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FOOD SAFETY AND STANDARDS  
AUTHORITY OF INDIA

Inspiring Trust, Assuring Safe & Nutritious Food  
Ministry of Health and Family Welfare, Government of India



# Microbiological Food Safety Challenges in Indian meat and poultry industry



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# Food Safety: Why?????

- Changing food habits
- Increased processing and handling
- Changing processes, products
- Globalization of food trade



## FOOD SAFETY A GLOBAL CONCERN

### Food Borne Disease Outbreaks, 2016

Outbreaks Reported	: 1892
Cases of illness	: 48 Million cases in a year
Hospitalization	: 128,000
Deaths	: 3000

*(CDC, 2018)*

- **31 global hazards** - 600 (95% uncertainty interval [UI] 420–960) million foodborne illnesses and 420,000 (95% UI 310,000–600,000) deaths in 2010.
- Norovirus and Campylobacter spp.
- **Foodborne diarrhoeal disease agents** - 230,000 (95% UI 160,000–320,000) deaths, particularly non-typhoidal Salmonella enterica (NTS, which causes diarrhoeal and invasive disease).
- **Other major causes of foodborne deaths** were Salmonella Typhi, Taenia solium, hepatitis A virus, and aflatoxin.
- **The global burden of foodborne disease** - 31 hazards was 33 (95% UI 25–46) million DALYs (Disability Adjusted Life Years)
  - *WHO Foodborne Disease Burden Epidemiology Reference Group (FERG), 2015*

Sr. No.	Species	Population (Millions)	Meat Production (MT)
01	Cattle	190.12	337.91
02	Buffalo	108.7	1450.98
03	Sheep	65.07	556.44
04	Goat	135.17	1041.11
05	Pig	10.12	468.80
06	Poultry	729.21	3643.45

2.2% of total world's meat production,

➤ 47.32% of meat contributed by poultry meat followed by 13.83% by buffalo, 14.22% by goat, 4.60% by sheep, 6.41% by pig and 4.62% by cattle, respectively.

# INDIAN MEAT INDUSTRY

- Meat production : 7.4 Million Tonnes
- Value of meat produced : Rs.26,870 Crores
- Meat products : Rs.950 Crores
- Registered slaughter houses : 3900
- Unregistered slaughter houses : 25750
- Abattoir cum Meat Processing Units: 80
- Meat Processing Units : 29
- EIC approved Meat and Poultry Products Unit in India : 15

# MEAT EXPORT

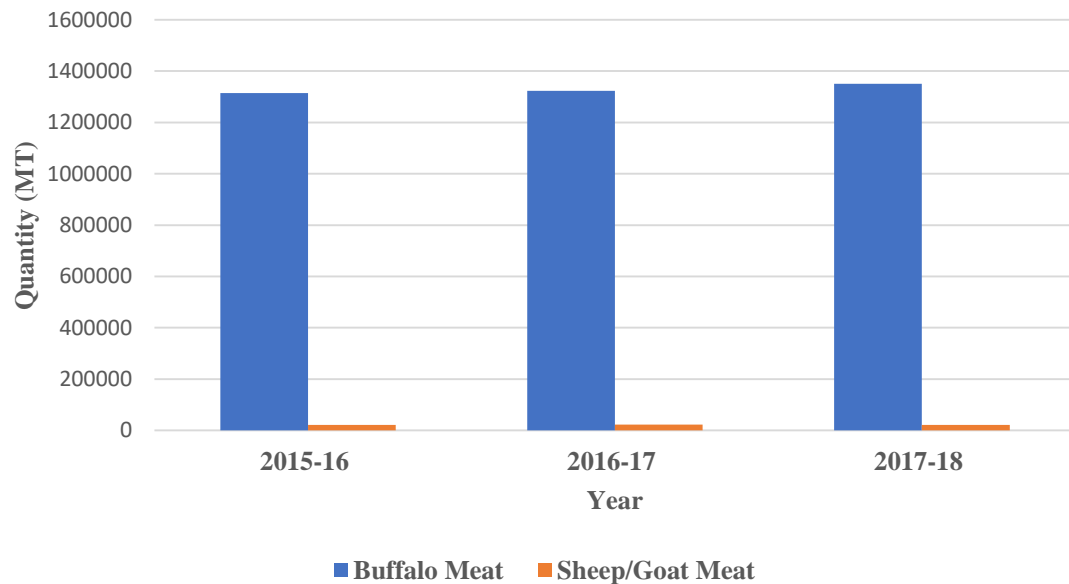
**Buffalo meat** : 13,50,563.48 MT ; Value of Rs. 26,033.82 Crores

