



# International Commission on Microbiological Specifications for Foods (ICMSF)

[www.icmsf.org](http://www.icmsf.org)

## Useful Microbiological Testing for Meat and Poultry Products

**Kiran Bhilegaonkar**

Principal Scientist and Head

Division of Veterinary Public Health

Indian Veterinary Research Institute

Bareilly, India



Since 1962





# Presentation Out-line

- Introduction
- Examples from chapter on Meat and Meat Products
  - Cooked meat
- Examples from Poultry chapter
  - Dried poultry meat
- FSSAI-ICMSF-CHIFSS – India Experience



# Meat : Facts and Figures

## Meat an important international food commodity

Most produced (**by value**) food commodity in the world

Global meat production :

Almost **five times**

**increase** in 50 years

- 1963: 78 million tonnes
- **2023: 363.9 million tonnes**

Total Production		\$2,006,628,429,224	
Rank	Commodity	Int'l \$	% Of Total
1	Milk, Cow	\$198,338,449,276	9.88%
2	Rice, paddy	\$100,576,416,113	9.50%
3	Pork	\$172,682,907,041	<b>8.61%</b>
4	Beef	\$171,163,310,870	<b>8.53%</b>
5	Chicken	\$137,224,034,261	<b>6.84%</b>
6	Wheat	\$85,942,102,550	4.28%
7	Soybeans	\$69,476,638,751	3.46%



# Important Vehicle – Food Commodities

Estimates of foodborne illnesses attributed to specific food commodity groups, by pathogen type, United States, 1998–2008\*

Commodity or commodity group	% illnesses				
	All agents	Bacterial	Chemical	Parasitic	Viral
Aquatic animals	6.1	3.9	61.6	33.3	3.9
<b>Land animals</b>	<b>41.7</b>	<b>64.0</b>	<b>13.3</b>	<b>0.1</b>	<b>30.0</b>
Plants	51.1	32.1	25.2	29.5	65.8
Undetermined	1.1	0.0	---	37.1	0.3

# USA Foodborne Illness by Product Type

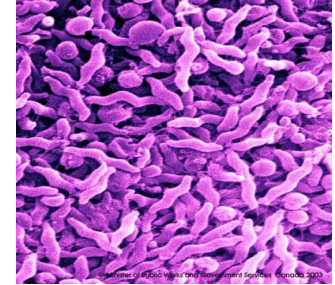
Batz et al 2012

TABLE ES-3: DISEASE BURDEN BY FOOD CATEGORY, SUMMED ACROSS PATHOGENS, BY COMBINED RANK

	FOOD CATEGORY	QALY Loss	COST OF ILLNESS (\$ MIL.)	ILLNESSES	HOSPITALIZATIONS	DEATHS
1	Poultry	14,744	2,462	1,538,468	11,952	180
2	Complex foods	7,518	2,078	3,001,858	11,674	189
3	Pork	7,830	1,894	449,322	4,334	201
4	Produce	6,171	1,404	1,193,970	7,125	134
5	Beef	5,766	1,338	760,799	4,818	131
6	Deli/Other Meats	5,065	1,338	204,293	1,889	129
7	Dairy products	5,410	1,232	297,410	2,933	114
8	Seafood	2,762	921	642,860	2,937	97
9	Game	2,551	651	46,636	1,106	69
10	Eggs	2,252	428	170,123	2,472	45
11	Baked goods	988	273	462,399	1,833	25
12	Beverages	403	94	146,577	606	8
	<b>TOTAL</b>	<b>61,461</b>	<b>14,114</b>	<b>8,914,713</b>	<b>53,678</b>	<b>1,322</b>

# Meat-borne Pathogens

- Meat/ Poultry: **Excellent support for microbial growth**
- Important source of pathogens
  - *Salmonella*
  - *Listeria monocytogenes*
  - *Campylobacter* spp.,
  - Pathogenic *E. coli* (including O157:H7 / other EHEC)
  - *Yersinia enterocolitica*
  - *Clostridium perfringens*





## Microorganisms in Foods 8

Use of Data for Assessing Process Control and Product Acceptance  
International Commission on Microbiological Specifications for Foods (ICMSF)

2011, 2011, XX, 400 p. 12 illus.

