# Overview of Microbiological Sampling and Testing: Indian Perspective

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Microbiological Food Safety Sampling and Testing in Food Safety Management, 8<sup>th</sup> October, 2018, FSSA (I), New Delhi

- Time line of Food Safety Regulations.
- Food Safety Regulations in India
- Enforcement Structure.
- Microbiology Sampling
- Microbiology Criteria for Safe Food
- Microbiology Testing/Laboratory.

1899	States / Provinces their own food laws with differencing standards for the same commodity. Conflicts in inter-provincial trade.
1943	Central Advisory Board for Central Legislation that brings in uniformity throughout the country
1954	Central Legislation – Prevention of Food Adulteration Act, 1954. Food and Drug adulteration included in Concurrent list.
1955	PFA Rules framed under the Act.
1955-2006	Amendments introduced time to time
2002-2004	Harmonization of food laws
2006	Food Safety & Standards Act – 2006
2011-to date	FSS Rules and Regulations framed and amendments introduced time to time

#### Earlier Indian Food Laws: A veritable grid of regulations



\* The Solvent Extracted Oil, Deoiled Meal, and Edible Flour (Control) Order (1967) Department of Consumer Affairs Ministry of Consumer Affairs, Food and Public Distribution

# Benefits of FSSA(I)

- Unification of eight laws i.e. steps to harmonization.
- Alignment of International Regulations.
- Science Based Standards.
- Clarity and uniformity on novel food areas.
- Help curb malpractices.

Boosts both domestic and international consumer confidence

### The Food Safety and Standards Authority of India



### Scientific Support for Regulations and Standards

**Food Authority** 

Provide scientific and technical advice to the Central and State Govts in matters of framing the policy & rules in areas which have a direct bearing on food safety and nutrition



#### **Central Advisory Committee**

Ensure close cooperation and coordination between the Centre, states and other stakeholders in the area of food including the consumer orgs.



#### Scientific Committee

Consists of Chairpersons of the Scientific Panels and six scientific experts They provide the scientific opinion on multi sectoral falling within the competence of more than one scientific panel and which do not fall within the competence of any panel

#### Scientific Panels

Consists of independent scientific experts in the subject area to provide scientific advice and opinion



# FSS Rules & Regulation, 2011

Licensing and Registration of Food Businesses

Packaging and Labelling

Food Product Standards and Food Additives

Prohibition and Restriction on Sales

Contaminants, Toxins and Residues

Laboratory and sampling analysis

### **The Enforcement Structure**



# FSO: Official Procedure for taking sample

Call one or more witnesses at the time of taking sample.

Obtain signature from one or two persons in all forms and documents.

Give notice in writing of his intention to the FBO/Vendor in Form V A

Form V A signature or thumb impression of FBO. If FBO refuses then signature of two witnesses









Adapted from Rather et al Front Pharmacol. 2017; 8: 830.

Food safety is best ensured by implementing food hygiene controls at each stage of food handling throughout the food chain. In India these food safety requirements are set out in <u>APPENDIX B of</u> <u>Chapter 3</u> of the Food Safety and Standards (Food Product Standards and Food Additives) Regulations, 2011.





# Microbiological Analysis : Sampling

Micro-organisms are rarely distributed uniformly throughout a food, nor in fact are they usually distributed randomly.

When micro-organisms are dispersed in a food material in the course of its production

- some may die,
- some may be unable to grow
- others may find themselves in microenvironments in which they can multiply.

The resulting distribution, containing aggregates of cells, is a contagious distribution

### Spatial Distribution of Microorganisms in Foods



#### Spatial Distribution of Chemicals & Toxins in Foods



# FSS Rules: Microbiological Analysis Sampling

The sampling plan includes the following elements:

- 1. The microbe or group of microbes of concern or interest
- 2. Number of samples to be tested (n)
- 3. Testing method(s);
- 4. Microbiological limit(s), m & M
  - a. Satisfactory (< m)
  - b. Acceptable (> m and < M)
  - c. Unsatisfactory (> M)
- 5. Number of samples (c) which fall into each category of microbiological limit.

### Choice of sampling plan

Absence or Presence **Bacillus cereus** Campylobacter Clostridium botulinum Cronobacter sakazakii *E.coli* 0157:H7 Listeria monocytogenes Pseudomonas aeruginosa Salmonella Shigella Staphylococcus aureus Vibrio Yersinia



Quality indicator/enumeration Total aerobic plate count Enterobacteriaceae Coliforms E.coli **Staphylococcus** (Coagulase +) Yeast & Mold Campylobacter spp Clostridium perfringens Pseudomonas aeruginosa Listeria monocytogenes

## Two-class attributes plan

- Sample(s) is (are) taken from the lot and tested.
- Only one microbiological limit "m" is involved in this plan,
- Two classes of attributes, < m & > m, could be identified.
- The maximum allowable number of sample(s) that yield unsatisfactory test results is represented by "c'



Choice of n and c varies with the desired stringency, which is determined by the level of hazard. For high stringency n is high and c is low.

### **Three-class attributes plan**

For a three-class attributes plan,

- 1. Two microbiological limits, m & M, are set.
- 2. The microbiological limit "m" commonly reflects the upper limit of a good manufacturing practice (GMP).
- 3. The criterion "M" marks the limit beyond which the level of contamination is hazardous or unacceptable.



