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Increase of Ascorbic Acid in Cauliflower during Blanching

While assessing the loss of nutrients of some common vegetables at different stages of canning operations, indications were obtained in some preliminary experiments that there might be some increase of ascorbic acid in cauliflower during blanching by hot water.

Retzer *et al.*[1] noted that there was a loss of 19 per cent and 18 per cent of ascorbic acid of cauliflower during blanching by hot water and by steam respectively. In 1947 Kaloyereas[2] in an investigation showed that blanching of cauliflower and spinach (boiling water or dielectric heat) resulted in a loss of ascorbic acid up to 82 per cent. There are, however, some references regarding increase of some vitamins during processing and storage of some foodstuffs. Lamb *et al.*[3] noted an increase of ascorbic acid during the processing of corn, peaches and spinach. McMillan and Todhunter[4] observed an increase of dehydroascorbic acid in cut cabbages after standing for 2 h. According to Poole and others[5] vitamin B_2 apparently increased by 43 per cent in cabbage during dehydration for 8 h. Brenner *et al.*[6] observed that the vitamin B_2 content of many products increased 25–200 per cent on storage. Kohman[7] also found that the apparent ascorbic acid content of canned foods (for infants, invalids and the aged) increased during processing.

Some experiments were performed to confirm the preliminary observations regarding increase of ascorbic acid in cauliflower during blanching by hot water. About 5 kg of cauliflower were purchased from the local market and brought to the laboratory. The edible portion was washed in tap water to remove dirt, dried with a towel and cut into small pieces. The pooled samples were mixed and four representative samples were taken, as quickly as possible, to determine the ascorbic acid content. The moisture content was determined simultaneously. About 3 kg of samples were blanched for 4 min at 82·2° C with about 5 vol. water in a glass-lined vessel heated by steam. A portion of the blanched sample was allowed to cool by itself and another portion was cooled by spray of water. Ascorbic acid and moisture were determined on the different samples after 5 min, 30 min and 1 h after blanching. Ascorbic acid determinations were made by using 2 : 6-dichlorophenol indophenol as recommended by the Association of Vitamin Chemists, Inc.[8].

The results are shown in Table 1.

Table 1. Effect of Blanching and Cooling Ascorbic Acid Content (mg per cent on Dry Basis)

Sample No.	Raw	Blanched, Cooling by water spray			Blanched, Slow cooling in air		
		5 min	30 min	60 min	5 min	30 min	60 min
1	459·8	986·3	1,038·0	975·7	963·8	975·7	919·6
2	495·1	1,211·0	1,191·0	879·2	1,185·0	1,288·0	1,121·0
3	595·1	761·9	771·1	798·7	896·6	1,026·0	827·3
4	567·0	736·4	808·3	671·7	726·8	694·0	725·7
5	646·9	862·4	902·4	841·2	823·5	853·3	872·4
6	458·3	396·6	439·7	467·1	446·4	517·7	498·9
Mean	537·0	825·8	858·4	772·3	840·4	891·6	827·5

From Table 1 it is evident that there is an increase in ascorbic acid content of cauliflower during blanching with hot water. The percentage increases observed are 53·7, 59·8 and 43·8 after 5 min, 30 min and 60 min (cooled by spray of water). The corresponding figures for samples cooled slowly in air are 56·5, 64·4 and 54·1.

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Absorption of l-^{14}C Lignoceric Acid in the Rat

Lignoceric acid, the straight-chain fatty acid having 24 carbon atoms, is a constituent of the sphingolipids where it is found in amide linkage with sphingosine. No compound having this fatty acid in ester bond has been isolated so far from animals. It has, however, been shown that when 1-^{14}C lignoceric acid was administered to rats, it was incorporated into both the sphingolipids and esterified lipids such as neutral and phosphoglycerides[1]. Since sphingolipids are constituents of the regular diet, the work reported here was undertaken to determine whether lignoceric acid is absorbed at all, and if so, in what form it would be transported, after absorption, in the lymph.

Male rats (100–200 g) were fed a fat-rich diet for 24 h and then fasted overnight. They were then anæsthetized with sodium pentothal (5 mg/100 g) and the thoracic duct was cannulated according to Bollman[2]. A neutralized aqueous suspension of 1-^{14}C lignoceric acid was administered either by stomach tube or by intraduodenal injection. The lymph was collected, extracted with 19 volumes of a mixture of chloroform/methanol, 2 : 1, and an aliquot taken for determination of total radioactivity. The rest was evaporated to dryness, the residue taken up in light petroleum ether and the phospholipids precipitated with acetone in the presence of ethanolic magnesium chloride; the supernatant was then taken twice through a column of 'MgO–Celite'[3].

Fig. 1 shows the radioactivity of the lymph lipids after administration of 1-^{14}C lignoceric acid by stomach tube and by intraduodenal injection. In these experiments about 15 per cent of the radioactivity was recovered in the lymph after 24–40 h. Occasionally, however, absorption of 25–30 per cent of the administered fatty acid was observed. When the animals were killed after 40 h, about 5 per cent of the radioactivity was found in the stomach and intestine, and more than 30 per cent was collected in the stool. It can be seen in Fig. 1 that a 4-h lag in absorption occurs after administration of lignoceric acid by stomach tube, due apparently to slow emptying of the content of the stomach.

Fractionation of the lymph lipids showed that about 85–95 per cent of the radioactivity was in the neutral glyceride fraction, about 3 per cent in the phospholipids and 3–10 per cent occurred as free fatty acid; this is similar to the results obtained with lower fatty acids[4–9].

These results suggest that if the amide bond of ingested sphingolipids can be hydrolysed in the digestive tract, the lignoceric acid (and possibly also other long-chain fatty