

Survey on the sorbic acid concentrations in cooked meat produced from meat processing plants

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Abstract

Sorbic acid is one of preservatives that is mostly used in general food. This study was carried out to measure the amount of the sorbic acid in cooked meat produced from meat processing plants in Gyeongbuk province. One hundred and fifty-three samples of cooked meat(42 spices added meats, 56 grinding cooked meats, 2 bacons, 5 jerked meats, 18 sausages, 30 hams) were collected from meat processing plants and analyzed for the concentration of preservative sorbic acid and its salts by using of high performance liquid chromatography(HPLC). Sorbic acid was not detected in spices added meats, grinding cooked meats, bacons, and jerked meats except on ham and sausage. But the concentration range of sorbic acid in sausage was 0.00~1.31g/kg, average 0.44g/kg, and in ham was 0.00~1.31g/kg, average 0.32g/kg. There was no sample that sorbate concentration exceeded the legal permitted level 2.0g/kg in cooked meat.

Key words : Sorbic acid, Preservatives, Cooked meat

Introduction

Because of the change of life form with increasement of two-earner, simplify of dietary life, modern people would like to eat the foodstuffs which the cooking method is simple. There is increasing rapidly the consuming quantity in the ham, sausage and bacon of a meat processing foodstuffs. When it sees the consuming quantity in a meat processing foodstuffs between recent 20 years, there is increasing to 30 times of the

consuming quantity in meat processing foodstuffs as which it was 1,896 tons in 1970, 5,779 tons in 1980 and 58,491 tons in 1990, respectively¹⁾.

Nowadays, there is also increasing the consuming quantity of foodstuff additives used by preventing a corruption and the deterioration due to a microbe growth, and not only quantity increasement but also various styles as the development of manufacture technique in meat processing foodstuffs.

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There were increasing day after day in people's concerns for the safety in foodstuff additives, that is, harmful preservatives, antibiotics, insecticides and so on.

Foodstuff hygiene's evaluation which was analysed daily acceptable intake for the foodstuff additives was practiced in the United states, Japan and other countries, It applies with the basic drafter to reduce consumer's damage thought of the necessary over against the food additive and confirm the safety for the food additive.

Yoo *et al*²⁾ were reported that it corresponded with 0.7~6.7% of intake quantity of benzoate, *p*-hydroxybenzoate and sorbic acid in comparison of the acceptable daily intake(ADI), and butylated hydroxy toluene(antioxidant) corresponded with 9.3% in comparison of the acceptable daily intake in Korea.

Lee *et al*³⁾ were reported that potassium sorbate was highly used up to 60% as the results of survey for the use condition in preservatives and antioxidants as indication fact in food cover materials and question paper in domestic, the preservatives next to potassium sorbate was butyl *p*-hydroxybenzoate and sodium benzoate. As the results of survey for the use condition in preservatives, sodium erythorbate was the highest (49.1%), next to sodium erythorbate was potassium sorbate(31.8%), and the use condition in antioxidants was ascorbic acid (55.4%).

In the foodstuff additives, sorbic acid and their salts act antibacterial effect to bacteria, then it effected to prolong their store duration for storage and circulation. It was used widely in the meat processing foodstuffs which begins a meat processing and others.

But the used amount was strictly limited and regulated. Permissible amount in domestic was generally under 2.0g/kg, but

dressing meat, many pulverization processing and spiced meat should not be detected.

In this study, for the survey to the use condition of preservatives, that is, sorbic acid and its salts in the meat processing foodstuffs which was permissible in the law of livestock processing, we carried out to measure the amount of the sorbic acid in cooked meat produced from meat processing plants in Gyeongbuk province.

Materials and methods

Samples : One hundred and fifty-three samples of cooked meat(42 spices added meats, 56 grinding cooked meats, 2 bacons, 5 jerked meats, 18 sausages, 30 hams) were collected from meat processing plants in Gyeongbuk province.

