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## THE ASCORBIC ACID CONTENT OF EAST TEXAS HOME CANNED AND COMMERCIALY CANNED TOMATOES AND BLACKBERRIES

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Although books on nutrition list the nutritive values of many foods, it is worthwhile for us to know the values of foods commonly produced in any locality. Soil, climate, sunshine, methods of growing all may affect the composition of the foods. In the present study, one of the authors was interested in tomatoes and blackberries which were grown and processed in her own locality in Texas.

We find that there has been a great deal of research on canned foods, especially the vitamin content, effects of various canning processes on the nutrients in foods, the stability of the vitamins in canned foods during storage, etc.

It has been found that there is considerable variation in the ascorbic acid (vitamin C) value of canned tomatoes due to the variety, climatic conditions during growth, and methods of processing. (American Medical Association, 1945). Moschette, *et al* (1947) stated that the temperature during storage determines, to a large extent, the effect of storage. Also, Lamb, *et al* (1947) found that desaturation before canning decreases the losses.

Not much work has been done on colored berries, such as blackberries. There is a wide range of values given for ascorbic acid content in raw blackberries. According to Hansen and Waldo (1944), climatic conditions during growth are largely responsible. These same workers also found that the genetic constitution of a variety of the fruit has a determining influence.

In the present study berries and tomatoes grown and canned commercially in a certain locality in Texas were tested for ascorbic acid. In addition, these same fruits were canned by three different home canning methods and were checked for this vitamin. During the canning season for each of these fruits, one number 2 can of each fruit was taken from the regular commercial cannery runs at intervals of one week until three cans of each had been selected. On the same days when the samples were selected, berries and tomatoes were taken from the stocks at the canneries and were canned at home according to three accepted methods, the open kettle, water bath, and steam process methods.

In the home canning methods the berries were washed and capped. In the open kettle method they were heated in thin syrup just to the boiling point and then were placed in sterilized jars and sealed. In the water bath method the berries were packed into jars, thin syrup was poured over them and they were heated in hot water to deaerate them. More syrup was then added, the jars sealed and processed in boiling water that covered the jars. The steam process was somewhat similar except that the water did not cover the jars, and deaeration and canning processes were somewhat longer than for the water bath method.

For the commercial methods, the berries were prepared as above, packed into tin cans, deaerated, filled with hot water, sealed, processed in boiling water, and then plunged into cold water.

For all methods the tomatoes were washed and skinned. In the open kettle method, they were heated in an aluminum pan to the boiling point, were packed into sterilized jars, salt was added and the jars sealed. The water bath and steam process were similar to the methods used for the berries. The washed and peeled tomatoes were packed into jars, they were deaerated, salt was added, the jars were sealed and were processed. The steam process method was slightly longer than the water bath. The commercially canned tomatoes were prepared as above, packed into tin cans, the air was exhausted, salt was added, the cans were sealed and were processed in boiling water. The time was longer than in the home canning methods.

The canning was done during the summer. Cans were brought to Norman in September and analyses were run for ascorbic acid.

The chemical titration method was used in the analyses. It was essentially the method described by Halliday and Noble (1943). In the case of the tomatoes, three weighed samples were taken from one jar from each of the four canning methods. Each sample was placed in a mortar, covered with three per cent metaphosphoric acid, macerated with specially prepared sand, and was centrifuged. The clear supernatant liquid was poured into a volumetric flask. More metaphosphoric acid was added to the centrifuge tubes, the mixture stirred and centrifuged again. The process was repeated four times to be sure all of the ascorbic acid was extracted. The extract in the volumetric flasks was then made up to volume with metaphosphoric acid and samples were used for the determinations.

The analytical process for the berries had to be varied somewhat from that used for the tomatoes. As the berries are rather low in ascorbic acid, larger samples had to be used, and these were too large to be centrifuged. Instead, the extract was strained through cheesecloth. The berry mixture was treated with several portions of metaphosphoric acid, the solutions poured into a volumetric flask and the extract made up to volume with metaphosphoric acid. Because the extract was dark and the test is a color test, it had to be decolorized, using vegetable charcoal. This process caused some loss of the vitamin. Therefore, a similar process had to be carried out on different amounts of pure ascorbic acid. Tests were run on the untreated and treated ascorbic acid, and from these figures, an equation was developed which was used in determining the original amount of the vitamin in the berries.

