1-1985

Sulfite Residues in Maraschino Cherries

Julie A. Nordlee

Laura B. Martin

Steve L. Taylor

Published in *Journal of Food Science* 50:1 (January 1985), pp. 256–257; doi: 10.1111/j.1365-2621.1985.tb13323.x

Submitted July 16, 1984; accepted September 10, 1984; first published January 1985.

Sulfite Residues in Maraschino Cherries

Julie A. Nordlee,[1] Laura B. Martin,[1] and Steve L. Taylor[1,2]

1. Food Research Institute, Department of Food Microbiology and Toxicology, University of Wisconsin, Madison, Wisconsin, USA
2. Department of Food Science, University of Wisconsin, Madison, Wisconsin, USA

Abstract

A survey of 53 samples of maraschino cherries from 14 different processors revealed that total sulfite residues averaged 52.3 ± 44.7 ppm. However, 58.5% of the samples had less than 40 ppm total SO_2, while only 7.6% had greater than 120 ppm total SO_2 indicating that the distribution was skewed in the direction of lower residue levels. Free sulfite residues in the 53 samples were considerably lower, averaging 14.2 ± 7.1 ppm. With free SO_2 levels, 35.8% of the samples had less than 10 ppm free SO_2, while only 5.7% had greater than 30 ppm free SO_2. With an average serving size of one cherry (3–7 g), maraschino cherries would contribute only 0.16–0.37 mg per serving of total sulfites as SO_2.

Introduction

Sulfiting agents have been used as bleaching agents in the processing of sweet cherries into maraschino cherries since the advent of the process (Joslyn and Braverman, 1954). Typically, the sweet cherries are held in a brine containing 0.75–1.5% sulfur dioxide and 3000–5000 ppm calcium salts for 6–12 months to obtain the necessary degree of bleaching. The cherries are sorted for size and the presence of stems, pitted, and returned to the brine. Most of the sulfite is removed by leaching with either hot or cold water before addition of artificial colorants, flavors, and sweeteners. However, the finished maraschino cherries retain traces of sulfite residues, as is usually acknowledged on the labels.

Recently, the ingestion of sulfites has been linked with the initiation of asthmatic attacks among a small percentage of asthmatics (Freedman, 1977; Stevenson and Simon, 1981). In controlled challenges with capsules containing potassium metabisulfite, the sensitive asthmatics will experience a decrease in lung function about 15–30 min following administration of the capsules (Stevenson and Simon, 1981). The sensitive asthmatics have variable degrees

of sensitivity to the sulfites; observed thresholds range from 5–100 mg of $K_2S_2O_5$. The degree of sensitivity of sulfite-sensitive asthmatics to sulfited foods remains to be determined. However, the ingestion of sulfited foods has been associated with several acute asthma episodes (Baker et al., 1981; Stevenson and Simon, 1981; Werth, 1982).

Consequently, concerns have been expressed regarding the presence of sulfite residues in foods. However, in some sulfited foods, the residual sulfite levels may be below the threshold doses needed to precipitate asthmatic attacks. In any case, better information is needed on the residual levels of sulfites in a variety of sulfited foods. The purpose of this study was to survey maraschino cherries from all major U.S. processors to obtain more accurate data on the residual sulfite levels in this particular product.

Materials and Methods

Sulfite analyses

Total SO_2 (total sulfite expressed as SO_2 equivalents) was measured by the modified Monier-Williams procedure (AOAC, 1975). The titration was performed with 0.01N NaOH rather than 0.1N NaOH to improve the sensitivity of the method. Free SO_2 (free sulfite expressed as SO_2 equivalents) was measured with an iodometric titration procedure (AOAC, 1975). The titration was performed with 0.002N I_2 rather than 0.02N I_2 to improve the sensitivity of the method. All analyses were performed on drained cherries.

Reproducibility studies

To determine the reproducibility of the method for free and total SO_2 with maraschino cherries, triplicate analyses were performed on a large, uniform batch of cherries. Two large jars of maraschino cherries were obtained from a local supermarket, drained, combined, and comminuted to yield the uniform sample.

Survey of maraschino cherries

A total of 53 samples of maraschino cherries were obtained from 14 different processors, representing most of the maraschino cherries packed in the United States. Regular, cocktail, and bucket cherries were included in the survey. Each processor provided at least one sample of each type of product that he produced.

Results and Discussion

The methods for total and free SO_2 analyses in maraschino cherries yielded quite reproducible results. The analysis of triplicate samples from a large homogeneous sample by the modified Minier-Williams method (AOAC, 1975) yielded total SO_2 levels of 61.6, 65.8, and 62.6 ppm. Replicate analysis of the same large sample for free SO_2 by the iodometric titration method (AOAC, 1975) gave values of 29.8, 27.2, and 28.2 ppm.

The survey of commercial samples of maraschino cheries showed that the residual levels of sulfite in maraschino cherries were rather low (Tables 1 and 2). As expected, total sulfite levels (Table 1) which represent a combination of free, inorganic sulfites and some forms of combined sulfites were higher than free sulfite levels (Table 2). The mean total

SO_2 level was 52.3 ppm, but the distribution was skewed with the majority of samples having total residual SO_2 levels below the mean. In fact, 58.5% of the samples had less than 40 ppm total residual SO_2. Free SO_2 levels were even lower with 67.9% of the samples having less than 14.9 ppm free SO_2. With free SO_2 residues, the overall range was considerably less than observed for total SO_2 levels.