Table 1. The kinds and number of sample collected for analysis

Name of sample	No of sample
Spices added meat	42
Grinding cooked meat	56
Bacon	2
Jerked meat	5
Sausage	18
Ham	30
Total	153

Investigation duration : We were analyzed the samples for the request and collecting to the Gyeongbuk veterinary service laboratory from January 2000 to December 2000.

Analytical method of sorbic acid

1) Sample pretreatment

First, we get 5g sample and dilute till 25ml (V/V) with distilled water, then sonicated for

30 min in ultrasonicator. Sonicated homogenizing fluid was strictly decanted 5ml, and added 0.5ml 1N hydrochloric acid and 0.005M cetyltrimethylammonium chloride (CTA) to this solution, therefore mixed thoroughly, and washed this solution with 10 ml methyl alcohol and 0.005M CTA solution in order. This washed solution was absorbed to Sep-Pak C₁₈ cartridge with the speed 2ml/min. Then, this cartridge was washed 10ml distilled water and elutriated 10ml methyl alcohol, adjust 10ml in total volume with methyl alcohol. Finally, this solution was filtrated with 0.45µm filter, and used analytical solution.

2) Analytical method of high performance liquid chromatography

Each pretreated solution was injected 50µl to HPLC(waters), and analyzed three times to the each sample. The concentration of all analytical results was calculated to substitute area results for the standard curve of sorbic acid. HPLC conditions for analysis of sorbic acid was shown in Table 2.

Table 2. HPLC conditions for analysis of sorbic acid

Distribution	Conditions
Mobile phase	Methanol : Acetonitrile : 5mM citric acid(pH4.0)=1:2:7
Injector	Waters 486 UV
Pump	Waters 600
Column	µ-Bondapak C ₁₈ (Waters 3.9×300mm)
Flow rate	1.0ml/min
AUFS	1
Run time	10min
Wavelength	230nm
Injection volume	50µl

3) Standard calibration of sorbic acid

Stock solution(100ppm) was prepared that 10mg sorbic acid(sigma) dissolved 5ml 0.1N sodium hydroxide, and adjust 100ml with distilled water. Standard solution was diluted with stock solution at 2, 4, 6, 8ppm with distilled water, and each standard solution was analyzed three times. Standard curve was recorded with linear regression analysis (coefficient value : 0.99986) with area at each concentration as shown in Fig 1.

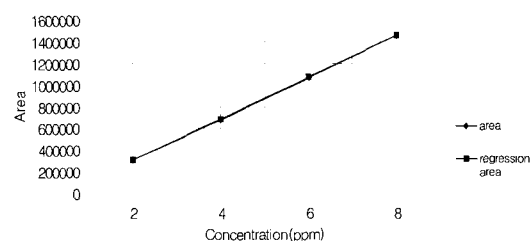


Fig 1. Standard calibration curve according to the peak area of sorbic acid according to the range 2 to 8 ppm.

Results and discussion

Generally, food does not last forever, not in the refrigerator or the freezer, nor out in the open air. Today, there are a variety of ways we preserve food. All foods contain bacteria. Food preservation needs to either slow down the growth of bacteria or kill it completely. Refrigeration and freezing are very common methods. Refrigeration slows the growth of bacteria and allows food to last much longer than without it. Certain types of food kept in the refrigerator can potentially last for a couple of weeks.

Freezing stops bacterial growth. Ice crystals form when water freezes. Meat and vegetables are great foods for freezing. Items in the freezer should be wrapped or covered

tightly and labeled. Canning is another common method of food preservation. At home, fruits and vegetables can be boiled to kill the bacteria.

Salting is another method of preserving food, and it is especially suitable for meats. The meat is soaked in a salty solution, or salt is rubbed onto the surface. Salt pulls the moisture out of the meat, which greatly reduces the growth of bacteria. Salted meat lasts an extra long time. There are also chemical substances used to preserve food longer on the shelf. Three common types of chemical preservatives are benzoates, nitrites and sulphites. The ingredients label on a food container may list a chemical such as sodium nitrite or sorbic acid. Chemical preservatives inhibit bacteria growth or kill it completely. Especially, sorbic acid (CH₃CH=CHCH=CHCOOH, molecular weight 112.12), called for 2,4-hexadienoic acid and 2-propenylacrylic acid, was used mold and yeast inhibitor, fungistatic agents for foods, especially meat, cheeses and milk processing products⁴⁻⁸⁾.

