

Analysis Report on “Surveillance on the Levels of Preservatives and Antioxidants in Ingredients of Commercially Available Baked Goods”

Summary

1. As to understand the composition of ingredients of baked goods commercially available in the market, the Municipal Affairs Bureau (IAM) carried out a targeted food surveillance on the levels of preservatives and antioxidants in baking ingredients in the third quarter of 2021, during which a total of 80 samples were randomly collected from department stores, supermarkets and baking supplies shops across Macao. The results revealed no abnormality, with a 100% pass rate. The surveillance helps to understand the levels of preservatives and antioxidants present in the ingredients of baked goods commercially available in the local market, and to better ensure the dietary health of the general public of Macao.

Background information

2. In recent years, with home-baking becoming increasingly popular, more and more people would buy flour, bakery premixes, milk powder, butter and other baking ingredients from supermarkets and baking supplies shops to make different types of cakes, breads and baked goods at home. Yet, the nutrients (e.g. carbohydrates, proteins and fats) present in most baking ingredients provide the favorable conditions for microbial growth and reproduction. Moreover, the food industry may use different types of food additives, such as preservatives and antioxidants, during the processing or preparation of baking ingredients to extend the shelf life and preserve the flavour of baked goods. However, excessive use of food preservatives or antioxidants may cause varying degrees of harm to human health¹⁻³.
3. Preservatives are a type of food additive added to food to prevent the degradation of quality (including fermentation and rancidification, among others) of foods due to microbial action and help to extend the shelf life of food products⁴. During food processing, storage and other processes, the microorganisms in food are

susceptible to environmental factors, e.g. temperature and humidity, which can lead to food spoilage. In view of this, the food industry will add an appropriate amount of preservatives to food according to the food type to inhibit the growth of bacteria and mould in food and extend the shelf life of food products ⁵⁻⁷. Commonly used food preservatives include benzoic acid, sorbic acid and sulphur dioxide.

4. Benzoic acid can inhibit the growth and reproduction of microorganisms, such as bacteria and mould. It is of low toxicity and is particularly effective in acidic foods. Under normal circumstances, the use of benzoic acid is unlikely to cause adverse health effects. However, its excessive intake may cause symptoms such as diarrhoea, stomach pain and rapid heartbeat. For special groups of the population, such as infants and young children, long-term intake of benzoic acid may trigger adverse reactions, such as asthma, urticaria and metabolic acidosis ⁶⁻⁸.
5. Sorbic acid is an unsaturated fatty acid with strong antibacterial properties and low toxicity. It readily participates in the normal metabolic processes of the human body and is oxidised into carbon dioxide and water. Sorbic acid is widely used in the food industry as it is a highly effective and safe preservative for use in food products and is unlikely to alter their taste and smell ⁶⁻⁷. However, excessive intake of sorbic acid over an extended period of time can inhibit bone growth and disrupt kidney and liver functions to some extent ⁹⁻¹⁰.
6. Sulphur dioxide has effective antimicrobial properties, is of low toxicity and water-soluble. Most of the sulphur dioxide in food can be removed by washing or cooking the food. It is therefore widely used in various types of food products. Moreover, sulphur dioxide is an antioxidant effective in slowing down discolouration in food products caused by oxidation, preserving their quality and freshness. Under normal circumstances, small amounts of dietary intake of sulphur dioxide will be excreted through urine and will not cause obvious toxic effects. However, its excessive intake may cause allergic reactions, or symptoms, such as

dyspnoea, diarrhoea and vomiting. It may also cause varying degrees of damage to the brain and other body tissues ¹¹⁻¹².