Table 1. Total SO_2 levels in maraschino cherries

Range of SO_2 levels[a]	No. of samples in range	Percentage (cumulative %) of samples in range
< 40	31	58.5 (58.5)
40–79.9	10	18.8 (77.3)
80–119	8	15.1 (92.4)
120–159	2	3.8 (96.2)
> 160	2	3.8 (100)
Total units 53		
Overall range < 10–203		
Mean ± S.D.[b] 52.3 ± 44.7		
Median 36.9		

[a]SO_2 level is given as ppm

[b]For purposes of calculating a mean, samples with < 10 ppm total SO_2 were regarded as having 10 ppm

Table 2. Free SO_2 levels in maraschino cherries

Range of SO_2 levels[a]	No. of samples in range	Percentage (cumulative %) of samples in range
5–9.9	19	35.8 (35.8)
10–14.9	17	32.1 (67.9)
15–19.9	6	11.3 (79.2)
20–24.9	5	9.4 (88.6)
25–29.9	3	5.7 (94.3)
≥ 30	3	5.7 (100)
Total units 53		
Overall range 6.1–32.7		
Mean ± S.D. 14.2 ± 7.1		
Median 14.2		

[a]SO_2 level is given as ppm

Several factors may influence the residual sulfite levels in maraschino cherries. Obviously, the leaching step is very important in the reduction of sulfite levels. The temperature of the water used in leaching and the length of the leaching period may be important factors in determining the effectiveness of the leaching step. The type of sugar used in the syrup could influence the distribution of free and total SO_2 in the cherries. Sucrose is a nonreducing sugar that will not react with sulfites, while fructose does react with sulfites. The use of fructose in the syrup would be predicted to result in formation of more combined sulfite and less free SO_2. These factors could explain the wide range of sulfite levels found in this survey. An upper limit of about 200 ppm total SO_2 was found in this survey. Higher residual sulfite levels are not likely to occur in maraschino cherries since high

residual sulfite will also bleach the artificial colorant that is added to the cherries to impart the desired bright red color.

What do these results mean to the sulfite-sensitive asthmatic regarding the ingestion of maraschino cherries? The average weight of a maraschino cherry is 3–7 g, and the average serving size is one cherry. Using the mean total SO_2 level obtained from the survey, total SO_2 per serving is 0.16–0.37 mg. Using the upper limit for total SO_2 (203 ppm) from the survey, total SO_2 per serving would be 0.61–1.4 mg. The residual total sulfite levels in maraschino cherries are 2–30 times less than the 5 mg (3 mg as SO_2) threshold of the most sensitive asthmatic identified so far. This calculation assumes that sulfite-sensitive asthmatics are equally responsive to free and combined forms of sulfite. The challenge studies (Baker et al., 1981; Stevenson and Simon, 1981) have been done with free sulfites; the sensitivity of these asthmatics to combined sulfites remains to be determined. If calculations were made on the basis of the mean free SO_2 level, the amount of SO_2 per serving would decrease to 0.04–0.10 mg. Thus, maraschino cherries are not likely to present much of a hazard to most sulfite-sensitive asthmatics unless rather large quantities are eaten, especially if the asthmatics do not respond to combined sulfites. However, until the questions about the comparative sensitivity to combined versus free sulfite can be answered, sulfite-sensitive asthmatics should be advised to limit their consumption of maraschino cherries to one cherry per serving (to protect against the chances of obtaining a sample with greater than 200 ppm total SO_2), and processors should be encouraged to retain their label statement that divulges the presence of traces of SO_2.

For other consumers, the acceptable daily intake (ADI) for sulfites as SO_2 is 0.7 mg/kg or 50 mg for a 70-kg individual. Maraschino cherries represent an insignificant contribution to the ADI.

Acknowledgments – Presented at the 44th Annual Meeting of the Institute of Food Technologists, Anaheim, California, USA, June 10–13, 1984. This research and its publication were supported by the College of Agricultural and Life Sciences, University of Wisconsin, Madison; the National Cherry Growers and Industries Foundation; and the Maraschino Cherry and Glace Fruit Processors Association.

References

AOAC. 1975. "Official Methods of Analysis," 13th ed. Association of Official Analytical Chemists, Washington, DC.

Balter, G.J., Collett, P., and Allen, D.H. 1981. Bronchospasm induced by metabisulfite-containing foods and. drugs. Med. J. Australia 2: 614.

Freedman, B.J. 1977. Asthma induced by sulphur dioxide, benzoate and tartrazine contained in orange drinks. Clin. Allergy 7: 407.

Joslyn, M.A., and Braverman, J.B.S. 1954. The chemistry and technology of the pretreatment and preservation of fruit and vegetable products with sulfur dioxide and sulfites. Adv. Food Res. 5: 97.

Stevenson, D.D., and Simon, R.A. 1981. Sensitivity to ingested metabisulfites in asthmatic subjects. J. Allergy Clin. Immunol. 68: 26.

Werth, G.R. 1982. Inhaled metabisulfite sensitivity. J. Allergy Clin. Immunol. 70: 143.