Available Formats:

▼ ▲ Hardcover ⓘ

ISBN 978-1-4419-9373-1

## Part II

Application of Principles to Product Categories

- **Chapter 8:** Meat Products pg 75 -94
- **Chapter 9:** Poultry Products pg 95-106





# Chapter 8: Meat Products

## Sub-categories of 'meat'

- Raw meat products (excluding comminuted meats)
- Raw comminuted meats
- Raw cured shelf stable meats
- Dried meat products
- Cooked meat products
- Fully retorted shelf-stable uncured meats
- Shelf-stable cooked cured meats
- Snails and Frog Legs



# Category: Sub-heads

Each category is discussed under following headings

Significant organisms

## Relative importance and usefulness of Microbiological testing data

- Critical ingredients
- In-process
- Processing environment
- Shelf life
- End product



# Cooked Meat Products (Perishable cured and uncured)

## Examples

- Cooked sliced beef
- Pate
- Meat pies
- Cooked Ham



## • Main Pathogens

- *Salmonella* (all)
- *L. monocytogenes* (all)
- *C. perfringens* (all uncured)
- *Campylobacter* (pork )
- EHEC (Beef, lamb or goat products)
- *S. aureus* (all not in-pack processed)

## Hazards in some regions

- *Yersinia* (pork)
- *Trichinella* (pork)

# Cooked Meat Product Testing

Relative importance		Useful testing
Critical ingredients	Low	These products do not contain non-meat ingredients of significance for microbiological safety or quality
In-process	High	Monitoring the cooking parameters is essential ( <b>TIME AND TEMPERATURE</b> )
	Medium	For products that support <i>L. monocytogenes</i> growth, <b>post-cook samples</b> can assess control of <i>Listeria</i> spp. Typical levels encountered post-cook: <b>Absence of <i>Listeria</i> spp.</b>

# Cooked Meat Product Testing

## Relative importance

## Useful testing

Processing environment

**High**

For products that support *L. monocytogenes* growth, during production **sample product contact surfaces before packaging**. Environmental sampling programme ongoing (floors, drains and non-product contact surfaces) for **absence of *Listeria* spp.**

**Medium**

Sample equipment surfaces before startup **to verify cleaning and disinfection**. e.g. ACC typical levels encountered <500 cfu/cm<sup>2</sup> may vary by surface type.

Shelf life

**Medium**

Shelf life testing may be **useful for refrigerated products with extended dates**. Shelf life testing of frozen products is not necessary

# Cooked Meat Product Testing

Relative  
importance

Useful testing (Indicators)

End  
product

**Medium**

Test for **indicators** of **ongoing process control** and trend analysis

Sampling plan & limits/g

Product	Microorganism	Analytical method	Sampling plan & limits/g				
			Case	n	c	m	M
Cooked Meat	<i>Aerobic colony count</i>	ISO 4833	2	5	2	10 <sup>4</sup>	10 <sup>5</sup>
	<i>E. coli</i>	ISO 16649-2	5	5	2	10	10 <sup>2</sup>
	<i>S. aureus</i>	ISO 6888-1	8	5	1	10 <sup>2</sup>	10 <sup>3</sup>
Cooked uncured meat (e.g. roast beef)	<i>C. perfringens</i>	ISO 7937	8	5	1	10 <sup>2</sup>	10 <sup>3</sup>



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# Cooked Meat Product Testing

Relative  
importance

Useful testing (Pathogens)

End  
product

**Medium**

Routine sampling for pathogens is not recommended unless the application of **GHP or HACCP is in question**. The following testing is then recommended:

Product	Microorganism	Analytical method	Sampling plan & limits/25g				
			Case	n	c	m	M
Cooked Meat	<i>Salmonella</i>	ISO 6579	11	10	0	0	-
Cooked Meat (supports growth)	<i>L. monocytogenes</i>	ISO 11290-1	N/A	5	0	0	-
Cooked Meat: no growth	<i>L. monocytogenes</i>	ISO 11290-2	N/A	5	0	10 <sup>2</sup>	-



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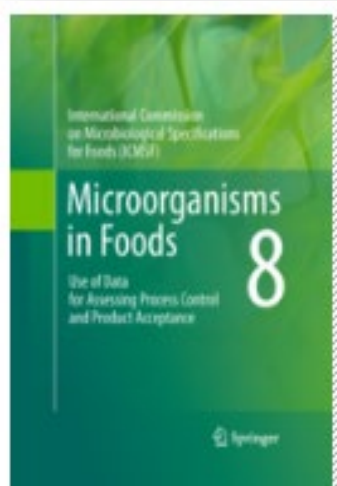
# Plan Performance Examples: cooked meat