Samples of the tomato and blackberry extracts and of the treated and untreated pure ascorbic acid were titrated with the dye, 2, 6-dichlorophenol-indophenol until the end point, a faint pink color which lasted five seconds, was reached. From these figures the ascorbic acid values of the samples were calculated.

The usual precautions were followed, namely, using glass distilled water for all solutions and for rinsing all equipment, not using dye more than four days old, keeping the dye and metaphosphoric acid in the refrigerator, and standardizing the dye daily. Blanks were run on the metaphosphoric acid before each test and preliminary checks were made on the berry and tomato extracts. All extracts were analyzed the day they were prepared.

In the canned products, differences in ascorbic acid content were found from week to week and also between the various methods of canning.

The ascorbic acid content values for the canned tomatoes ranged from 11.8 mg to 20.27 mg per 100 gms of tomatoes. The averages were 16.81 mg for tomatoes canned by the water bath method, 16.24 mg for those canned by the steam process, 14.90 mg for the open kettle method and 14.19 mg for the commercial method (See Table I). These figures are averages for analyses of samples canned by each method for all three weeks. The tomatoes had been stored a little over three months before the tests were run. Tomatoes

canned by the water bath and steam process had the highest values while those canned by the open kettle and commercial method had the lowest values. Doubtless, the explanation for the results of the open kettle method is that this method allows more air to come in contact with the tomatoes, and consequently there is more chance for destruction of ascorbic acid. The very low values for the test of the first week commercially canned tomatoes account for the low average for this method. As this was the first week the cannery was in operation, its technique might not have been as good as it was later. However, omitting this figure, the average, 15.39 mg per 100 grams of tomatoes, is still lower than that for the tomatoes canned by the water bath or steam process methods. The processing period used in the commercial method was longer than for the water bath or steam process. This fact could account for the lower figures.

TABLE I

*The Ascorbic Acid Values of Canned Tomatoes and Blackberries  
In Mg per 100 grams of fruit*

	COMMERCIAL METHOD	OPEN KETTLE METHOD	STEAM PROCESS	WATER BATH
CANNED TOMATOES	14.19	14.90	16.24	16.81
CANNED BLACKBERRIES	2.97	2.67	2.63	3.21

The blackberries were checked about five months after canning. The berries canned by the water bath showed the highest values, those canned by the commercial method next, and the open kettle and steam process were about the same (Table I). The values were much lower than those for the tomatoes, but available figures on raw berries are low. Therefore, the figures for the canned berries are about what one would expect. Water was added to all cans either as water or thin syrup. Even traces of copper in the water can catalyze the oxidation of vitamin C. Also, the water or syrup diluted the vitamin. One therefore cannot expect the values for the canned berries to be as high as the fresh fruit. As the water bath method employs a lower temperature, there would not be as much destruction as in methods using a higher temperature during processing. This fact possibly accounts for the higher values for berries canned by this method. In the commercial method the cans were cooled quickly after the processing was completed, a practice that probably decreases the destruction of ascorbic acid.

It may be seen (Table I) that the water bath method gave the highest values for both the tomatoes and berries. The water bath has been most highly recommended for home canning, and the open kettle the least. The latter method is apt to produce a less desirable-looking product, and one that does not keep so well. From this experiment, one would conclude that the open kettle method also causes greater destruction of vitamin C. The results of this study show that the commercial method, so far as ascorbic acid is concerned, is more satisfactory for berries than for tomatoes.

The effect of the weather during the growing period upon the ascorbic acid values was also checked. It was noted that both berries and tomatoes picked after a rain were softer and contained more vitamin C than the others.

This study shows that tomatoes canned by any method are a richer source of ascorbic acid than canned blackberries. One good-sized serving of canned tomatoes will satisfy about one-fifth of the day's needs for this vitamin while one serving of blackberries will satisfy only about four per cent of the day's needs.

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