

Survey Situation of Sulfites Residues in Dry Food: A Case Study in Bangkok Metropolitan Area

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Abstract:

Sulfites, including compounds like sulfur dioxide, sodium sulfite, and others, are commonly used as food additives for preservation, color fixation, and quality enhancement. The allowable quantities of sulfite additives are regulated by the Ministry of Public Health. They serve as preservatives, inhibiting microbial growth, and as antioxidants to prevent oxidation reactions. Excessive consumption can lead to respiratory irritation and allergic reactions, particularly in individuals with asthma. Labeling requirements for sulfite-containing products aim to inform consumers, especially those with sulfite allergies, as mandated by Thailand's Food and Drug Administration. This information is usually displayed after the Ingredients section. To examine samples of noodle products for the presence of sulfite additives. This study is a cross-sectional study aimed at examining the contamination of food with sodium hydrogen sulfite additives. Food samples were collected in the Bangkok metropolitan area between July - Aug 2023, using convenient sampling methods. Sulfite test kit produced by the department of medical science was used to test sulfite contamination in the samples. From a sample of 37 items tested for sulfite content, which consisted of 17 samples of fresh rice noodles, 3 samples of fresh rice vermicelli, 3 samples of semi-prepared dried rice vermicelli, 2 samples of fresh glass noodles, 10 samples of dried glass noodles, and 2 samples of dried rice crackers, it was found that samples containing detectable levels of sulfite additives, as measured by the equipment used, totaled 9 samples. This accounts for 24.32% of the total samples tested. Specifically, the samples that were found to contain sulfite additives included 2 samples of fresh rice noodles, 3 samples of fresh rice vermicelli, 1 sample of semi-prepared dried rice vermicelli, 2 samples of fresh glass noodles, and 1 sample of dried glass noodles. more than half of the samples detected sulfite residue, were fresh rice products such as fresh rice noodle and fresh rice vermicelli.

Keywords —sulfite residues, dry food product

Introduction

"Sulfites" are a group of chemical substances commonly used in the production of various foods as additives. They are used as preservatives to prevent oxidation reactions, as color fixatives, to enhance the quality of flour, and as antimicrobial agents. Chemicals in this group include sulfur dioxide (INS 220), sodium sulfite (INS 221), sodium hydrogen sulfite (INS 222), sodium metabisulfite (INS 223), potassium metabisulfite (INS 224), potassium sulfite (INS 225), and sodium thiosulfate (INS 226). The Ministry of Public Health's Announcement No. 418 of the year 2020, [1] which specifies the criteria, conditions, usage methods, and allowable amounts of food additives (Part 2), controls the use of sulfite additives by type of product. The maximum allowed quantities of sulfite additives may vary depending on the type of product.

Sulfites are used in food products for two main purposes. Firstly, they are used as preservatives because they effectively inhibit the activity of bacteria, yeast, and mold. They are cost-effective and easy to use. Another purpose is to use them as antioxidants or agents to prevent oxidation reactions. Sulfites inhibit both enzymatic browning reactions, which result from enzymes, and non-enzymatic browning reactions. Additionally, certain types of sulfites, such as sodium sulfite and sodium metabisulfite, also have properties as color fixatives and flour quality enhancers. Therefore, food products that may contain sulfite additives include fresh fruits and vegetables, dried fruits and vegetables, pickled fruits and vegetables, candied fruits, jams, brown sugar, palm sugar, molasses, gelatin, canned bamboo shoots, canned mushrooms, canned coconut milk, canned pumpkin, frozen foods, and products made from flour such as jelly noodles, rice noodles, and dumplings, among others.[2]

