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Presence of sulphites in different types of partly processed meat products prepared for grilling

V Korićanac, D Vranić, D Trbović, R Petronijević and N Parunović

Institute of Meat Hygiene and Technology, Kaćanskog 13, 11000 Belgrade, Serbia

E-mail: vladimir.koricanac@inmes.rs

Abstract. In the period January 2016 to May 2017, the presence and levels of sulfite were examined in 270 samples of hamburger, sausage (various types), pljeskavica (Serbian-style meat patties of various types) and ćevapi or ćevapčići (grill kebabs) from the Serbian market. Some (12.59%) of these partly processed meat products contained sulfites, expressed as SO_2, at levels above 10 mg/kg, and so did not meet requirements laid down in the National Regulation. In the remainder of the meat products (87.41%), sulfite contents were below 10 mg/kg, which is considered as "not detected". By groups, 100% of hamburgers, 91.76% of sausages and 90.48% of pljeskavica met requirements of National Regulation. The meat product group with the biggest percentage of non-compliant meat products in which sulfites were detected was the ćevapi or ćevapčići – 18.10% of them contained sulfites. All in all, most of the partly processed meat products from the Serbian market met the National Regulation regarding sulfite content, and they were safe for consumption. Nonetheless, the high percentage of ćevapi or ćevapčići that contained sulfites leads us to conclude that regular and periodic control is necessary and one of the most important steps in ensuring safe and quality meat products for consumers.

1. Introduction

Sulfites are compounds that contain the sulfite ion (SO_3^{2-}). Sulfur dioxide (SO_2) has been used since ancient times for its cleansing, disinfecting and purifying properties. In addition, sulfites have a number of technological uses, for example, as antioxidants, bleaching agents, flour treatment agents and preservatives. Sulfites are permitted in various foods such as wine, cordials, dried fruit and vegetables. They are used in the food industry to maintain food color, to prolong shelf life, and to prevent microbial growth [1]. Sulfites are present in some foods, naturally or as additives, but they are not used in most fresh foods. According to the U.S. Food and Drug Administration (FDA), about 1% of population are sensitive to sulfites, and so that is why the same body requires sulfites to be declared when used as an ingredient in the food, when used as a processing aid, or when present in an ingredient used in the food. That applies where the concentration of total SO_2 is equal or over 10 mg/kg (ppm) [2]. Below this limit, the amount of sulfites is considered as insignificant, as this is limit of detection, and food is considered as sulfite free.

Sulfites can cause allergy like reactions (intolerances), most commonly asthma symptoms in those with underlying asthma, sometimes allergic rhinitis-like reactions, occasionally urticaria (hives) and very rarely, anaphylaxis (severe allergic reaction). Wheezing is the most common reaction. The mechanism by which reactions occur is unclear. SO_2 gas is an irritant, and so reflex contraction of the airways from inhaling it is one possible explanation. This mechanism might explain the rapid onset of symptoms when drinking liquids like beer or wine, when SO_2 gas is inhaled during the swallowing

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process. Some people with asthma and who react to sulfites have a partial deficiency of the enzyme sulfite oxidase, which helps to break down SO_2. Not many people have positive skin allergy tests to sulfites, indicating true (IgE-mediated) allergy [3]. Sensitivity to sulfites in food is dependent on how much a person is exposed to SO_2 or sulfites from all sources. The pathogenesis of adverse reactions to sulfites has not been clearly documented but it is unlikely that sulfite reactions are allergic and immunity-mediated or produce anaphylactic reactions. Labeling of foods containing sulfite at concentrations of 10 mg/kg or more is required in the European Union, although the threshold for sensitivity reactions could be even lower [4].

The toxicity of sulfites is generally low. Evaluations by the Scientific Committee for Food (SCF) and by The Joint FAO/WHO Expert Committee on Food Additives (JECFA) have led to the conclusion that, for most consumers, sulfites in foods are of low health concern, although single, large oral doses of sulfites can produce gastrointestinal disturbances [1].