- **Geometric mean concentration (cfu/g) at 95% probability of rejection**  
(table A2 pg 361)
  - **PLAN: *E. coli* n=5 c=2 m=10 M=100**
    - » S.d.(0.25) = 17                      S.d. (0.5) = 25
    - » S.d.(0.8) = 33                      S.d. (1.2) = 39
- **Geometric mean concentration (per g or ml) at 95% probability of rejection**  
(table A3 pg 362)
  - **PLAN: *L. monocytogenes* n=5 c=0 m=0 (25g)**
    - » S.d.(0.25) = 1 cell in 44 g              S.d. (0.5) = 1 cell in 49 g
    - » S.d.(0.8) = 1 cell in 55 g              S.d. (1.2) = 1 cell in 62 g

# Chapter 9: Poultry Products

## Sub-commodities of Poultry Products

- Raw poultry products
- Cooked poultry products
- Fully retorted shelf-stable poultry products
- Dried Poultry Products





# Dried Poultry Products

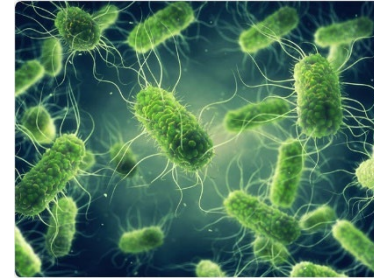
- Examples

- Dried cooked chicken
- Bouillon powder/paste
- Dried salted chicken strips



- Main Pathogens

- *Salmonella*





# Dried Poultry Product Testing

## Relative importance

## Useful testing

Critical ingredients

Low

These products do not contain non-meat ingredients of significance for microbiological safety or quality

In-process

**High**

Monitoring the **cooking and formulation parameters like pH and preservatives**. The manufacturing **process should be validated for control of salmonellae** that are present in poultry meat

Low

Routine microbiological testing of in-process samples is not recommended





# Dried Poultry Product Testing

## Relative importance

## Useful testing

Processing environment

**Medium**

Sample equipment surfaces before startup to **verify cleaning and disinfection**. E.g. ACC typical levels encountered **<500 cfu/cm<sup>2</sup>** but may vary by surface type.

Shelf life

Low

These products are inherently shelf-stable when properly dried and protected from high humidity. The higher the  $a_w$  of snack products may require verification of stability e.g. mould

# Dried Poultry Product Testing

**Relative importance**

**Useful testing**

End product

**Medium**

Routine sampling is not necessary. If application of **GHP and HACCP is in question**, sampling for Salmonellae may be considered.

Product	Microorganism	Analytical method	Sampling plan & limits/25 g				
			Cas e	n	c	m	M
Dried Poultry	<i>Salmonella</i>	ISO 6579	11	<b>10</b>	<b>0</b>	<b>0</b>	-



# Plan Performance: Dried Poultry Products

- Geometric mean concentration (cfu per g) at 95% probability of rejection ([table A3 pg 362](#))
  - PLAN: *Salmonella* **n=10 c=0 m=0 (25g)**
    - » S.d.(0.25) = 1 cell in 93 g      S.d. (0.5) = 1 cell in 120 g
    - » **S.d.(0.8) = 1 cell in 180 g**      S.d. (1.2) = 1 cell in 310 g

# Codex

CAC/RCP 58-2005

Page 1 of 52

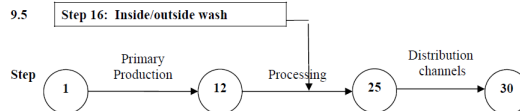
## CODE OF HYGIENIC PRACTICE FOR MEAT<sup>1</sup>

CAC/RCP 58-2005

1. INTRODUCTION .....	3
2. SCOPE AND USE OF THIS CODE .....	3
3. DEFINITIONS .....	4
4. GENERAL PRINCIPLES OF MEAT HYGIENE .....	8
5. REFERENCES .....	9

## GUIDELINES FOR THE CONTROL OF *CAMPYLOBACTER* AND *SALMONELLA* IN CHICKEN MEAT

CAC/GL 78-2011



### 9.5.1 GHP-based control measures

66. The inside and outside of all carcasses should be thoroughly washed, using pressure sufficient to remove visible contamination. Appropriate equipment should be used to ensure direct water contact with the carcass. The removal of contaminants may be aided by the use of brushing apparatus installed in line with the inside/outside wash.