**Sheep/goat meat** : 21,906.51 MT ; Value of Rs. 835.74 Crores

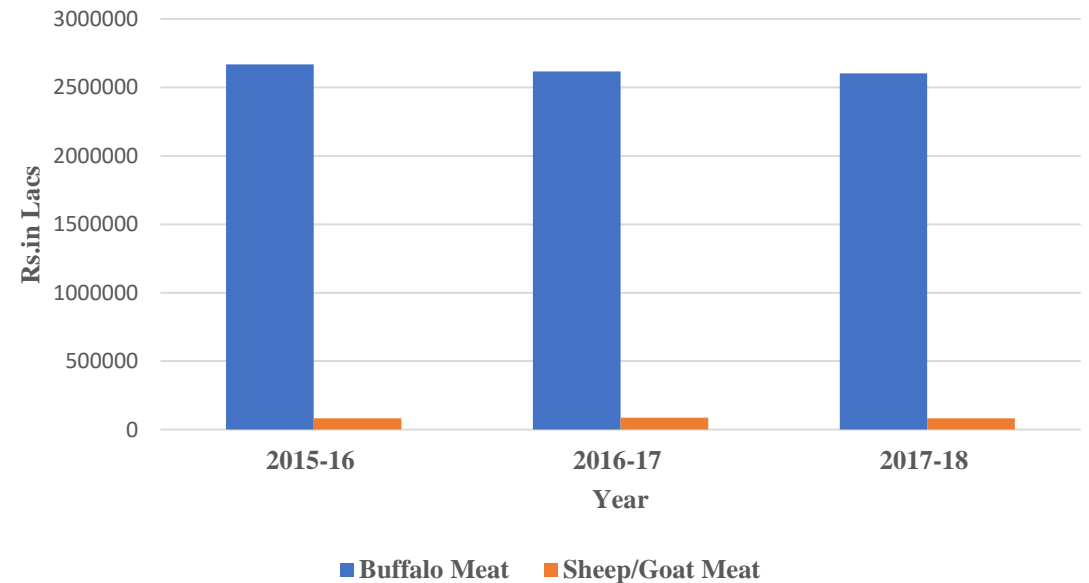
*India is the largest exporter of buffalo meat and third largest exporter of meat after Brazil & Australia*

(APEDA, 2017-18)

Exported quantity (MT) of differnt meat



Export earnings from different meat



# MEAT EXPORT

- India exports to more than 60 countries of the World
- Deboned and deglanded frozen buffalo meat, which accounts for 97% of the total meat export.
- Major market for Indian buffalo meat is Malaysia and Egypt and for sheep and goat meat is UAE, Iran and Jordan.
- India also exports small quantity of processed meat to Thailand, Yemen, and Japan
- Poultry products to Saudi Arabia, Oman, Kuwait and Qatar.
  - ***Int.J.Curr.Microbiol.App.Sci (2018) Special Issue-7: 4627-4634***



# INDIAN POULTRY INDUSTRY

- *Transformed from backyard to a well organized industry*
- Organized sector : 70%
- Unorganized sector : 30%
- Egg production : 88.139 billion eggs (3<sup>rd</sup> in Egg Production)
- *(Approx. 75% of egg production is contributed by commercial poultry farms, remaining comes from household/backyard poultry).*
- Broiler production : 4.9 million MT (4<sup>th</sup> in Broiler Production)
- Poultry products export : Rs. 515.90 Crores



- India is leading with 10 percent in the poultry growth followed by Brazil with 7 percent, the USA with 2.1 percent and China with 2 percent.
- Recommendation of NIN suggests per capita consumption should be 180 eggs and 11 kg meat while actual consumption is 61 eggs and 3.9 kg chicken meat.
- Under the policy initiatives of the Indian government towards doubling the income of farmers by 2022, poultry sector is going to be a major contributor.