7. Antioxidants are a type of food additive capable of preventing or delaying the degradation of the quality of food due to oxidation, and therefore extending the shelf life of food products ⁴. During food production, processing or storage, food products are susceptible to oxidation due to factors such as oxygen, light exposure, temperature or enzymes, which can cause discolouration, rancidity and spoilage in food products. In view of this, the food industry uses antioxidants to prevent or slow down oxidation and spoilage in food ¹³. The majority of the commonly used antioxidants are phenolic compounds, which are further classified into synthetic and natural antioxidants by their origins. The commonly used synthetic antioxidants include propyl gallate (PG), tertiary butylhydroquinone (TBHQ), butylated hydroxyanisole (BHA), and butylated hydroxytoluene (BHT), among others.
8. Propyl gallate (PG) is of very low toxicity and water-insoluble. It is widely used in edible oils and fat-containing foods to prevent their air oxidation, which may turn them rancid and develop an unpleasant odour. However, excessive intake of propyl gallate can damage the kidney and cause contact dermatitis, cheilitis, and perioral dermatitis ¹⁴.
9. Tertiary butylhydroquinone (TBHQ) exhibits effective antibacterial properties and is often used to improve the flavour and appearance of food products. But excessive consumption of foods containing tertiary butylhydroquinone may cause nausea, vomiting, or tinnitus, and in severe cases, suffocation ¹⁵⁻¹⁶.
10. Butylated hydroxyanisole (BHA) and butylated hydroxytoluene (BHT) are suitably used in food products rich in oils and fats. They can combine with the peroxides produced during lipid oxidation in these products to form antioxidants that help to prevent food oxidation and spoilage. However, studies have shown

that excessive addition of BHA and BHT into food may cause potential harm to the liver, spleen, and kidneys. In severe cases, it can inhibit the activity of respiratory enzymes and cause cancer in the human body ¹⁷.

11. Considering that baking ingredients are essential for making baked goods like bread and cakes, the Municipal Affairs Bureau (IAM) carried out a surveillance on preservatives and antioxidants present in ingredients of baked goods commercially available in the local market ¹⁸, so as to ensure the ingredients meet the requirements for food safety and to safeguard the health of the public of Macao.

Regulatory measures implemented in Macao

12. The Administrative Regulation No. 7/2019 “Standards for Uses of Preservatives and Antioxidants in Foodstuffs” establishes the maximum limits of use of preservatives and antioxidants in baking ingredients, such as flour, bakery premixes, milk powder, and butter, among others.

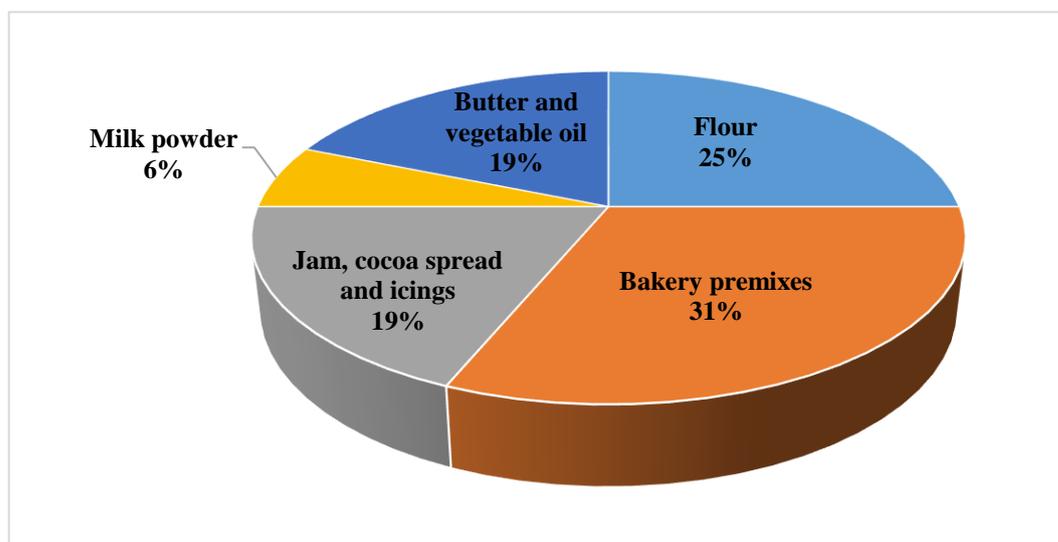
Objectives

13. The objectives of this surveillance are to understand the levels of preservatives and antioxidants in ingredients of baked goods commercially available in the market of Macao and to ensure that they comply with the food safety requirements.