### 9.5.2 Hazard-based control measures

#### For *Campylobacter*

67. Carcass washing systems with 1-3 washers using water with 25-35ppm total chlorine have been shown to reduce levels of *Campylobacter* by about 0.5 log<sub>10</sub> CFU/ml of whole carcass rinse sample. Post-wash sprays using Acidified Sodium Chlorite (ASC) or TSP may further reduce *Campylobacter* levels by an average of 1.3 log<sub>10</sub> CFU/ml or 1.0 log<sub>10</sub> CFU/ml of whole carcass rinse sample respectively.

#### For *Salmonella*

68. Inside/outside washing using a spray application of 20-50 ppm chlorinated water has been shown to reduce the prevalence of *Salmonella*-positive broiler carcasses from 25% to 20%. A second inside/outside washing following upon the first resulted in a reduction of *Salmonella*-positive broiler carcasses from 16% to 12%.



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# Conclusions

- Microbiological testing to be used **appropriately & pragmatically**
- No food safety program can rely solely on microbiological testing
- **ICMSF recommendations** should **be used as a guideline**
- Legislative microbiological standards in national and international trade need to be applied and complied with
- The **ICMSF sampling plan performance calculator** can be used to **evaluate alternative plans**. ([http://www.icmsf.org/main/software\\_downloads.html](http://www.icmsf.org/main/software_downloads.html) )





# FSSAI-ICMSF-CHIFSS Activities - India

## Microbiological Food Safety Capacity Building

- **Development of short, simple Guidance Documents** on useful sampling and testing for specific food sectors
- **Development of training material** based on ICMSF publications for the priority sectors such as **Meat/Fish/Milk**.
- **Capacity Building** and Dissemination of knowledge





# Consultative Sessions – Poultry Industry



FOOD SAFETY AND STANDARDS  
AUTHORITY OF INDIA  
*Inspiring Trust, Assuring Safe & Nutritious Food*



FSSAI - CHIFSS - ICMSF Consultative Session  
on

“Enhancing Microbiological Quality and Safety in Poultry Sector in India”

Venue: Confederation of Indian Industry (CII), 105, Kakad Chambers, 132, Dr Annie Besant Road,  
Worli, Mumbai - 400 018

Date: 8<sup>th</sup> May'19 | Time: 1030 hrs – 1600 hrs

Mumbai  
Western  
India



FOOD SAFETY AND STANDARDS  
AUTHORITY OF INDIA  
*Inspiring Trust, Assuring Safe & Nutritious Food*



FSSAI - CHIFSS - ICMSF Consultative Session  
on

“Enhancing Microbiological Quality and Safety in Poultry Sector in India”

Venue: Confederation of Indian INDUSTRY (CII)

No.1086|HAL 2nd Stage|12th Main| Indiranagar| Bangalore - 560008

Date: 13<sup>th</sup> May'19 | Time: 1030 hrs – 1600 hrs

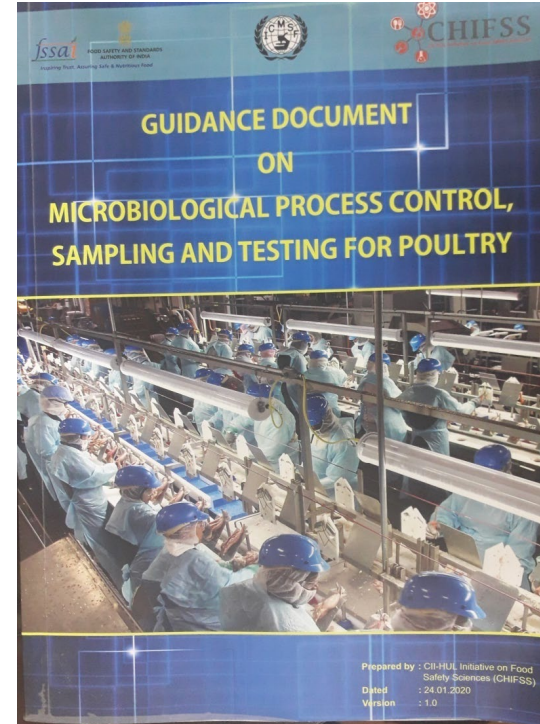
Bangalore  
Southern  
India



# Guidance Document

## Guidance Document

- Microbiological Process Control, Sampling and Testing for Poultry
- Released by Director NFL, FSSAI in January, 2020