## INCREASED DEMAND

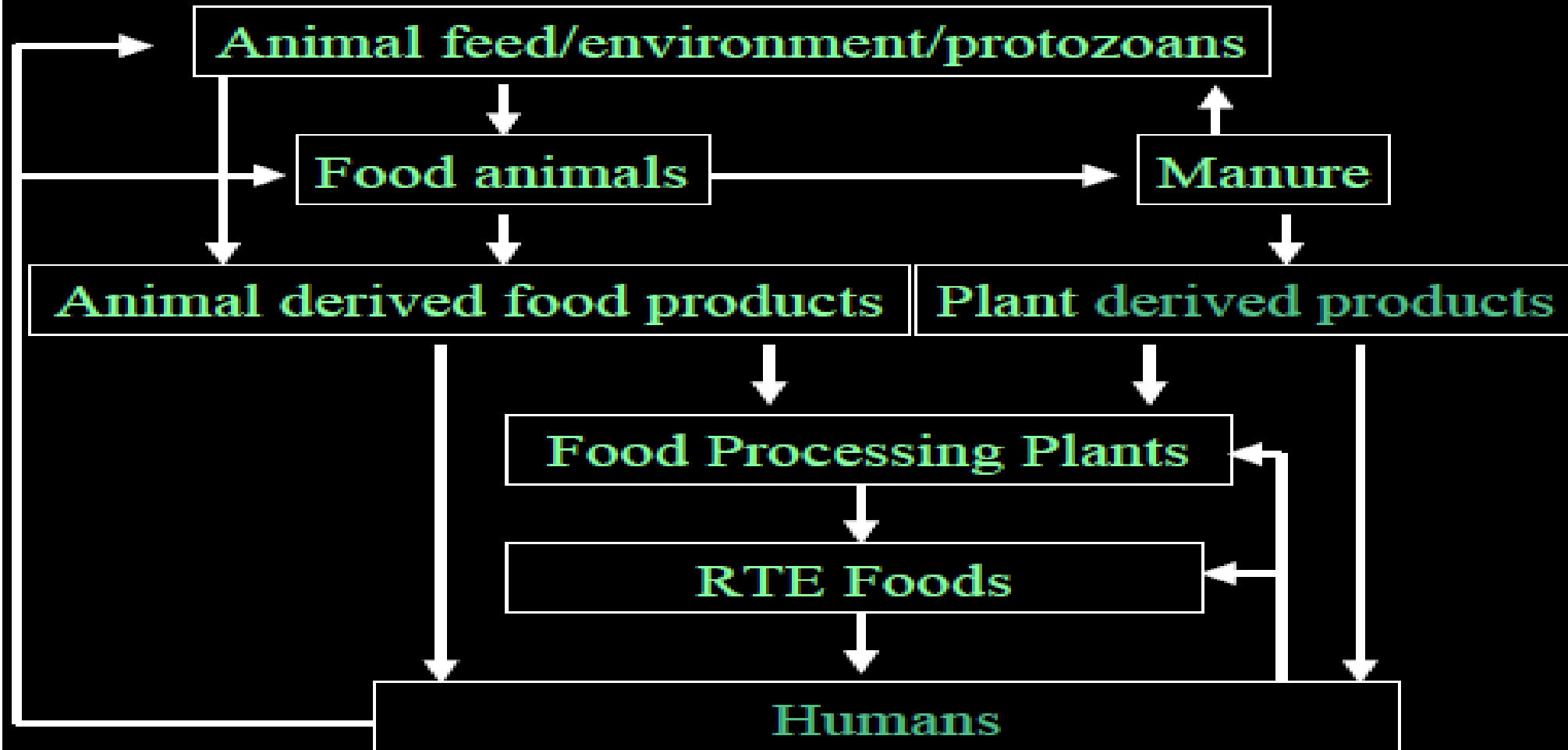
Sr. No	Type of Meat	Increased Demand (Million MT)	Rural (%)	Urban (%)
1	Sheep and Goat	4.57	16.19	83.81
2	Beef and Buffalo	1.00	<b>53.00</b>	<b>47.00</b>
3	Chicken	0.64	45.31	54.69
4	Eggs	31.47 (Billion)	45.41	54.59

## Trends in meat and egg production in India

Year	Meat (Million MT)	Eggs (Million No.)
2012-13	5.9	69731
2013-14	6.2	73438
2014-15	6.7	78484
2015-16	7.0	82929
2016-17	7.4	88139

