

Enshi sulfur dioxide residues in food risk assessment

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Abstract. From 2012 to 2019, the risk monitoring of food chemical contaminants and harmful factors in Enshi Prefecture found that the sulfur dioxide residues in food exceeded the standard seriously, and the sample exceeded the standard rate of 8.16%-17.7%, including pickled vegetables, edible starch, and dried vegetables. Among them, the sulfur dioxide content exceeded the standard rate of 63.64%, 48.00%, 30.09%, and the risk quotient (HQ) was 0.464, 0.075, and 0.527, respectively. Due to the low consumption of dried vegetables, pickled vegetables, edible starch and edible fungus products, they are still at a safe level, but the cumulative effect of sulfur dioxide residues in the diet may pose health risks to consumers.

1 Introduction

Food safety is a major livelihood issue related to the health and life safety of the people. In the "GB 2760-2014 National Food Safety Standard Food Additives Use Standard"^[1], sulfur dioxide is widely used as a food additive in food. At the same time, China has strict regulations and management on the use of sulfur dioxide. Enshi CDC food safety risks of long-term monitoring, we found 2012--2019 Residues in the amount of sulfur dioxide in foods Enshi the standard. Active sulfur dioxide in food research and health risk assessment, providing technical support and scientific basis for long-term monitoring of food additives in Enshi.

2 Materials and Methods

2.1 Sample collection

A total of 714 samples were randomly collected in small restaurants, markets and stores in Enshi Prefecture, Hubei Province, China, during 2012 to 2019. The sample types included pickled vegetables, food starch, soy products, edible mushrooms, dried vegetables, nuts and seeds cereal products, etc.

According to the food safety risk monitoring manual, the sample size of each product is at least 1.0 kg. After purchase, the samples were immediately sent to a laboratory for testing after crushing ^[2-3].

2.2 Analysis procedure

The sample was pulverized, mixed, uniformly 5g weighed sample into the distillation flask. Add 250mL of distilled water, install the condensing device, insert the lower end of the condensing tube into the liquid level of the iodine flask pre-prepared with 25mL of lead acetate absorption

solution, then add 10mL of hydrochloric acid solution to the distillation flask, stop it immediately, heat it for distillation, about 200 mL, away from the liquid surface so that the lower end of the condensing duct, redistillation 1min, while the blank test.

To remove iodine flask were added 10mL of hydrochloric acid, 1 mL of starch indicator solution, then shake with iodine standard solution was titrated to the color of the solution turns blue and 30s do not fade, the record Iodine Titration volume of solution consumed. The standard solution of iodine titration volume, calculated content of sulfur dioxide in food analysis.

2.3 Risk assessment

2.3.1 Dietary exposure assessment

Dietary exposure assessment model is mainly based on the Environmental Protection Agency released. According to the monitored sulfur dioxide residue and food consumption data, calculate the estimated daily intake of sulfur dioxide in food according to formula (1) ^[4-5].

$$EED = \frac{\sum_{i=1}^n (C_i \times F_i \times P_i \times E_i) \times ABS \times EF \times ED}{BW \times AT} \quad (1)$$

Where: EED: daily exposure of sulfur dioxide [mg/(kg·d)]; C_i: exposure concentration of sulfur dioxide (mg/kg); F_i: daily intake (kg/d); P_i: processing Factor; E_i: edible factor; ABS: gastrointestinal absorption coefficient of sulfur dioxide; EF: exposure frequency; ED, exposure duration; BW: human body weight (kg); AT: flattening time 365 × ED. Assuming that the average age of people for 70 years, adult body weight of 60 kg, P_i, E_i, ABS values are 1, EF 365 days.

2.3.2 Risk quotient

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The risk description of chemical hazards with thresholds is generally carried out using the risk quotient method HQ. The risk quotient (HQ) is calculated by EED and ADI according to the following formula (2).

$$HQ = \frac{EED}{ADI} \quad (2)$$

Where, HQ risk quotient value of all people, and ADI acceptable daily intake of sulfur dioxide. In this study, the ADI for sulfur dioxide was 0.7 mg/(kg·bw·d) set by JECFA^[6].

Its meaning is: when HQ>1, it means there is a risk, the greater the value, the greater the risk.

2.3.3 Maximum safe consumption

The maximum safe daily consumption (Fimax) of sulfur dioxide residue food is calculated according to the following formula (3).

$$Fi_{max} = \frac{BW \times ADI}{Ci} \quad (3)$$

Where: Fimax: indicates the maximum safe daily consumption(kg/d); BW: body weight represents the crowd(kg); Ci: represents food in sulfur dioxide content(mg/kg).