Sulfite-containing substances in the form of sulfite compounds can break down into sulfur dioxide gas when exposed to heat or an oxidizing agent. Sulfur dioxide gas has a pungent odor, dissolves well in water, and can be harmful to the body. Exposure to sulfur dioxide gas at a concentration of 8 ppm can cause irritation in the respiratory system. At 20 ppm, it can lead to eye irritation and act as a food allergen if ingested. When a small amount of sulfite is consumed, the body can convert it into sulfate, which is non-toxic and can be excreted through urine. However, excessive intake can reduce the efficiency of protein and fat utilization in the body. Additionally, this gas has the property of breaking down Vitamin B1 in the body. Accumulating a high amount of sulfur dioxide gas in the body may lead to symptoms such as breathing difficulties, abdominal pain, diarrhea, dizziness, loss of consciousness, and in severe cases, it can be fatal for individuals with sulfite sensitivity. This sensitivity is less common in children but more prevalent in adults. It is believed that only a small percentage of individuals are at risk of experiencing side effects, and those most at risk are adults with asthma. Reactivity to sulfites is very rare in individuals without asthma, but it may occur in up to 5% of asthma patients. People in this high-risk group should exercise caution or avoid foods, beverages, or medications containing sulfite compounds as ingredients. [3,4]

Due to the allergenic nature of sulfite-containing substances, many countries require food manufacturers to provide allergy information on food product labels for individuals with sulfite allergies[5]. In the case where sulfite-containing substances are used or may be present in the manufacturing process, Thailand, in accordance with the announcement of the Food and Drug Administration, Ministry of Public Health (No. 367) in 2014,[6] mandates that food operators must display allergy information for individuals with sulfite allergies when the concentration of sulfite compounds is 10 ppm or higher. This information is typically presented on the label, such as "Allergy Advice: Contains Sulfur Dioxide" or "Contains: Sulfites," and is usually listed after the Ingredients or Important Components section.

The objective of this study is to examine the presence of sulfite compounds in noodle products, which is one of the commonly used ingredients in daily meals. It aims to determine whether the levels of sulfite compounds exceed the standards set by the Ministry of Public Health. Samples were collected from various establishments in the Bangkok metropolitan area and tested using contamination testing kits. The information gathered can serve as a guideline for communicating the safety of consuming noodle products that may pose a risk of contamination with excessive amounts of sulfite compounds to consumers. This will also prompt consumers to exercise caution when choosing to consume these food items in the future.

Objective

To examine samples of noodle products for the presence of sulfite additives

Study Methods

This study is a cross-sectional study aimed at examining the contamination of food with sodium hydrogen sulfite additives. Food samples were collected in the Bangkok metropolitan area between July -

Aug 2023, using convenient sampling methods. The sample collected shown in Table no. 1, and were used for testing purposes. Sulfite test kit produced by the department of medical science was used to test sulfite contamination in the samples.[7]

Table 1. samples collected (n=36)

NO.	Type	Quantity
1	Noodle	17
2	Fresh rice noodle	3
3	Instant Noodle	3
4	Fresh rice vermicelli	2
5	Dry vermicelli	10
6	Dried Rice Vermicelli	2
	Total	37

Sample Preparation:

Divide the sample into plastic cups, approximately 5 grams each. Then, add about 10 milliliters of clean water. Let it sit for approximately 2 minutes.

Experiment Steps

1. Drop 3-4 drops of the solution from the dropper bottle into the prepared sample cup, then shake to mix them together.
2. Observe the color of the resulting solution immediately.

Interpretation

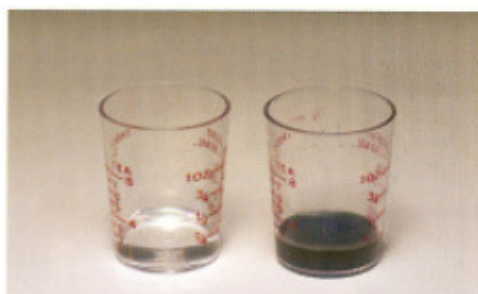


Figure 1. displays the results of the immediate test after dropping the solution from the sulfite testing kit onto the food sample. The glass on the left, provided by the Department of Medical Sciences, shows the color fading of the solution, while the glass on the right does not show any color fading.