Generally, polyunsaturated fatty acids could act strong fungistatic action, sorbic acids was easily metabolized in human body as well as the other fatty acid which is similar with the number of carbon atom

existing in the natural world.

Sorbic acid, colorless crystal, would mildly effect mold and yeast inhibitor, fungistatic agents for foods in acidic solution as well as other antiseptics. Their acute toxicity(LD₅₀) was 7,360mg/kg in rats.

Sodium sorbate and potassium sorbate was odorless and white crystal, dissolved in water comparably, and it's use was similar with sorbic acid. In toxicity, side actions were irritation in eye and mucous membrane, sometimes occurrence contact allergy. Patients with ringworm in limbs could show erythema, soreness, and pruritus because of ointment contained sorbic acid⁹⁻¹⁵⁾.

To measure the amount of the sorbic acid in cooked meat and their products produced from meat processing plants, we were collected 153 samples of cooked meat(42 spices added meats, 56 grinding cooked meats, 2 bacons, 5 jerked meats, 18 sausages, 30 hams), analyzed for the concentration of preservative sorbic acid and its salts by using of high performance liquid chromatography(HPLC). As shown in table 3, sorbic acid was not detected in spice added meats, grinding cooked meats, bacons, and jerked meats except on ham and sausage. But the concentration range of sorbic acid in sausage was 0.00~1.31g/kg,

Table 3. Sorbic acid and its salts level detected in each cooked meat (g/kg)

Distributions	No of sample	Range of detected concentration	Mean
Spiece added meat	42	ND*	-
Grinding cooked meat	56	ND	-
Bacon	2	ND	-
Jerked meat	5	ND	-
Sausage	18	0.00-1.31	0.44
Ham	30	0.00-1.31	0.37

*ND : No detectable

average 0.44g/kg, and in ham was 0.00~1.31g/kg, average 0.32g/kg. There was no sample that sorbate concentration exceeded the domestic legal permitted level 2.0g/kg in cooked meat. Therefore, all samples should be adjusted within permissible limits of the law of livestock processing in domestic.

According to the Kim *et al.*⁹⁾, they reported the mean concentration of sorbic acid in 18 sausage was 0.35g/kg(0.00~1.46g/kg), that in 23 ham was 0.32g/kg(0.00~1.35g/kg), that in 4 bacon was 0.445g/kg(0.00~1.46g/kg). By means of Song^{10,11)}, the mean concentration of sorbic acid in 14 sausage had been 0.71g/kg(0.00~1.31g/kg), that in 26 ham had been 1.10g/kg(0.64~1.46g/kg), that in 6 bacon had been 0.96g/kg(0.90~1.01g/kg).

In comparison of the results in Kim *et al.*⁹⁾ and Song^{10,11)}, the mean concentration of sorbic acid in sausage was similar with present study, but the mean concentration of sorbic acid in ham was a few higher the results in Song^{10,11)} than present study, and the mean concentration of sorbic acid in bacon was same higher the result in Kim *et al.*⁹⁾ and Song^{10,11)} than present study. The cause of high concentration with other reporters than present study had been thought because of many samples of preservative free products from meat processing plants in Gyeongbuk province than other reporter

By the survey of Kim *et al.*⁹⁾, they reported that mean daily intake volume of sorbic acid in food was 6.011mg, this result was low than acceptable daily intake established by FAO/WHO, that is 0~25mg/kg(BW). In case of 50kg in human body weight, acceptable daily intake by FAO/WHO was 1250mg, this concentration was not reached the daily intake volume surveyed by Kim *et al.*⁹⁾. Therefore, the use level and intake volume of sorbic acid was not considered threatening

stage to human health. But we were continuously surveyed in depth because of preventing many side action to intake continuously to the specific food used by sorbic acid and its salts as preservatives and producing safe meat processing food.

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