Microbiological criteria Packaged Drinking Water	Permissible limit
Coliform bacteria (cfu/250 ml)	Absent
Faecal Streptococci,& Staphylococcus aureus, (cfu /250 ml)	Absent
Sulphite Reducing Anaerobes, (cfu/50 ml)	Absent
Pseudomonas aeruginosa, (cfu/250 ml)	Absent
Aerobic Microbial Count at 20-22°C in 72 h, (cfu /ml, max)	100
at 37± 1°C in 24 h, (cfu /ml, max)	20
Yeast and mold/ 250 ml	Absent
Salmonella and Shigella, cfu/250 ml	Absent
Vibrio cholera, and V. parahaemolyticus cfu/250 ml	Absent



#### FSSA Notification dated 15 November 2016

### **Microbiology Requirements for Fish and Fishery Products**

1. Chilled/frozen finfish, 2. Chilled/frozen crustaceans, 3. Chilled/frozen cephalopods, 4. Live Bivalve molluscs\* 5. Chilled/frozen bivalves, 6. Frozen cooked crustaceans or frozen heat-shocked mollusca, 7. Dried or salted and dried 8. Thermally processed 9. Fermented 10.Smoked 11.Accelerated freeze-dried 12. Fish mince/surimi and analogues, 13.Fish pickle, 14. Battered and breaded 15.Convenience fishery products 16.Powdered fish-based products.



**Process Hygiene indicators** Aerobic plate count Coagulase positive Staphylococci Yeast and mold count No parameters for Bivalve molluscs clams, oysters, mussels, scallops) <u>Stage</u> After Chilling or freezing End of manufacturing

#### **Microbiological Safety Indicators** E coli Salmonella Vibrio cholerae (O1 and O139) *Listeria monocytogenes Clostridium botulinum* (absence of viable cells and Botulinum toxin) n=5 and c=0

### Microbiology Requirements for Milk and Milk Products

Hygiene Indicator organisms

Coliform count, Coagulase positive staphylococci Yeast and mold count Faecal streptococci **Applicable** End of manufacturing process

Infant Formula/ infant milk substitutes Enterobacter sakazakii (n=30, c=0, m=Absent/10g) Salmonella (n=60, c=0, m=Absent/25g) L. monocytogenes (n=10, c=0, m= Absent/25g) Follow up formula and Cereal based complementary food Salmonella (n=15, c=0, Absent/25g)

FOOD SAFETY AND STANDARDS (FOOD PRODUCTS STANDARDS AND FOOD ADDITIVES) REGULATIONS, 2011 Version –VII (31.08.2018)



 Microbiological Safety Indicator organisms

 E coli

 Salmonella/Shigella

 Listeria monocytogenes

 Bacillus cereus

 Sulphite reducing clostridia

 Enterobacter sakazakii

 (n=5, c=0)



### Microbiology Criteria for Meat and Meat Products

1. Canned/Retort pouch meat product

#### 2. Chilled meat

- 3. Cured/pickled meat products
- 4. Dried/Dehydrated meat/meat products
- 5. Fermented meat product
- 6. <u>Fresh meat</u>
- 7. Frozen meat
- 8. <u>Raw marinated/minced/comminuted</u> <u>meat</u>.
- 9. Semi-cooked /Smoked Meat/meat food

Fresh /Chilled/Minced/Comminuted meat Salmonella (n=5, c=0, m=Absent/25g) Canned/Retort pouch meat products Clostridium botulinum Campylobacter spp (n=5 and c=0, m= Absent/g ) Process Hygiene Criteria

Aerobic plate count Coagulase positive Staphylococci Yeast and mold count *E.coli* **Applicable** End of manufacturing process

Microbiological Safety Indicators Salmonella Listeria monocytogenes Sulphite reducing Clostridia Campylobacter spp Clostridium botulinum (n=5 and c=0)

### Microbiology Criteria for Fruit & Vegetable Products

Salmonella Listeria monocytogenes Sulphite reducing Clostridia E. Coli 0157 and Vero or Shiga toxin producing E. coli Vibrio cholera

Aerobic plate count Staphylococci (Coagulase +ve) Yeast and mold count *Enterobactericiae*  1. Cut or minimally processed 2. Frozen fruits and vegetables Dehydrated or dried 4. Thermally processed Fermented or pickled or 5. acidified Fruit beverages 7. Pasteurized Juices Retort processed 8.

FOOD SAFETY AND STANDARDS (FOOD PRODUCTS STANDARDS AND FOOD ADDITIVES) REGULATIONS, 2011 Version –VII (31.08.2018)

#### Spices : Salmonella (Absent/25g)



### **Baker's Yeast**



#### Compressed Baker's yeast

- Total bacterial count, CFU/g (on dry basis), Max 7.5×10<sup>5</sup>
- E. coli, CFU Absent in 1 g
- Salmonella, Shigella species Absent in 25 g
- Coliform count, CFU/g, Max 10
- Rope spore count, CFU/g, Max 10



#### Dried Baker's yeast

- Total bacterial count, CFU/g (on dry basis), Max 8×10<sup>6</sup>
- E. coli, CFU Absent in 1g
- Salmonella, Shigella species Absent in 25g
- Coliform count, CFU/g, Max 50
- Rope spore count, CFU/g, Max 100

# Microbiology testing facilities

#### Laboratories:

- 1. State Food Testing Laboratories
- 2. FSSA(I) Notified Laboratories
- 3. Referral Laboratories
- Unidirectional: Unit operations separated in time and space with separate Air Handling Units.
  - Sample Receipt & Documentation
  - Sample Preparation
  - Media Preparation
  - Inoculation
  - Reference Culture
  - Incubation and Enumeration
  - Decontamination

Personnel: FSSA(I) Certified Food Analysts with expertise in Food Microbiology

Methods: Latest version of the ISO method ( or its BIS equivalent, if available)

Equipment: BSL-II, Autoclaves, Stomacher, Automated pathogen

detection system etc.

Quality Assurance: ISO17025: 2005





Under the SoFTEL scheme of FSSA(I) the State Food Testing Laboratories now have upgraded state-of-the-art Microbiology Testing Laboratories

# THANK YOU