

Analysis Report on “Surveillance of Aflatoxin Content in Food Souvenirs Sold in Macao”

Objective and Samples

1. To understand the safety profile of Macao food souvenirs sold on the local market, the Municipal Affairs Bureau (IAM) conducted targeted surveillance¹ covering locations in Macao where food souvenirs are sold, including souvenir shops, supermarkets and street vendors, in the second quarter of 2023. **A total of 150 samples of Macao food souvenirs were collected and tested for Aflatoxin B1 content, and the results showed no abnormalities, with a pass rate of 100%,** indicating that the safety risk posed by food souvenirs sold on the Macao market is extremely low. This study helped to develop a better understanding of the Aflatoxin B1 content in Macao food souvenirs available on the market, ensuring the dietary health of the Macao public.

Background

2. Macao food souvenirs are a popular choice for souvenirs and gifts among the public and tourists in Macao. The souvenir industry in Macao dates back a long way, in which food souvenirs are an important cultural symbol of Macao, playing a pivotal role in promoting the Chinese and Western cultures in Macao and establishing its brand as a tourist city. At present, there is a large variety of food souvenirs available on the market, such as peanut candy, almond biscuits, phoenix cookies, nougat, walnut cookies and lard cakes, among which nutty snacks are a rather popular type of food souvenir in Macao.
3. Food souvenirs made with peanuts and other nuts, which have a unique flavour and high nutritional value, have always been a favourite of the Macao public and tourists alike due to their delicious taste. However, improper handling of nuts before and after their harvest or during processing and storage processes, such as prolonged exposure to a warm and humid environment, may create fertile ground for aflatoxins. Aflatoxin B1, the most common and toxic aflatoxin, can hardly be destroyed by washing or under normal cooking and processing temperatures owing to its stable molecular structure and heat resistance. Therefore, Aflatoxin

B1 contamination has always attracted the attention of different sectors of society (see Note 1 for more details)²⁻⁹.

4. Nut-based snacks such as peanut candy, crisp peanut candy and peanut biscuits are representative food souvenirs in Macao, and summer sees extraordinarily high sales of food souvenirs contributed by the public and tourists as it is the peak season for tourism in Macao. With these factors taken into account, IAM carried out targeted surveillance of food souvenirs in Macao¹ in the second quarter of this year to enhance the safety surveillance of these food items. Samples of food souvenirs sold in Macao were tested for Aflatoxin B1 to determine the safety of Macao food souvenirs, ensure food safety in Macao and provide a scientific basis¹⁰ for the “Food Safety Guidelines on Reducing Aflatoxin Contamination in Peanuts” launched this year.