3 Results and discussion

Similar studies on sulfur dioxide residues in fresh vegetables, edible fungi and dried fruits have been reported^[7-8]. Table 1 lists the residual concentration and risk quotient of sulfur dioxide in 714 samples. In general, the average concentration of sulfur dioxide in dried vegetables, pickled vegetables, edible starch and edible fungus products are higher than the MRLs(Dried vegetables, pickled vegetables, food starch and edible fungi articles sulfur dioxide limits were 200, 100, 30 and 50 mg / kg), and the risk quotient (HQ) is 0.527, 0.464, 0.075, and 0.025, respectively. Due to the low consumption of dried vegetables, pickled vegetables, edible starch and edible fungus products, they are still at a safe level, but the cumulative effect of sulfur dioxide residues in the diet may pose health risks to consumers. These results are consistent with previous research results.

Table 1 different food categories sulfur dioxide and residual concentration risk quotient

Category	Number of samples	Ci (mg/kg)	Max (mg/kg)	Excessive rate(%)	Fi (kg/d)	EED mg/(kg·d)	HQ
Dried vegetables	216	2170	6654	30.09	0.0102	0.369	0.53
Pickled vegetables	11	1910	7362	63.64	0.0102	0.325	0.46
Edible starch	25	717	5853	48.00	0.0044	0.053	0.075
Edible fungus products	117	303	5712	7.69	0.0034	0.017	0.025
Bean products	92	171	6294	5.43	0.0118	0.034	0.048
Nuts and seed products	85	55.8	2055	0	0.0038	0.004	0.005
Grain milled products	6	30.5	38.9	0	0.0135	0.007	0.010
Fresh edible fungus	101	19.2	49.2	0	0.0034	0.001	0.002
Starch products	56	12.6	15.4	1.79	0.0044	0.001	0.001
Cereal products	5	11.8	14.0	0	0.28	0.055	0.079

In terms of sample sampling, Table 2 shows that samples with excess sulfur dioxide are mainly from small restaurants, farmer's markets and shops, and their excess rates are 16.86%, 11.11%, and 6.45%, respectively. These places are where local people mainly buy food.

Table 2 Different types of sampling sites exceeded the rate of sulfur dioxide

Sampling session	Number of samples	Ci(mg/kg)	Max(mg/kg)	Excessive rate(%)
Farmers market	421	1240	6654	16.86
store	279	216	1428	6.45
Roadside stalls	5	34.9	69.5	0
Small restaurants	9	37.2	153	11.11
Total	714	540.1		12.61

For sulfur dioxide residues in food, we calculated according to the formula (3), adult day dried vegetables, pickled vegetables and other foods, the maximum safe intake does not exceed 0.21 kg, 0.42 kg, 0.84kg. However, when the residual sulfur dioxide in dried vegetables is 2170mg/kg, the safe daily intake is only 0.019kg.

Sulfur dioxide as a food additive, because of having a bleaching action, antioxidant and preservation, food preservation which is widely used in the food production

process. Because the children in the formative years, a variety of food demand, sulfur dioxide dietary exposure risk is greater. Therefore, sulfite overuse and misuse may have potential adverse effects on human health.

In this exposure assessment process, we assume that processed foods factors, edible part of the factor, gastrointestinal absorption coefficient are less 1 part of the sample number, representativeness is not strong, which give exposure assessment of sulfur dioxide added to the uncertainty.

4 Conclusions

This study provides Enshi sulfur dioxide residues in food risk assessment to the general population. According to the "GB 2760-2014 Food Safety National Standards for the Use of Food Additives", the excess rate of sulfur dioxide samples in different food categories varies greatly. Among them, pickled vegetables, edible starch, and dried vegetables have the highest sulfur dioxide content, which is 63.64%, respectively. The risk quotient (HQ) of 48.00% and 30.09% were 0.464, 0.075 and 0.527 respectively. Due to the low consumption of pickled vegetables, edible starch and dried vegetables, they are still at a safe level, but the cumulative effect of sulfur dioxide residues in the diet may pose health risks to consumers.

In order to prevent people, especially children in the diet overexposure sulfur dioxide, it is still necessary to reduce and limit the use of sulphites and sulfur dioxide by law enforcement activities, and called for tighter regulation of public education and implementation of integrated management additive method, Ensure food safety.

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