TABLE 1

THE DESTRUCTION OF CAROTENE BY WATER EXTRACTS OF MINCED RAT STOMACH MUCOSA AS COMPARED WITH SOYBEAN "CAROTENE OXIDASE"

Volume extract	Rat stomach mucosa extract*			Sobyean extract		
	Number of determinations	Destruction of carotene		Number of determinations	Destruction of carotene	
		Range	Average		Range	Average
ml		*Per cent.*	*Per cent.*		*Per cent.*	*Per cent.*
1.0	6	57.8–86.2	74.2	6	70.0–78.5	74.0
0.5	6	61.0–79.7	70.8	4	48.8–72.8	61.9
0.25	2	58.8–69.1	64.0	..	.....	...
0.20	4	51.0–55.8	54.1	2	40.0–44.4	42.2
0.10	1	.....	45.3	2	28.7–32.5	30.6
0.05	1	.....	28.0	..	.....	...
1.0 (no Linolate)	5	0–28.0	12.2	3	0–35.0	15.0
1.0 (heated) †	1	.....	36.8	..	.....	...
0.5 "	1	.....	32.8	..	.....	...
0.1 "	1	.....	20.0	..	.....	...

* Rats were on a stock diet: Average weight of the six rats used was 215 grams.
† The extract was heated on a boiling water bath for 15 minutes.

by a water extract of a low-grade wheat flour, the active agent in the stomach extract is not. On the other hand, the stomach extract appears to be more susceptible to inhibition by α-tocopherol than does the soybean extract. A further point of difference between the two extracts became evident in a study of the pH activity curves. Over a pH range of 3.0 to 6.6 using the citric acid-sodium phosphate buffer system the soybean lipoxidase was inactive below pH 4.0 and showed its maximum at about pH 5.5; the falling off was gradual on the alkaline side of the optimum. However, the rat stomach showed considerable activity even at pH 3.0. This may have a relation to a natural resistance to the acidity of the normal stomach possessed by this active carotene-destroying agent. In other respects the pH activity curve of the stomach extract was very similar to that of the soybean enzyme. The pH optimum was 5.7 and the falling off on the alkaline side was gradual.

TABLE 2

COMPARATIVE INHIBITION OF RAT STOMACH AND SOYBEAN "CAROTENE OXIDASE" BY TOCOPHEROL AND CENTRIFUGED 5 PER CENT. WATER EXTRACT OF SECOND CLEAR WHEAT FLOUR

Incubation time	Rat stomach extracts* †			Soybean extracts†		
	Number of determinations	Destruction of carotene		Number of determinations	Destruction of carotene	
		Range	Average		Range	Average
Minutes		*Per cent.*	*Per cent.*		*Per cent.*	*Per cent.*
15	5	35.5–65.9	52.6	3	65.1–70.5	67.6
30	14	56.8–81.9	70.1	3	71.3–80.8	76.0
30 (plus flour extract)	5	51.5–78.9	66.8	5	23.6–43.5	37.1
15 (1 mg) (Tocopherol)	1	.....	5.0	1	.....	42.0
30 (1 mg) (Tocopherol)	1	.....	25.0	1	.....	45.5

* Rats had been on a synthetic ration composed of 30 per cent. lard, 5.5 per cent. salts, 25 per cent. casein, sucrose and synthetic vitamins. Average weight was 178 grams.
† One ml of extracts used.

Other organs have been tested for a carotene-destroying agent in their water extracts. Preliminary results have shown that liver is quite potent while muscle and small intestine appear to have little or no potency. However, it should be mentioned that the extracts of small intestines were not clear and contained a large amount of extraneous material. As mentioned above, lack of clarity in stomach extracts indicates a resistance to destruction of carotene, and the same may be the case with the intestinal extracts. The fact that muscle extract shows no potency appears to exclude the possibility that the destructive action of the tissue extracts on carotene is an artifact resulting from iron-porphyrins or similar compounds extracted from the blood contained within the organs.[5]

Some time after the above results were obtained an attempt was made to repeat certain phases but with slightly anomalous results. No apparent change in the procedure was made, but a new supply of methyl linolate was employed, with the result that a lag phase of from one to two hours incubation time was noted during which little or no destruction of carotene occurred. However, after this time interval carotene destruction began and proceeded rapidly to near completion within 30 minutes. The general results were the same as previously noted, in that methyl linolate was required in conjunction with the stomach extract, neither being effective by itself. This peculiarity may have been caused by a small amount of an antioxidant in the new batch of linolate, or it may have been related to a variation in the efficiency of extraction of the active agent from the minced stomach.

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AN UNIDENTIFIED NUTRIENT REQUIRED FOR PROPER UTILIZATION OF DL-ALPHA-TOCOPHEROL BY THE CHICK[1]

DURING attempts to study the rôle of vitamin E in chick nutrition with a simplified ration, the chick was not protected from a vitamin E and A deficiency when

[5] F. Haurowitz, P. Schwerin and M. M. Yenson, *Jour. Biol. Chem.*, 140: 353, 1941.

