Product innovation: understanding food safety hazards and how to control them

Proteins for Food & Health seminar

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Overview

- Drivers of NPD and innovation
- HACCP & hazards associated with novel proteins
- Microbiological food safety
  - Preservation toolkit – risk mitigation
  - The hurdle approach to food preservation
  - The Food Safety Objective (FSO)
  - Validation: challenge & shelf-life testing
- Allergens & food safety
Staying on trend in 2019!

Clean label
Plant derived proteins
Health & wellbeing
Certified organic
Snacking
FRESH!
Sustainable

Hazards associated with novel proteins

The role of HACCP in your products’ safety

- All businesses should seek to have a Food Safety Program
  - Outlines how a business will identify, control and manage food safety hazards during manufacture

Hazard Analysis Critical Control Point
- What are the potential hazards for your product/process? (microbiological, chemical, allergen & physical)
- What is the risk & potential consequence of each hazard?
- What can be implemented to mitigate (prevent or reduce) risk?
  - Identify where in the process to apply control -
    Critical Control Points
  - Identify which factors to control -
    Critical Control Factors
- Monitoring: how do we know we are applying control measures appropriately?
Hazards associated with novel proteins

- **Microbiological**
  - Bacterial pathogens, mycotoxins (fungal), viruses, parasites, marine biotoxins (algae)

- **Chemical**
  - Heavy metals, pesticide residues, cleaning agents, biocides

- **Allergens**
  - Proteins; e.g. milk, peanut, tree nuts

- **Physical**
  - Glass, metal, other foreign materials

A new HACCP is needed for every product/process

Opportunity for hazards, through-chain

- **On farm**
  - animal
  - plant
  - environment

- **Processing**
  - heat
  - chill
  - disinfection
  - salt
  - acid

- **Distribution**
  - temperature
  - storage

- **Retail**
  - temperature
  - storage
  - food service

- **Consumer**
  - storage
  - food preparation
  - ingestion

Food safety hazards can enter, survive & persist throughout the food chain
**Food preservation toolkit: the options**

**Inhibiting/delaying growth of microorganisms**
- **Reduce temperature**: freezing, chilling
- **Reduce available water (water activity)**: drying, curing (salting), conserving (sugar)
- **Reduce pH**: acidifying, fermenting
- **Preservatives**: antimicrobial compounds, organic/inorganic acids, smoke
- **Removal/Replacement of oxygen** (vacuum/modified atmosphere packaging)

**Inactivating microorganisms**
- **Physical processing**: heat (pasteurisation/canning), pressure (HPP)
- **Chemical sanitisers**: chlorine & other chemicals to surface inactivate microorganisms
- **Some formulations**: e.g. mayonnaise (acid, salt, pH, water activity)

**Intrinsic: in the food**  **Extrinsic: outside the food**  **Processing: applied to the food**

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**Microbiological safety - finding the balance**

*Meeting our Food Safety Objectives without compromise*

- **Need to control/eliminate microbes**
- **Product development**
- **Tastes great & is healthy**
- **Safety/stability assured**

**Conventional**  **Innovative**
The hurdle concept – a holistic approach

Food safety & stability is dependant on the interplay between processing, intrinsic & extrinsic factors...as well as the microbes in there to start

Each combination of hurdles defines the microbiological safety & stability of a food
The hurdle concept – a holistic approach

Making a change to any of these hurdles can destabilise the system!

- **HEAT**
- **pH**
- **a\textsubscript{w}**
- **CHILL**

Food system
Hurdles

Microbes still viable in the food

Microbes inherent in the food

↓ salt = water activity (a\textsubscript{w}) ↑

a\textsubscript{w} can be a critical preservative factor

Figure adapted from Leistner & Gould, 2002

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The hurdle concept – a holistic approach

With innovative processing & novel/natural preservatives there is a real opportunity to for exciting NPD for healthier foods

- **HEAT**
- **pH**
- **a\textsubscript{w}**
- **CHILL**

Food system
Hurdles

Microbes still viable in the food

Microbes inherent in the food

SAFE!

Figure adapted from Leistner & Gould, 2002
Smarter food safety

OLD – prescriptive, inflexible
- Traditional food safety based on adherence to prescriptive approaches to achieve compliance
  - Inflexible - prescribe approach for achieving the goal
  - Difficulties arise for validating novel technologies – constrains innovation

NEW – smarter, more flexible → innovation
- (ICMSF, 1998) proposed new scheme for management of microbial hazards in foods
  - The Food Safety Objective (FSO) approach – defines the goal
  - Flexible - does not prescribe approach for achieving the goal
  - Permits demonstration of equivalence of control measures – supports innovation

The Food Safety Objective

\[ H_0 - \Sigma R + \Sigma I \leq FSO \]

- \( H_0 \) = initial level of the hazard
- \( \Sigma R \) = hazard reduction (inactivation or removal)
- \( \Sigma I \) = hazard increase (growth or recontamination)

All expressed in \( \log_{10} \) units

Which bugs/how many?  How do we kill them?  How do we stop them?

A through chain approach
How to validate a process – A challenge!

**Challenge test**
- How your product will perform if faced with a ‘worst case’ microbe scenario
  - **CHALLENGED**

**Shelf-life study**
- How your product will perform given the microbes in it at the time of production
  - **NOT CHALLENGED**

- Deliberately inoculate with a **specific microorganism** at a known concentration
- Includes both pathogenic (safety) & spoilage (stability) microorganisms
- **Challenging performance** related to –
  - Formulation hurdles ($\text{pH}$, $a_w$, salt): **Inactivation / Inhibition**
  - Process efficacy (thermal, HPP, chemical sanitisation): **Inactivation**
  - Shelf-life conditions (atmosphere, packaging, temperature, time): **Inhibition**

Allergens

- Allergens are proteins found in common food ingredients
- Food allergies affect 2% of Australian adults but are estimated to affect around 6-8% of children
- 1 in 10 babies aged 12 months now have food allergy in Australia

**Allergens required to be labelled in Australia**
- Cereals containing gluten – wheat, rye, barley, oats and spelt
- Crustacea
- Egg
- Fish
- Milk
- Peanuts
- Soybeans
- Sesame seeds
- Tree Nuts
- Lupin
- Added Sulphites (10m g/kg or more)

Slide acknowledgement: Fiona Fleming
Allergen labelling requirements (FSANZ)

Allergen labelling is required when present as:

- an ingredient; or
- an ingredient of a compound ingredient; or
- a food additive or component of a food additive; or
- a processing aid or component of a processing aid.

FSANZ guidance on novel foods

- Novel foods and novel food ingredients are regulated under Standard 1.5.1 – Novel Foods in the Food Standards Code
- A novel food cannot be sold as food or used as a food ingredient unless it is listed in the Standard
- FSANZ is currently reviewing the requirements in the Food Standards Code for novel foods
Summary

Consumer demands & a focus on healthier foods are driving new product development & innovation in the food industry

NPD must be approached with food safety front & centre; includes HACCP for identifying microbiological, chemical, physical & allergen hazards

Microbiological food safety incorporates an understanding of the hurdle concept & food safety objectives & applying strategies to reduce risk

Challenge testing plays a critical role in assessing the microbiological safety & stability of foods

Allergens are proteins that can cause reactions in consumers; be aware that novel proteins sources may introduce new allergen hazards. Check with FSANZ

Thank you

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