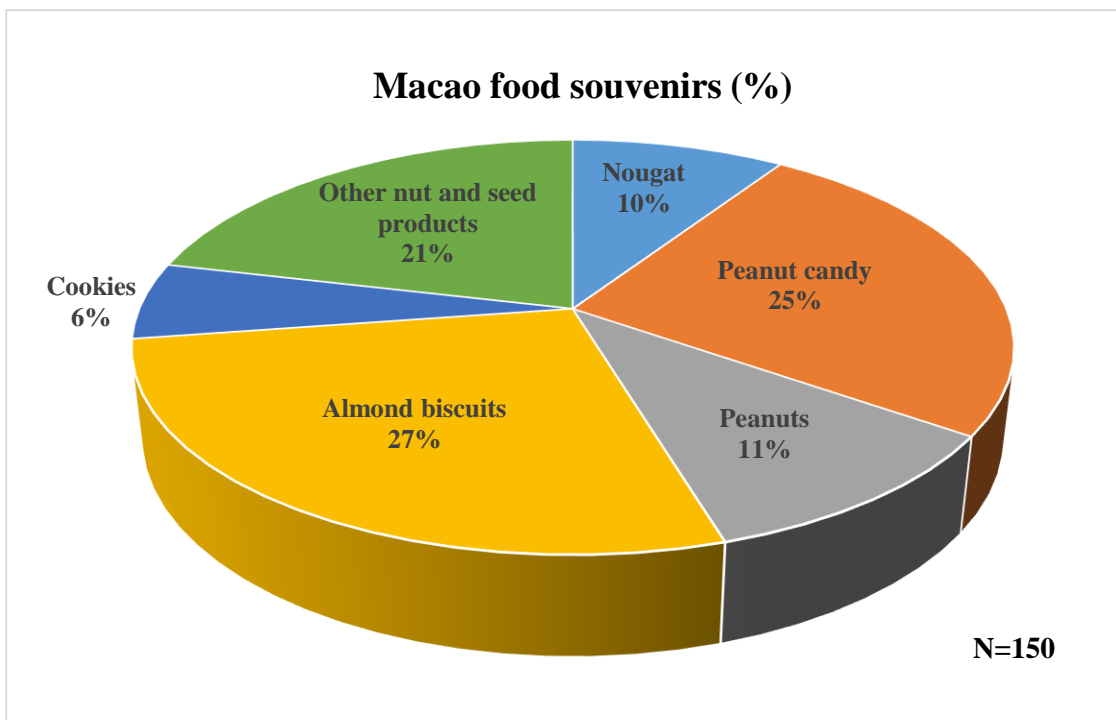
Sample Testing and Regulatory Measures in Macao

5. Sample distribution: This targeted food surveillance was carried out by IAM in the second quarter of 2023. A total of 150 samples of food souvenirs produced in Macao were collected from **local souvenir shops, supermarkets and street vendors** (Table 1 and Figure 1) and tested for Aflatoxin B1.

Table 1. Categories of Macao Food Souvenirs

| Macao food souvenirs | Number of samples by category | Total number of samples |
|-----------------------------|-------------------------------|-------------------------|
| Peanut candy | 38 | 150 |
| Nougat | 14 | |
| Peanuts | 16 | |
| Almond biscuits | 41 | |
| Cookies | 9 | |
| Other nut and seed products | 32 | |

Figure 1. Sampling Ratio of Macao Food Souvenirs in the Targeted Surveillance



6. Regulatory measures in Macao: Administrative Regulation No. 13/2016 “Maximum Limits of Mycotoxins in Food”¹¹ establishes the upper limit of the Aflatoxin B1 content in peanuts and peanut products, as well as other cooked nuts and seeds and their products (Table 2).

Table 2. Upper limit of aflatoxins in Macao food souvenirs (Administrative Regulation No. 13/2016 “Maximum Limits of Mycotoxins in Food”)

| Analyte | Food category | Limit |
|--------------|------------------------------------------------|----------|
| Aflatoxin B1 | Peanuts and peanut products | 20 µg/kg |
| | Other cooked nuts and seeds and their products | 10 µg/kg |

Results and Advice

7. This study covered 150 samples of locally produced food souvenirs that are common in Macao, including peanut candy, Japanese-style peanuts, nougat, almond biscuits and cookies. The test results suggest that trace amounts of

Aflatoxin B1 were detected in 18 samples, and according to the Administrative Regulation No. 13/2016 “Maximum Limits of Mycotoxins in Food”, **the aflatoxin B1 content in all the samples is within the acceptable range (see Table 3), with a pass rate of 100%.** The results indicate that there is an extremely low risk of Aflatoxin B1 in the food souvenirs sold in Macao. The small fraction of samples in which trace amounts of Aflatoxin B1 were detected reflects possible aflatoxin contamination of the raw ingredients (i.e. nuts, including peanuts). It is the responsibility of food producers to monitor, improve and strictly control the storage conditions of raw ingredients, and it is therefore incumbent on the sector to take appropriate control and prevention measures according to the realities on the ground.