# On-line Training Meat and Poultry

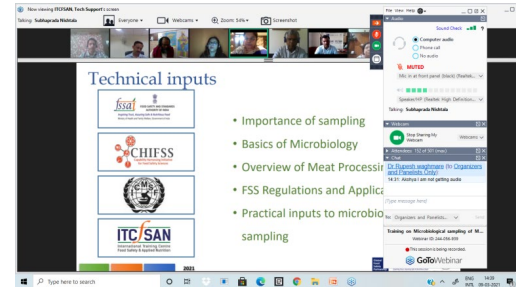
## Sampling for Microbiological Testing: Meat and Poultry Collaborations with ITC FSAN

Industry  
Meat and Poultry

Two

Food Safety  
officers of  
different  
States

Ten



# Training - Food Safety Officers of different States

## Technical inputs



## Program Metrics

10  
EXPERTS

1759  
PARTICIPANTS

9  
months

30  
States & UT

4.33+  
Faculty Training

10  
Programs



Dr Sanu Jacob,  
FSSAI



Dr. Kiran  
Bhilegaonkar,  
ICAR IVRI



Dr Rupesh Waghmare



Dr Vijay Pal Singh

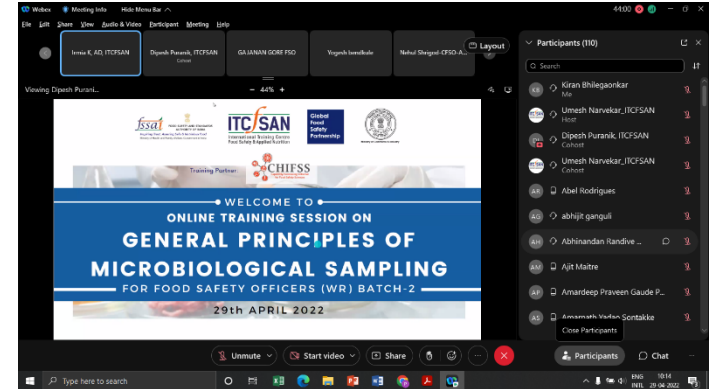


# On-line Trainings on

## General Principles of Sampling for Microbiology

### For Food Safety officers of States - 5

- West Region - 2
- East Region – 1
- South Region - 1
- North Region - 1



# Consultative Sessions – Fisheries Sector Industry

Enhancing Microbiological  
Quality and Safety for  
Fisheries Sector in India

Two Sessions for FBOs



ICMSF – CHIFSS Consultative Session

on

“Enhancing Microbiological Quality and Safety for Fisheries Sector in India”

Date: 12<sup>th</sup> - 13<sup>th</sup> July 2021

Mode: Online



FSSAI - ICMSF – CHIFSS Two Day Digital Consultative Session on

“Enhancing Microbiological Quality and Safety for Fisheries Sector in India”

Date: 4<sup>th</sup> – 5<sup>th</sup> October 2021

Mode: Online



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# Guidance Document



## Guidance Document

- Microbiological Process Control, Sampling and Testing of Fish and Fishery product

# On-line training Microbiology of Fish and Fish Products

## Fish and Fish Products Food Safety Officers – 4

- Western Region
- Southern Region
- Northern Region
- Eastern Region

Meeting Info: 02:15:36

Participants: Samiksha Pawar, ITCFSAN's..., NARFELM AHMAD, Abdul Majid, Abhijit, Anil Kumar Food safety...

Viewing Samiksha Pawar, ITCFSAN's a... - 43%

**WELCOME TO ONLINE TRAINING ON**  
**MICROBIOLOGICAL SAMPLING OF FISH AND FISH PRODUCTS**  
21st October 2022  
FOR FOOD SAFETY OFFICERS (NR)

Training Partner: CHIFSS

Windows taskbar: Type here to search, 24°C, 11:56, 21-10-2022



# Hands-on Training Activities

## Food Microbiological Techniques for **Meat and Poultry** Industry Participants - Two

- National Food laboratory, FSSAI Ghaziabad (**Delhi**) (20<sup>th</sup> -24<sup>th</sup> January 2020)
- Mumbai Veterinary College, **Mumbai**. 21<sup>st</sup> - 24<sup>th</sup> Dec. 2022.

### 1. CHIFSS-FSSAI: Hands on Training “Food Microbiological Techniques for High Risk Foods- Meat and poultry”



FSSAI – CHIFSS-BVC-ICMSF

Collaborative

“Hands on Training - Food Microbiological Techniques for High Risk Foods-Meat and Poultry “





**Thanks**