Testing of samples and test parameters

14. This targeted food surveillance was carried out by IAM in the third quarter of 2021. A total of 80 samples were randomly collected from department stores, supermarkets and baking supplies shops across Macao. The collected samples included flour, bakery premixes, milk powder and butter, among others, which were tested for the presence of preservatives (benzoic acid, sorbic acid and sulphur dioxide) and antioxidants (propyl gallate, tertiary butylhydroquinone, butylated hydroxyanisole and butylated hydroxytoluene). The countries and regions of origin of these samples included Hong Kong, Japan, Korea, Portugal, France, Italy, Belgium and Australia.

Figure 1. Proportion of samples collected for the surveillance on ingredients of baked goods commercially available in the market



Conclusion and recommendations

15. The test results revealed that the levels of preservatives and antioxidants in all samples of ingredients of baked goods complied with the limits of use established by Administrative Regulation No. 7/2019 “Standards for Uses of Preservatives and Antioxidants in Foodstuffs” (Table 1), with a 100% pass rate.

Table 1. Results of surveillance on ingredients of baked goods commercially available in the market

Ingredients of baked goods	Number of samples	Number of samples with level(s) of preservative(s) and/or antioxidant(s) exceeding the established limits of Macao	Result of testing*
Flour	20	0	Pass
Bakery premixes	25	0	Pass
Jam, cocoa	15	0	Pass

spread and icings			
Milk powder	5	0	Pass
Butter and vegetable oil	15	0	Pass

*Pass signifies that the levels of preservatives and antioxidants in the tested samples were within the maximum limits of use established for the specific foodstuffs by Administrative Regulation No. 7/2019 “Standards for Uses of Preservatives and Antioxidants in Foodstuffs”.

16. The surveillance helps to determine the levels of preservatives and antioxidants in ingredients of baked goods sold in Macao, while providing a scientific basis for related works to be carried out in the future. In addition, IAM has issued a press release to inform the industry and the general public about the results of the surveillance, which are already uploaded to the website of “Food Safety Information”.
17. Considering that there are multiple ways to sell food products in Macao, the public would shop for baking ingredients online through social networking sites and instant messaging applications, besides directly from department stores, supermarkets and baking supplies shops. However, when buying food products from abroad through online stores and intermediaries, it is difficult to know whether the production, storage and transport of the overseas food products comply with food safety and hygiene requirements. Therefore, the public should avoid buying food products through online stores and intermediaries. In addition, it is advisable to maintain a balanced diet, and use baking ingredients that are high in sugar or fats in moderate amounts and consume baked goods in moderation.
18. Advice for the food industry:
 - Select reliable food sources and suppliers with care. Do not supply flour, bakery premixes, milk powder and other ingredients of unknown origin;

- For food ingredients that are stored at room temperature, keep them in a cool and well-ventilated place. For easily perishable food ingredients, store them properly in the refrigerator (refrigeration temperature below 5°C and freezing temperature -18°C or lower) and check the interior temperature of refrigerator regularly;
 - The food industry has the obligation to keep records of incoming and outgoing goods, respective receipts, invoices and relevant documents, to facilitate the competent authorities in tracing the origin of questionable food products and their distribution when necessary, and to protect their own interests;
 - In case of doubt about the origin, hygiene condition and quality of a certain food product, do not buy, sell or supply it;
 - In addition, the food industry should comply with the requirements of good manufacturing practices in the use of preservatives and antioxidants in food. For instance, preservatives or antioxidants should be used at the lowest necessary level in food to achieve the desired effect.
19. Advice for the public:
- Always buy baking ingredients from reputable shops in good hygiene condition;
 - Check the quality of the food product, whether its packaging is intact and that it is within the expiration date;
 - After purchase of food products that require refrigeration, store them in the refrigerator as promptly as possible to shorten the time they are left out at room temperature;
 - After the food packaging has been opened, keep the food in a clean food storage bag or container, and consume it as soon as possible;
 - If the food is spoiled, has an unpleasant smell or turns mouldy, do not buy nor consume it;
 - Individuals who may develop hypersensitivity reactions to preservatives or antioxidants should always read the food labels carefully during food

purchase.

Note: In general, the more samples of baking ingredients of baked goods are tested, the more information is obtained to understand the safety of commercially available baking ingredients. As this surveillance only sampled and tested some of the most popular types of baking ingredients, the results merely provide an overview of the levels of preservatives and antioxidants in ingredients of baked goods sold in Macao in a given period.

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