Table 3. Results of targeted surveillance of Aflatoxin B1 content in Macao food souvenirs

| Food category | Analyte | Number of samples | Detection rate* | Number of samples exceeding the upper limit | Detection value range** |
|----------------------|--------------|-------------------|-----------------|---------------------------------------------|-------------------------|
| Macao Food Souvenirs | Aflatoxin B1 | 150 | 12% | 0 | <0.1-0.857µg/kg |

*All detection results above the detection limit are considered detected, including those between the detection and quantification limits.

**The detection and quantification limits of Aflatoxin B1 in this surveillance are set at 0.03µg/kg and 0.1µg/kg respectively, where any detection value smaller than 0.1µg/kg is regarded as a value between the detection and quantification limits.

- Considering that Macao food souvenirs are one of the most popular products purchased by the public and tourists, and souvenirs such as peanut candy, almond biscuits and other nut-based snacks, are the most favoured by them, **the test results in this surveillance have offered a scientific basis for the formulation of the relevant guidelines, “Food Safety Guidelines on Reducing Aflatoxin**

Contamination in Peanuts”¹⁰, to draw the sector’s attention to food hygiene and safety matters during the production and storage of peanuts, producing food that meets food safety standards and lowering the risk of aflatoxin contamination. **IAM has published a press release to inform the sector and the public of the results of this targeted surveillance and has uploaded the results to the Food Safety Information website¹.**

9. It is also worth noting that food is sold through a variety of channels in Macao. In addition to souvenir shops, supermarkets and street vendors, food souvenirs can also be purchased on social media websites, instant messaging apps, etc. However, members of the public are advised to refrain from online purchases or indirect purchases outside Macao as it is difficult to confirm whether the food purchased through these channels conforms to food hygiene and safety requirements in its production, storage, transport, etc.

10. Recommendations for the sector and the public (Table 4):

Table 4. Advice to the sector and the public

| Advice to the Trade | Advice to the Public |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> ● Purchase hygienic and high-quality ingredients from reputable suppliers and improve food safety and hygiene management in the various aspects, including raw food ingredients, preparation, transport, storage, display and sale; ● <u>Mark the information about food souvenirs clearly, such as their expiration dates and storage requirements;</u> ● Store the utensils, containers and packaging bags that come into contact with food properly, with routine cleaning and disinfection; ● Provide appropriate protective | <ul style="list-style-type: none"> ● Make purchases in shops with a good reputation and clean in-store environment; ● <u>Read the labels carefully when making a purchase, pay attention to the expiration date and avoid purchasing food souvenirs of unknown origin or with unclear labels;</u> ● If there is any doubt or abnormality regarding the origin and safety of the food, do not purchase it and stop eating it immediately; ● Avoid purchasing food souvenirs online or from an agent to reduce food safety risks caused by improper |

| Advice to the Trade | Advice to the Public |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>equipment when displaying food souvenirs to prevent contamination;</p> <ul style="list-style-type: none"> ● Individuals handling food must abide by personal and environmental hygiene requirements strictly. Do not purchase, sell or supply food if there are doubts regarding its origin, hygiene conditions or quality; ● The sector is also obliged to keep purchase and sales records or relevant receipts to enable competent authorities to trace the source and flow of the food and protect its own interests. | <p>handling of food during storage and transport;</p> <ul style="list-style-type: none"> ● In addition, considering the slightly high sugar and fat content of some food souvenirs, it is recommended to consume them in moderation and maintain a balanced diet. If necessary, the public should read the nutrition labels on the packaging carefully before purchasing. ° |

Note: Under normal circumstances, the larger the number of samples collected, the better it is to understand the safety profile of Macao food souvenirs sold on the market. This survey, however, only included some Macao food souvenirs commonly available on the market in its sampling, and therefore, the corresponding results can only roughly reflect the Aflatoxin B1 content in Macao food souvenirs in a given period of time.

Note:

1. The table below (Table 5) is a brief introduction to the pathogenic microorganism tested in this study and its adverse health effects.

