

BORIC ACID OCCURRING NATURALLY IN SOME FOODS.

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Among the common chemical preservatives which have been used in foods and which are prohibited entirely or tolerated under certain restrictions by the Federal Foods and Drugs Act, as now enforced, are benzoic acid, salicylic acid, sulfurous acid, boric acid and formaldehyde. Boric acid is used principally for preserving meats, meat products, fish and dairy products. Its presence can be detected readily by acidifying the ash of the sample with hydrochloric acid and then dipping a piece of turmeric paper into the solution. If boric acid is present the yellow turmeric paper becomes red on drying.

In the course of some food analyses the writer had occasion to test a sample of datanut butter which was made from dates ground very fine, and peanut butter. The butter has the consistency of a stiff jam and is very pleasing to the taste. I obtained a positive but not a very strong test for boric acid. It seemed unlikely that boric acid had been used as an artificial preservative in such small quantities as evidently existed in the material. I then tested some peanuts which had been roasted but found no boric acid in them. Dates, however, gave a test for boric acid when the acidified ash was tested with turmeric paper. It was obvious, then, that the boric acid in the datanut butter must be, in part, at least, naturally occurring in the dates. Several European writers have reported the occurrence of small amounts of boric acid in natural foodstuffs. In the Analyst for 1914 is an abstract of an article by G. Bertrand and H. Agulhon in Bull. Soc. Chim. 1913, 13, 824-827, citing the occurrence of boric acid in milk and eggs. In the Analyst for 1912 is an abstract of an article by L. Robin in Eighth Int. Cong. App. Chem. 1912, Vol. 1, 429-432, in which he states that boric acid is a natural constituent of wines. In the Analyst for 1913 is an abstract of an article by V. Villavecchia and I. Barboni in Ann. Lab. Chim. Cent. delle Gabelle 1912, 6, 27-68, in which the occurrence of boric acid in Italian salt is discussed. In Zeit. Offentl. Chem. 1905, XI, 231-234, is discussed the occurrence of boric acid in common salt.

The above mentioned facts led to experiments in which a quantitative analysis for boric acid was made in some of our common fruits. Because of the limited time and because of lack of fresh fruits, dried fruits were used. The writer tried at

first to measure the boric acid by comparing the colors in tubes which contained about fifty cc. of solution. The standards were boric acid dissolved in weak hydrochloric acid to which was added some standard turmeric solution. In other tubes were hydrochloric acid solutions of the iron free ash of the sample to which a standard solution of turmeric had likewise been added. The Schriener-Schorey colorimeter was used. The quantities of boric acid in the fruits were so small, however, that the depth of color given with the standard turmeric solution was too weak to give accurate comparison.

The method finally used was one for estimating very small quantities of boric acid in organic substances described by G. Bertrand and H. Agulhon in *Comptes rend.* 1913, 157, 1433-1436 and reported in the *Analyst* for 1914. Ten or twenty grams of animal substance or one gram of vegetable substance are mixed with sodium carbonate and ignited to ash which need not be white. To the ash 5-10 cc. of phosphoric acid are added and the whole transferred to a flask with 20 cc. of methyl alcohol. The mixture is distilled and the distillate is collected in a platinum dish containing 2 or 3 drops of sodium hydroxide solution. A second portion of methyl alcohol is added and the second distillate collected with the first. The combined distillates are evaporated to dryness and the residue taken up with $\frac{1}{2}$ cc. of tenth normal hydrochloric acid. A strip of turmeric paper 3 mm. by 45 mm. is put into the hydrochloric acid solution so that about 20 mm. extends above the edge of the containing vessel. The whole is set aside for 24 hours at room temperature or for 3 hours at 30 degrees. The length of the colored strip at the outer end of the turmeric paper is compared with a similar colored strip on paper immersed in solutions containing known amounts of boric acid. The method depends on the formation of a volatile compound of methyl alcohol and boric acid which is distilled over and the second portion of alcohol is used to make sure that all of the boric acid is taken over.

The standards for comparison are made by dissolving known amount of boric acid in weak hydrochloric acid. The standards must be treated exactly as the sample is treated—the same quality of turmeric paper must be used, it must remain in the solution the same length of time as the paper remains in the solution of the sample and the turmeric paper must be placed in each solution simultaneously. If these conditions are fol-

lowed the writer found that the length of coloration of the turmeric paper is directly proportional to the quantity of boric acid present. For example where 0.2 mg. boric acid was used the coloration measured 4.5 mm.; with 0.4 mg. it was 9 mm.; with 0.6 mg. it was 13.5 mm.; with 0.8 mg. it was 16.5 mm. Experiments started at different times would show the same proportionality but different numbers. With practice in measuring the colored area on the strips the method becomes as accurate as any good colorimetric analysis method such as the determination of nitrates in water, for example.

Following is the data of the experiments:

TABLE I.

SAMPLE	WEIGHT	BORIC ACID	PERCENT
Dates.....	1.0010g	0.3 mg	0.0299
Dried Peaches.....	1.0054	0.066	0.0065
Dried Apricots.....	1.0174	0.022	0.00216
Prunes.....	1.0080	0.08	0.00792
Figs.....	1.0247	0.04	0.0039
Raisins.....	1.0178	0.05	0.0049

The writer had previously found boric acid in some sausages and these were now examined quantitatively.

TABLE II.

SAMPLE	WEIGHT	BORIC ACID	PERCENT
Wienerwursts (C. P. Co.).....	10.0181 g	0.05mg	0.00049
Pork Sausages (C. P. Co.).....	4.3720	trace	

The salt with which the meat was cured which was used in the preparation of these sausages was then examined. Salt from another packing house and also from a dairy was examined.

TABLE III.

SAMPLE	WEIGHT	BORIC ACID	PERCENT
Salt (C. P. Co.).....	4.0907 g	0.02mg	0.00045
Salt (D. P. Co.).....	4.0886	0.02	0.00048
Salt (Dairy).....	2.5600	0.02	0.00077

Among the fruits dates show the largest percentage of boric acid with prunes next. The quantities in the other fruits and in sausages and salt is insignificant. These results show that in some of our common fruits, probably in meat and certainly in common salt there are minute though measurable quantities of boric acid occurring naturally. However, it does not seem probable that these amounts of boric acid could injure the persons eating the foods.

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