Introduction

- Baking at high temperatures is adequate to kill any vegetative cells present, but post baking contamination can occur during filling and topping bakery products with sensitive ingredients.
- *Staphylococcus aureus* (S.aureus) and *Bacillus cereus* (B.cereus) are common pathogens present in these products. Their presence is an indication of poor hygiene practices (unhygienic handling), inadequate refrigeration, and poor quality raw materials. The growth of bacteria often occurs between the cream/custard topping of the dessert and the body of the dessert[1].
- S.aureus and B.cereus have the ability to produce enterotoxins which survive the baking process.
- Shelf life is not only dictated by microbiological safety but also by spoilage and loss of quality, in particular appearance and texture. Staling and mould growth are some of the main causes of spoilage in bakery products[2].
- It is vital that bakeries follow the correct hygiene practices to maintain the quality and safety of products, preventing the risk of foodborne illnesses in consumers.

Objectives

- Assessment of the microbiological quality of ready-to-eat cream and custard filled bakery products, sold in Dublin City Centre, using S.aureus and B.cereus as indicators of hygiene and safety.
- Observe the degradation of microbiological and sensory quality of cream filled bakery products over time.
- Observe the practices applied in bakeries in Dublin and investigate the level of knowledge of hygiene and safety by management and employees.
- Conclude if these products are a high risk to consumer health, and whether more stringent control measures need to be put in place.

Materials & Methods

**Microbiological Examination to determine the presence of S.aureus and B.cereus**

1. **Materials**
   - 10g of sample weighed into stomacher bag
   - 90ml of MRD added
   - Homogenised for 3 minutes
   - Diluted from 10^1 to 10^4
   - Vortexed to mix the samples
   - Spread onto selective agar (everything carried out in duplicate)
   - Incubated at 37°C for 48 hours
   - Colonies counted and converted to cfu/g

2. **Survey of bakeries to determine their level of knowledge and observe their practices**

3. **Mini sensory trial to assess the loss of quality over several days of storage and refrigeration**

**Results**

1. **1. Identification of S.aureus and B.cereus Using Confirmation Tests**

   ![Fig.1: Confirmed S.aureus grown on Baird-Parker agar from bakery samples. Black/grey colonies with clear halo around the colonies.](Image)

   **Table 1: Results of Confirmation Tests on Black Growth on Baird Parker Agar**
<table>
<thead>
<tr>
<th>Gram Stain:</th>
<th>Catalase:</th>
<th>Coagulase:</th>
<th>Oxidase:</th>
<th>API 50 CHB/E &amp; Biolog</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gram positive, cocci</td>
<td>Positive</td>
<td>Positive</td>
<td>Negative</td>
<td>Negative for B.cereus</td>
</tr>
</tbody>
</table>

2. **2. Results of Total Counts for S.aureus and Suspected B.cereus in Samples**

   - Low (Satisfactory), Moderate (Acceptable/Borderline), High (Unsatisfactory/Hazardous).
   - Set out in Regulation (EC) 2073/2005 – Microbiological Criteria for Foodstuffs

   ![Fig.2: Suspected B.cereus grown on B.cereus agar base from bakery samples. Yellow/cream colonies turned sections of the agar turquoise.](Image)

   **Table 2: Results of Confirmation Tests on Yellow Growth on B.cereus Agar Base**
<table>
<thead>
<tr>
<th>Gram Stain:</th>
<th>Catalase:</th>
<th>Coagulase:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gram positive, baci</td>
<td>Positive</td>
<td>Negative</td>
</tr>
</tbody>
</table>

3. **3. Mini Shelf life & Temperature Abuse Study**

   **Fig.3: S.aureus Results**
   Total of 11 samples tested. The charts represent the number of samples that tested low, moderate or high for levels of S.aureus and B.cereus.

   **Fig.4: Suspected B.cereus Results**
   Total of 11 samples tested. The charts represent the number of samples that tested low, moderate or high for levels of S.aureus and B.cereus.

   **Table 3: Results of Confirmation Tests on Black Growth on Baird Parker Agar**
<table>
<thead>
<tr>
<th>Gram Stain:</th>
<th>Catalase:</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Gram positive, cocci</td>
<td>Positive</td>
<td>Positive</td>
<td>Negative</td>
</tr>
</tbody>
</table>

**Discussion & Conclusions**

- The majority of cream and custard filled bakery products tested had moderate levels of S.aureus and suspect B.cereus. These products were purchased fresh in the morning, and immediately tested. The levels should be low, which indicates that hygiene practices, and particularly hygienic handling of products in bakeries, need to be improved. The amount of bacteria could easily reach a high level in the afternoon, causing a risk to consumers.
- A small percentage of samples which had high levels of S.aureus and suspect B.cereus were all purchased from the same premises, confirming poor hygiene in this particular bakery.
- All ready-to-eat cream filled bakery products should be consumed on the day of purchase. Consumers must ensure that these products are wrapped and refrigerated until consumed.
- The shelf life of these products is also dictated by the loss of sensory quality of refrigerated bakery products as early as 24 hours after purchase.
- Bakery staff have high levels of food safety/hygiene knowledge, but it is not always put into practice. More stringent control measures must be enforced to protect consumer safety.

**References**