If the color of the added solution immediately fades (no blue to purple color appears, as shown in the glass on the left), it indicates that the sample contains sulfite additives at a detectable level (the lowest

detectable level of free sulfite is 150 ppm). However, if the resulting solution shows a blue to purple color (as demonstrated in the glass on the right), it suggests that the sample may either not contain sulfite additives or they are present in such low quantities that they cannot be detected by the aforementioned testing kit.

Data Analysis

The statistics used for data analysis are descriptive statistics, including frequency and percentage.

Study Results

From a sample of 37 items tested for sulfite content, which consisted of 17 samples of fresh rice noodles, 3 samples of fresh rice vermicelli, 3 samples of semi-prepared dried rice vermicelli, 2 samples of fresh glass noodles, 10 samples of dried glass noodles, and 2 samples of dried rice crackers, it was found that samples containing detectable levels of sulfite additives, as measured by the equipment used, totaled 9 samples. This accounts for 24.32% of the total samples tested. Specifically, the samples that were found to contain sulfite additives included 2 samples of fresh rice noodles, 3 samples of fresh rice vermicelli, 1 sample of semi-prepared dried rice vermicelli, 2 samples of fresh glass noodles, and 1 sample of dried glass noodles. (Table No.2)

Table 2. Number and Percentage of Sulfite Testing Results (n=36)

NO.	Type	Quantity	Test Result	
			Positive n (%)	Negative n (%)
1	Noodle	17	2 (11.76)	15 (88.24)
2	Fresh rice noodle	3	3 (100.00)	0 (0.00)
3	Instant Noodle	3	1 (33.33)	2 (66.67)
4	Fresh rice vermicelli	2	2 (100.00)	0 (0.00)
5	Dry vermicelli	10	1 (10.00)	9 (90.00)
6	Dried Rice Vermicelli	2	0 (0.00)	2 (100.00)
	Total	37	9 (24.32)	28 (75.68)

Summary and Discussion

From a total of 37 samples tested for sulfite content, which were all categorized as flour-based products, 9 samples were identified to contain sulfite additives in quantities exceeding 150 ppm. Additionally, the samples that tested positive using the testing kit were predominantly fresh food products.

From the announcement of the Ministry of Public Health (Version 418) in the year 2020,[1] which specifies the criteria, conditions, usage, and allowable proportion of food additives (Version 2), it sets the maximum quantity of sulfite additives allowed to be present in pasta, noodles, and similar products that have undergone processes such as fresh, dried, and semi-prepared at 35 ppm, 45 ppm, and 20 ppm respectively. It can be observed that the samples of fresh noodles tested exceeded the specified standards. Consumption of these products in excessive amounts may lead to respiratory difficulties, abdominal pain, diarrhea, dizziness, loss of consciousness, especially in individuals who have consumed these foods regularly for an extended period.[8] It may result in beriberi, a condition caused by a reduction in vitamin B1 levels in the body due to the deteriorating effects of sulfite compounds. Moreover, individuals with sulfite sensitivity or allergy may experience severe reactions, potentially leading to shock and even fatality.

Due to sulfites, which act as whitening agents and inhibit food discoloration, as well as hinder the growth of bacteria, yeast, and mold, they are used as preservatives to prevent the oxidation reaction of fatty acids. Manufacturers incorporate chemicals containing sulfites into noodle products. This is because consumers prefer noodles that appear white, and also due to the hot and humid climate in Thailand, fresh noodle products are susceptible to spoilage. Therefore, it is necessary to add these substances to prevent the growth of microorganisms. The experimental results indicate that all tested samples of fresh noodles exceeded the specified standards in terms of sulfite content [9,10]

The results of this test align with the previous research, which examined 20 random samples of noodles collected from various markets in the Bangkok metropolitan area. It was found that out of the total noodle products tested, 2 samples of flat rice noodles and 2 samples of glass noodles contained sulfite compounds in the range of 10-100 ppm, accounting for 20% of the total noodle products tested. Furthermore, a separate study examined 16 samples of fresh glass noodles and found sulfite contamination in all samples, accounting for 100% of the total samples. Comparing these results with the findings from this experiment, which found sulfites in 100% of the fresh glass noodle samples, they are consistent.

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