Table 5. Introduction to Aflatoxin B1 and its adverse health effects

| Mycotoxin | Introduction and Adverse Health Effects |
|--------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Aflatoxin B1 | <ul style="list-style-type: none"> ● Aflatoxins are secondary metabolites produced mainly by <i>Aspergillus flavus</i> and <i>Aspergillus parasiticus</i>. The toxicity of aflatoxins varies greatly depending on the type or structure, and they are mainly divided into Aflatoxins B1, B2, G1 and G2, among which Aflatoxin |

| | |
|--|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | <p>B1 is the most common and toxic type, with the highest chance of causing liver cancer. Aflatoxin contamination in food arises primarily from the exposure of nuts and other crops to <i>Aspergillus flavus</i> in the field or during harvest, transport and storage, especially in hot and humid environments. Aflatoxin B1 is heat-resistant, making it difficult to be destroyed at normal cooking and processing temperatures.</p> <ul style="list-style-type: none"> ● According to a research report by the International Agency for Research on Cancer (IARC), an agency of the World Health Organisation, there is sufficient evidence of the carcinogenicity of aflatoxins in humans and animals. They can also induce embryonic malformations and destroy liver tissues in humans and animals alike. Moreover, ingestion of aflatoxins can reduce the immunity of humans and animals and cause negative impacts such as nutritional disorders. It may also result in acute or chronic poisoning (which mainly damages the liver) and even death. Therefore, aflatoxins are listed in the Carcinogenic Hazards to Humans (Group 1). |
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December, 2023

References

1. Municipal Affairs Bureau: “IAM conducted targeted surveillance of Macao food souvenirs and results showed no abnormality”. 29 August 2023
Link:
<https://www.foodsafety.gov.mo/c/foodinspec3/detail/ee686ea1-1329-4920-b469-ee281910e5b0>
2. Municipal Affairs Bureau: “Aflatoxins in Edible Oils and Fats”. 24 April 2023
Link:
<https://www.foodsafety.gov.mo/c/briefreviewofrisk/detail/9e876275-1f79-4ad0->

b47f-d717ab67e705

3. Hong Kong Food and Environmental Hygiene Department: “Aflatoxins in Food”.
8 October 2018

Link:

https://www.cfs.gov.hk/tc_chi/multimedia/multimedia_pub/multimedia_pub_fs73_02.html

4. Hong Kong Food and Environmental Hygiene Department: “Chemical Hazards Evaluation - Aflatoxin in Foods”. 17 August 2017

Link:

https://www.cfs.gov.hk/tc_chi/programme/programme_rafs/programme_rafs_fc01_16_report.html

5. Ministry of Agriculture and Rural Affairs of the People’s Republic of China: “Identification and Prevention of Aflatoxin Contamination in Agricultural Products and Food”. 27 November 2020

Link:

http://www.jgs.moa.gov.cn/kptd/202011/t20201110_6356097.htm

6. European Food Safety Authority (EFSA) . Risk assessment of aflatoxins in food.
9 March 2020

Link:

<https://www.efsa.europa.eu/en/efsajournal/pub/6040>

7. Singapore Food Agency (SFA) . Aflatoxins and Food Safety. 28 April 2022

Link:

<https://www.sfa.gov.sg/food-information/risk-at-a-glance/aflatoxins-and-food-safety>

8. National Cancer Institute (NIH) . Aflatoxins. 5 December 2022

Link:

<https://www.cancer.gov/about-cancer/causes-prevention/risk/substances/aflatoxins>

9. Centers for Disease Control and Prevention (CDC) . Aflatoxin. 13 January 2012

Link:

<https://www.cdc.gov/nceh/hsb/chemicals/aflatoxin.htm>

10. Municipal Affairs Bureau: “Trade Information - Trade Guidelines”. 16 October 2023

Link:

<https://www.foodsafety.gov.mo/c/tradeguidelines/listwithtab>

11. Printing Bureau: Administrative Regulation No. 13/2016 “Maximum Limits of Mycotoxins in Food”

Link:

https://bo.io.gov.mo/bo/i/2016/22/regadm13_cn.asp