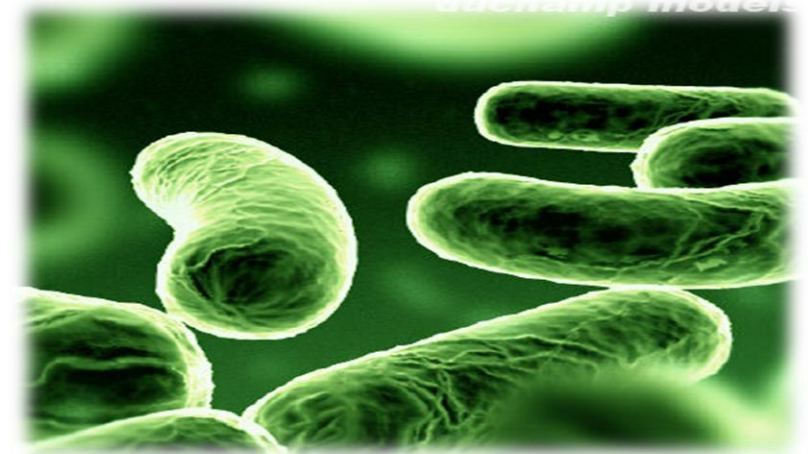
Dept. of Animal Husbandry GOI, 2017

# Transmission of Foodborne Diseases



## Microbiological food safety Challenges

- *Campylobacter jejuni*- *sanitation problem*
- *Salmonella* (multidrug resistant strain) *carried intestinal tracts, improper cooking*
- *E. coli* O157:H7 - *young, elderly & immune compromised at greatest risk; HUS - hemolytic uremic syndrome*
- *Listeria monocytogenes* - *grows at refrigerated temperatures; pregnant women, young & elderly at greatest risk; proper cleaning & cooking, zero tolerance*
- *Bacillus cereus*
- *S. aureus* - *food handling problem*
- *Clostridium botulinum* - *produces an enterotoxin, 'cafeteria germ'*
- *Yersinia enterocolitica*
- *Mycobacterium paratuberculosis*



## Cause of Bacterial Food-borne Illness

- Improper holding temperature : 63%
- Poor personal hygiene : 28%
- Contaminated equipment : 23%
- Inadequate cooking : 21%
- Food from unsafe source : 12%
- Others : 20%

*\* Total exceed 100% because multiple factors may be involved*

## Sources of Bacterial food-borne Illness

- Food service establishments : 77%
- Private home : 20%
- Food Processor : 3%





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# Important Pathogens

# *Salmonella*

- ❖ 2541 serotypes
- ❖ >128 serotypes present in India
- ❖ New added every year
- ❖ Prevalence in human (non typhoid) : 1 -5%
- ❖ Prevalence in healthy carriers : 1 -2%
- ❖ Prevalence in meat and poultry : 5 -7%
- ❖ RTE meats and poultry products : 0 -3%

# *E. Coli*

- ❖ One of the most common pathogen
- ❖ Different types

➤ EPEC

➤ ETEC

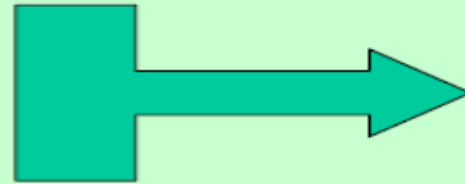
➤ EIEC

➤ EAaggEC

➤ EHEC

➤ DAEC

➤ CDTEC



**Frequently reported**



**Several isolations  
in recent times**

# Prevalence in meats

- ❖ **Numerous reports**
- ❖ Meat and poultry products : 20-50%; up to 100%
- ❖ Human diarrhoea
- ❖ Animal diarrhoea
- ❖ **STEC (EHEC): ↑ Isolations in recent years**
- ❖ Animals : Important reservoirs
- ❖ Isolations from meats : Buffalo, sheep, goat, kebabs, sausages
- ❖ Majority STEC are non O 157: H 7
- ❖ O 157: H 7 : Rare



# Prevalence of STEC in Human

Source	No. of E. Coli	STEC	Place	Reference
Diarrhoeal Patients	1338	9	New Delhi	Pamchandran and Verghese (1987)
HUS patients	25	19	New Delhi	Koishore et al., (1992)
Haemorrhagic enteritis	240	18	Bareilly	Kapoor et al. (1995)
Diarrhoea and UTI infection	67	15	Bareilly	Banerjee et al. (2001) & Ratore (2000)

# *L. monocytogenes*

- ❖ Meningo-encephalitis & abortion
- ❖ Grows well : Refrigeration temperature
- ❖ Grows : Moderately low pH, High salt concentration
- ❖ Survives and can multiply under diverse environmental conditions
  - Various stages of production, processing and storage
- Biofilm production