Sulfites are used as food additives for a variety of applications. In most countries, sodium and potassium sulfate ($NaHSO_3$, $KHSO_3$), sodium and potassium meta-bisulfite ($Na_2S_2O_5$, $K_2S_2O_5$), and sodium sulfite (Na_2SO_3) are allowed, along with sulfur dioxide gas (SO_2). In some countries, potassium sulfite (K_2SO_3) and sulfurous acid (H_2SO_3) are allowed. The U.S. has a long-standing restriction on use of sulfites in meats, but this restriction does not exist in all other countries [2].

In Serbia, sulfites in food are regulated by National Regulation [5]. Accordingly, sulfites are not allowed in partly processed meat products, except in some rare cases and types of foods (breakfast sausage with 6% grain or burger meat with 4% vegetables and/or grain). Similarly, to the FDA, all values under 10 ppm are considered as insignificant.

The European Standard [6] specifies a distillation method for the determination of the sulfite content, expressed as SO_2, in foodstuffs in which the content of sulfite is at least 10 mg/kg. The method is applicable in the presence of other volatile sulfur compounds. It is not applicable to cabbage, dried garlic, dried onions, ginger, leeks and soy proteins. It has been shown that the analysis of isolated soy protein leads to false positive results [6].

The principle of this method is based on measuring free sulfite plus a reproducible portion of bound sulfites (such as carbonyl addition products) in foods. The test portion is heated with refluxing solution of hydrochloric acid to convert sulfite to SO_2. A stream of nitrogen is introduced below the surface of the refluxing solution to sweep SO_2 through a water-cooled condenser and, via a bubbler attached to the condenser, into hydrogen peroxide solution, where SO_2 is oxidized to sulfuric acid. The generated sulfuric acid is titrated with standardized sodium hydroxide solution. The sulfite content is directly related to the generated sulfuric acid [6].

The aim of this study was to determine levels of sulfites in retail meat products commonly consumed in Serbia.

2. Materials and Methods

In the period January 2016 to May 2017, 270 samples of different types of partly processed meat products prepared for grilling (6 hamburgers, 85 sausages, 63 pljeskavica (Serbian-style meat patties of various types) and 85 ćevapi or ćevapčići (grill kebabs)) were examined for SO_2 content. Samples were collected from the Serbian market, and were produced mostly by domestic producers.

The presence of sulfites was determined according to the standard procedure [6] and expressed as SO_2 in mg/kg (ppm).

All chemicals used for analysis of the presence of sulfites in partly processed meat products prepared for grilling were of analytical grade and were used as received without any further purification. The results analysis and graphical presentation of their distribution was performed using Microsoft Office Excel 2016.

3. Results and Discussion

The results of determination of sulfites in the examined partly processed meat products prepared for grilling are shown in table 1. Also, distributions of the results, by groups and in all meat products examined, are graphically presented in figures 1-5.

Table 1. Number of samples of partly processed meat products prepared for grilling examined for the presence of SO_2 , for the period January 2016 – May 2017.

Type of samples	Not detected (<10 mg/kg SO_2)	Detected (>10 mg/kg SO_2)
Hamburger (6)	6	0
Sausage, various types (85)	78	7
Pljeskavica, various types (63)	57	6
Ćevapi or ćevapčići (116)	95	21
All samples (270)	236	34

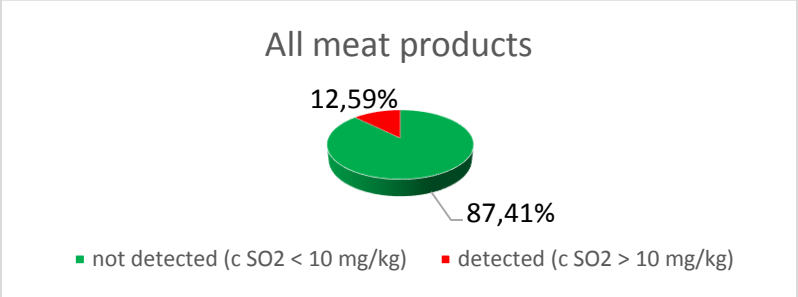


Figure 1. Percentage of all meat products examined where the presence of sulfites was detected or not detected.

