Table 3. A comparison of the different levels of dehydrated sweet potato fed with the different levels of vitamin A administered as International Units of reference cod liver oil shows the growth for one gram of dehydrated sweet potato to be similar to that obtained with 130.2 International Units. This value is slightly higher than Dozier's,[4] who found that one gram of dehydrated sweet potato, prepared from a stored sweet potato crop, gave not less than 102 International Units. Because no other biological assay work has been done to determine the vitamin A content of dehydrated sweet potato, no further comparisons can be made. However, Wilson[5] reports from 120 to 160 International Units in the dehydrated sweet potato product when testing a sample by Snell's antimony trichloride method of analysis.

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[4]Private communication.

[5]Gilbert Wilson and W. N. Masters, "Sweet Potato Dehydration," Chemurgic Series, Bulletin No. 2 (August, 1940), 20.

TABLE 3

THE AVERAGE GAINS IN GRAMS WHEN SPECIFIED AMOUNTS OF DEHYDRATED SWEET POTATO OR REFERENCE OIL* WERE FED TO ALBINO RATS

Amount of Vitamin A Supplement Given	Number of Animals	Total Gains Per Day in Grams	Average Gains Per Day in Grams
Dehydrated Sweet Potato			
0.5 gm.	6	3.84	0.63
0.7 gm.	6	5.93	0.98
1.0 gm.	6	8.13	1.35
1.5 gm.	6	12.92	2.15
Reference Oil			
55.1 I. U.**	6	4.32	0.72
86.2 I. U.	6	5.57	0.93
100.2 I. U.	6	6.31	1.05
130.2 I. U.	6	7.74	1.30
165.2 I. U.	6	11.78	1.96

*Cod liver oil, standardized by United States Pharmacopoeia.

**I. U. represents International Unit, which equals the Unites States Pharmacopoeia Unit.

A discussion of discrepancies found between biological methods and chemical methods of analysis for determining vitamin A is given in the procedure. Investigators report that the biological method of assay gives higher vitamin A values than does the chemical method of analysis, attributing the difference to active substances which give better growth in the test animal than the gain expected for the

amount of vitamin A administered. Consequently, Møllgaard, 1938,[6] found that biological tests are necessary for the determination of requirements even though vitamin A and carotene can be expressed accurately in terms of the pure crystalline substance. The difference in vitamin A content of dehydrated sweet potato as determined by the antimony trichloride method and biological assay reverses the findings of other research workers, namely that the biological method gives higher values than the chemical method. Differences in the amount of vitamin A in the original sweet potato may account for this since the same sample was not used in determining the vitamin A content by the two methods. Fresh sweet potatoes may have different vitamin A content even though the variety is the same and the same method of assay is used, as indicated by comparison of results obtained by McLeod et al,[7] 1932, who found 30 Sherman-Munsell units per gram in the Nancy Hall variety of sweet potato, and those obtained by Hessler and Cole,[8] 1932, who found only

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[6]H. Møllgaard, "Om biologiske bestemmelser af A-vitamin," (Biological Estimation of Vitamin A), Ugeskr. Loeger, C (1938), 1317-1324, abstracted in Nutrition Abstracts and Reviews, VIII (1939), 889.

[7]F. L. McLeod, Aileen Tolbert, and L. E. Toole, "The Vitamin A and B Content of Nancy Hall Sweet Potato," Journal of Home Economics, XXIV (1932), 928-929.

[8]M. C. Hessler and Blanche Cole, "The Vitamin Content of Nancy Hall Sweet Potato," Missouri Agricultural Experiment Station, Bulletin 310, p. 40.

8 Sherman-Munsell units per gram in the same variety. The possibility of fertilizing treatment as the variable factor is eliminated, because Swanson et al,[9] 1940, found that fertilizing treatment had no effect on the vitamin A content of sweet potatoes. The vitamin A value varies with the fresh or dry state and the length of the storage period as shown by Fraps and Treichler,[10] 1933, who stated that it is possible that there is a loss of vitamin A during storage at room temperature, while McLeod et al[11] found the vitamin A value to increase approximately three times the original content after storage. Consequently, the difference between the values obtained with these two methods is unaccounted for except for the original vitamin A content of the sweet potato.

Earlier workers base the content of foods on the Sherman-Munsell unit, and therefore, most of the available literature expresses vitamin A content in these terms. Munsell, 1938, describes the Sherman-Munsell unit as that

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[9]Pearl Swanson, Gladys Stevenson, E. S. Haber, and P. Mabel Nelson, "Effect of Fertilizing Treatment on Vitamin A Content of Sweet Potatoes," Food Research, V (1940), 431.

[10]G. S. Fraps and Ray Treichler, "Losses of Vitamin A in Drying Fresh Raw Carrots and Sweet Potatoes and Canned Spinach," Journal of Agricultural Research, XLVII (1933), 539.

[11]F. L. McLeod, M. R. Armstrong, M. E. Heap, and L. A. Tolbert, "Vitamin A Content of Five Varieties of Sweet Potatoes," Journal of Agricultural Research, C (1935), 181-187.

amount (of vitamin A) which, when fed daily (six times a week), just sufficed to support a rate of gain of three grams a week in a standard test rat during an experimental period of four to eight weeks.[12] This unit has a variable value ranging from 0.8 to 2.5 Sherman-Munsell units as an equal to one International Unit. Using this conversion figure, the vitamin A value of the dehydrated sweet potato ranges from 104.2 International Units to 325.2 International Units. Allowing for 71 per cent loss in weight during dehydration due to removal of water,[13] the vitamin A value of the present product is 39 International Units when calculated for the fresh, less concentrated product. This gives a range of 31.2 to 97.5 International Units according to the Sherman-Munsell value. This wide range proves that vitamin A value based on the Sherman-Munsell growth units is less accurate than vitamin A values obtained by comparison with a known standard.

The value of 130.2 International Units per gram makes the dehydrated sweet potato a most important source of vitamin A in the diet, particularly when transportation or storage facilities are such that space must be conserved.

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[12]Hazel E. Munsell, "Vitamin A. Methods of Assay and Sources in Food," Journal of American Medical Association, CXI (1938), 245-252.

[13]Gilbert Wilson, W. N. Masters, J. L. Carrico, "Chemurgic Industrial Possibilities of the Sweet Potato," Chemurgic Series, Bulletin No. 1, (October, 1939), p. 14.

The minimum adult requirement for vitamin A is 3,000 International Units per day,* which can be met with approximately 23 grams of dehydrated sweet potato, while the child's requirement ranges from 4,888 International Units per day for the two-year old child to 6,456 International Units per day for the six-year old child** and can be met with approximately 37 grams and 49 grams of dehydrated sweet potato respectively.

Thus, results discussed here show that Puerto Rico sweet potatoes, dehydrated immediately after harvesting by the sulphur dioxide process, contain not less than 130.2 International Units per gram.

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*Steibling's standard.
**Cowgill's standard.

CHAPTER IV

SUMMARY

A sample of dehydrated sweet potato made from freshly harvested crop of Puerto Rico variety is analyzed biologically for its vitamin A content. The amount of vitamin A present is determined by comparing the gains in weight produced by a given amount of dehydrated sweet potato with gains obtained from feeding graded amounts of reference oil.

Data are presented to show that one gram dehydrated sweet potato contains not less than 130.2 International Units per gram.

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