[1] Technical Contribution No. 107, South Carolina Agricultural Experiment Station. Published by permission of the director of the South Carolina Agricultural Experiment Station. We are indebted to Merck and Company, Inc., Rahway, N. J., for dl-alpha-tocopherol; Anheuser-Busch and Company, St. Louis, Mo., for dried brewers' yeast; Distillation Products, Inc., Rochester, N. Y., for vitamin A; Central Soya Company, Inc., Decatur, Indiana, for soybean phosphatides; and E. I. du Pont de Nemours and Company, New Brunswick, N. J., for vitamin D_3.

these vitamins were included in the ration at a level several times the requirement. Slanetz and Scharf[2] reported that soybean phosphatides promoted proper utilization of vitamin A in the rat. Quackenbush, Cox and Steenbock[3] found that dl-alpha-tocopherol was an antioxidant for vitamin A and carotene.

The percentage composition of the basal ration was as follows: Dextrin 52.3, Cellophane 3, casein (purified) 30, gelatin 5, salts 4.6, lard 5 and choline 0.1. In addition each one hundred grams of the ration contained 200 I. U. vitamin D_3, 800 I. U. vitamin A (natural esters), 0.1 mg 2-methyl-1,4-naphthoquinone, 0.5 mg thiamin, 1 mg riboflavin, 0.5 mg pyridoxin, 2 mg Ca-pantothenate, 2 mg nicotinic acid, 30 mcg biotin, 1 mg inositol and a fuller's earth eluate equivalent to 12 grams of dried brewers' yeast. This ration is adequate in all water-soluble nutrients required for normal growth of the chick; however, it is inadequate in vitamin E and an unrecognized fat-soluble substance which is necessary for proper utilization of vitamin E. This unrecognized nutrient is found in yeast and soybean phosphatides. It can be removed from yeast by extraction with hot Skellysolve B and is soluble in ether, Skellysolve B and Stoddard solvent.

The data presented in Table 1 summarize the study on the unrecognized fat-soluble nutrient. Chicks receiving only the basal ration (Trial 1) started to develop vitamin E deficiency symptoms at about 12 days of age, and by the 28th day severe vitamin A and E deficiency symptoms were present. Those receiving 0.001 per cent. dl-alpha-tocopherol, trial 2, developed vitamin A and E deficiency symptoms simultaneously with those in trial 1. When the basal ration was supplemented with 0.001 per cent. dl-alpha-tocopherol plus 5 or 10 per cent. dried brewers' yeast, they developed normally. If they received 0.001 per cent. dl-alpha-tocopherol plus 5 per cent. brewers' yeast which had been extracted for 72 hours in a Soxhlet extractor with hot Skellysolve B, they developed vitamin E and A deficiency symptoms. If the basal ration was made adequate in dl-alpha-tocopherol and supplemented with 2 per cent. soybean phosphatides the chick developed normally. When the chicks were given massive dosages of vitamin A (4,000 I. U. per day) for the first three days of life and also the basal ration made adequate in vitamin E, they developed only vitamin E deficiency during the first 35 days of life.

TABLE 1

INFLUENCE OF DIFFERENT SUPPLEMENTS ON THE DEVELOPMENT OF VITAMIN E AND A DEFICIENCY SYMPTOMS IN CHICKS

Trial	Supplement to basal ration	Observations up to 5 weeks of age		
		Mortality	Vitamin E deficiency	Vitamin A deficiency
		Per cent.	Per cent.	Per cent.
1	None	100	83	100
2*	dl-alpha-Tocopherol	100	90	100
3*	dl-alpha-Tocoperol, 5 per per cent. yeast	0	0	0
4*	dl-alpha-Tocopherol, 10 per cent. yeast	0	0	0
5*	dl-alpha-Tocopherol, 2 per cent. soybean phosphatides	0	0	0
6*	dl-alpha-Tocopherol, 5 per cent. extracted yeast	100	70	100
7	5 per cent. extracted yeast	100	60	100
8*	dl-alpha-Tocopherol, massive vitamin A dosage.	20	67	0

* dl-alpha-Tocopherol was added at a level of 0.001 per cent.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

A METHOD FOR INDICATING THE MOISTURE CONTENT OF FOODS DURING DEHYDRATION[1]

IN the dehydration of foods, such as vegetables, fruits, meats, etc., there is a great need for a method which will indicate, in the dehydrators, the moisture content of the dehydrating material and which will tell when the material has dried to the proper or preferred moisture content and is ready to be removed. At the present time, three different methods are used for this purpose: (1) appearance and feel of the material by hand; (2) taking a sample and determining its moisture content; and (3) dehydrating the material for a definite and predetermined length of time. Obviously, for one reason or another, these methods can not be considered entirely satisfactory.

It is the purpose of this note to present a method which can be used in dehydrators to indicate, by proper calibration, the moisture content of the dehydrating material at the various stages of dehydration and to tell when the material has dried to the proper or preferred moisture content and is ready to be removed.

The method is based upon the well-known phenomenon that the evaporation of water lowers the temperature. When the fresh material is being dehydrated, there are two temperatures, that of the chamber and that of the material itself. At the beginning, when

[2] C. A. Slanetz and A. Scharf, *Proc. Soc. Exp. Biol. and Med.*, 53: 17, 1943.

[3] F. W. Quackenbush, R. P. Cox and H. Steenbock, *Jour. Biol. Chem.*, 145: 169, 1942.

[1] Journal article No. 660, new series.