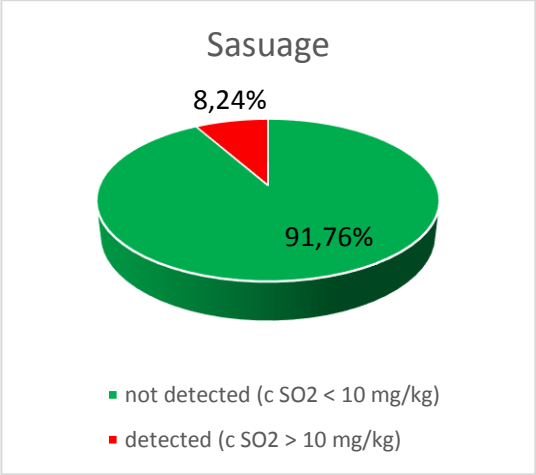


Figure 2. Percentage of sausages where the presence of sulfites was detected or not detected.

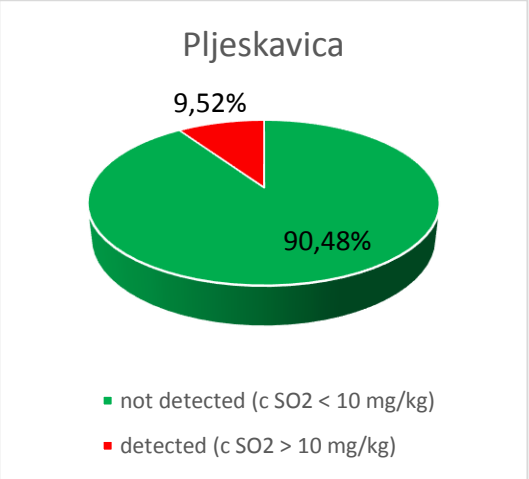


Figure 3. Percentage of pljeskavica where the presence of sulfites was detected or not detected.

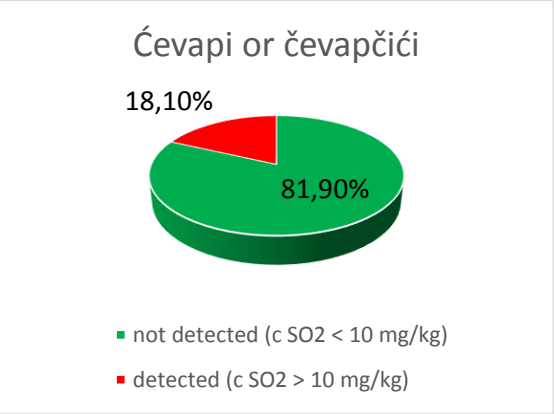


Figure 4. Percentage of ćevapi or ćevapčići where the presence of sulfites was detected or not detected.

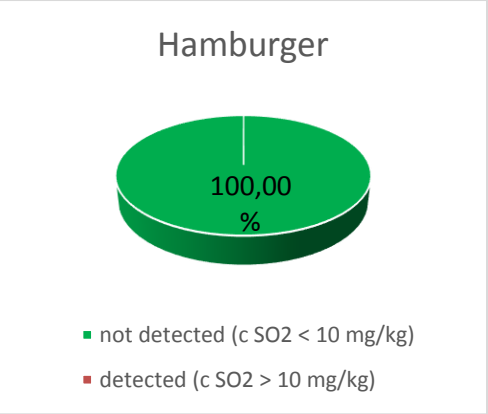


Figure 5. Percentage of hamburger where the presence of sulfites was detected or not detected.

4. Conclusion

Most of the tested meat products, 87.41% of them, met the National Regulation regarding the presence of sulfites, did not contain sulfites at detectable levels, and were safe for consumption. Hamburgers were the most safe, as 100% of them were without detectable sulfites, although we note that just six hamburgers were examined. The meat product group that had the highest percentage of products with sulfites detected was the group of ćevapi or ćevapčići, where 18.10% of examined products did not meet requirements laid down in National Regulation.

All in all, most of products across the selected meat groups were safe for consumption. However, the relatively high number of partly processed meat products in which sulfites were detected leads us to conclude that periodic and regular control by the responsible authority is a necessary step in ensuring the safety and fitness for consumption of these products.

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