## Prevalence in meats

Source	Prevalence	Place	Reference
Buffalo meat	< 10 %	Gujrat	Brahmbhatt and Anjaria (1993)
Goat meat	< 10 %	Bareilly	Banurekha et al., (1998)
Goat meat	6.66 %	Bareilly	Barbuddhe et al., (2000)
Sheep meat	7.8 %	Bareilly	Barbuddhe et al., (2000)
Various meats and Products	3 – 8 %	Bombay	Waskar et al., (2005)
Poultry meat	8.5 %	Nagpur	Kalorey et al., (2005)

## Prevalence in Humans

Source	Prevalence	Place	Reference
Abortion	14 %	Mumbai	Krishna et al., (1996)
Abortion still births	3 %	Gujrat	Bhujwala et al., (1973)
Abortion	3.3 %	Northern India	Kaur et al., (2007)
Abortion	10 %	Nagpur	Kalorey et al., (2008)
Abortion	6 %	Goa	Barbuddhe et al., (2008)



# *Campylobacter*

- ❖ Important diarrhoeal pathogen
- ❖ Guillain-Barré Syndrome
- ❖ Human diarrhoea : 10 -15%
- ❖ Many asymptomatic carriers
- ❖ Poultry : Most important transmitters
- ❖ Isolations from **poultry meat** : 20 -50% up to 100%
- ❖ Other meats : 3 -5%
- ❖ Industrialized countries: Manifestations are severe
- ❖ In Asian countries: Symptoms are milder.

# *Aeromonas*

- ❖ Emerging pathogen of importance : Diarrhea
- ❖ Implicated in extra intestinal infections
- ❖ **Pathogen found in aquatic environment**
  - Saline & brackish water
  - Drinking water
  - Treated & un-treated sewage
  - Abattoir waste water
  - Colonize slow sand filters
- ❖ **Fish –Major source**
- ❖ **Poultry, Mutton, beef, milk, etc. are also found to be contaminated**

## Prevalence in meats

Source	Prevalence	Place	Reference
Mutton	24 – 37 %	Hisar	Khurana & Kumar et al., (1997)
Poultry	32 – 38 %	Hisar	Khurana & Kumar et al., (1997)
Poultry meat	16 %	Bareilly	Kumar (1998)
Poultry meat	16 %	Bareilly	Ghatak (2005)
Eggs	12 – 22 %	Bareilly	Agarwal (1997) Kumar (1998)
Goat meat	12 %	Bareilly	Kumar (1998)
Various RTE meat products	14 %	Bareilly	Waskar (2005)



# Prevalence in Human

Source	Prevalence	Place	Reference
Diarrhoea	6.5 %	Chennai	Komathi et al., (1998)
Diarrhoea	8 %	Kolkata	Chaterjee and Neogy (1972)
Diarrhoea	0.2 %	Vellore	Jesudasan and Koshi (1990)
Diarrhoea	6.5 %	Bareilly	Ghatak (2005)

# Clostridium Prefringens

- ❖ Meat and poultry : Common pathogen
- ❖ Thermostable spores
- ❖ Post production temperature abuse
- ❖ Large scale production

Inadequately  
heated meat  
dishes

Human  
outbreaks

- ❖ Prevalence in meats
  - ❖ Buffalo: 40 - 85%
  - ❖ Goat: 35 -75%
  - ❖ Poultry: 30-75%
- ❖ RTE meat and poultry products: 20 – 85%

## *Staphylococcus aureus*

- ❖ Intoxication: Thermostable enterotoxin
- ❖ Post-production contamination & favourable storage temperature
- ❖ Meat and poultry: Less frequently associated
- ❖ Milk products : More commonly implicated
- ❖ Human: Foodborne emetic episodes, pyogenic skin infection, post-operative wound
- ❖ Prevalence in meat and poultry products 10 –100%

## *Bacillus cereus*

- ✓ Diarrhoegenic and Emetic syndrome
- ✓ Emetic : Rice dishes
- ✓ Diarrhoea: Animal products
- ✓ Mild nature of symptoms: Under reported
- ✓ Implicated in some food borne episodes
- ✓ Prevalence in meat and poultry products-: Variable :10 -70%

# Parasites

## ❖ Relatively less emphasis given

➤ Taeniasis: Adult tape worm infection

❖ Toxoplasmosis

❖ Amoebiasis

❖ Cryptosporidiosis: Emerging

❖ *Animals help in perpetuation of Zoonotic Parasites Frequently reported are*

❖ Cysticercosis: Buffalo : 0.11%, Sheep : 0.20%,

Pig : 0.46%

➤ Neurocysticercosis: Partial Seizures : 40 %

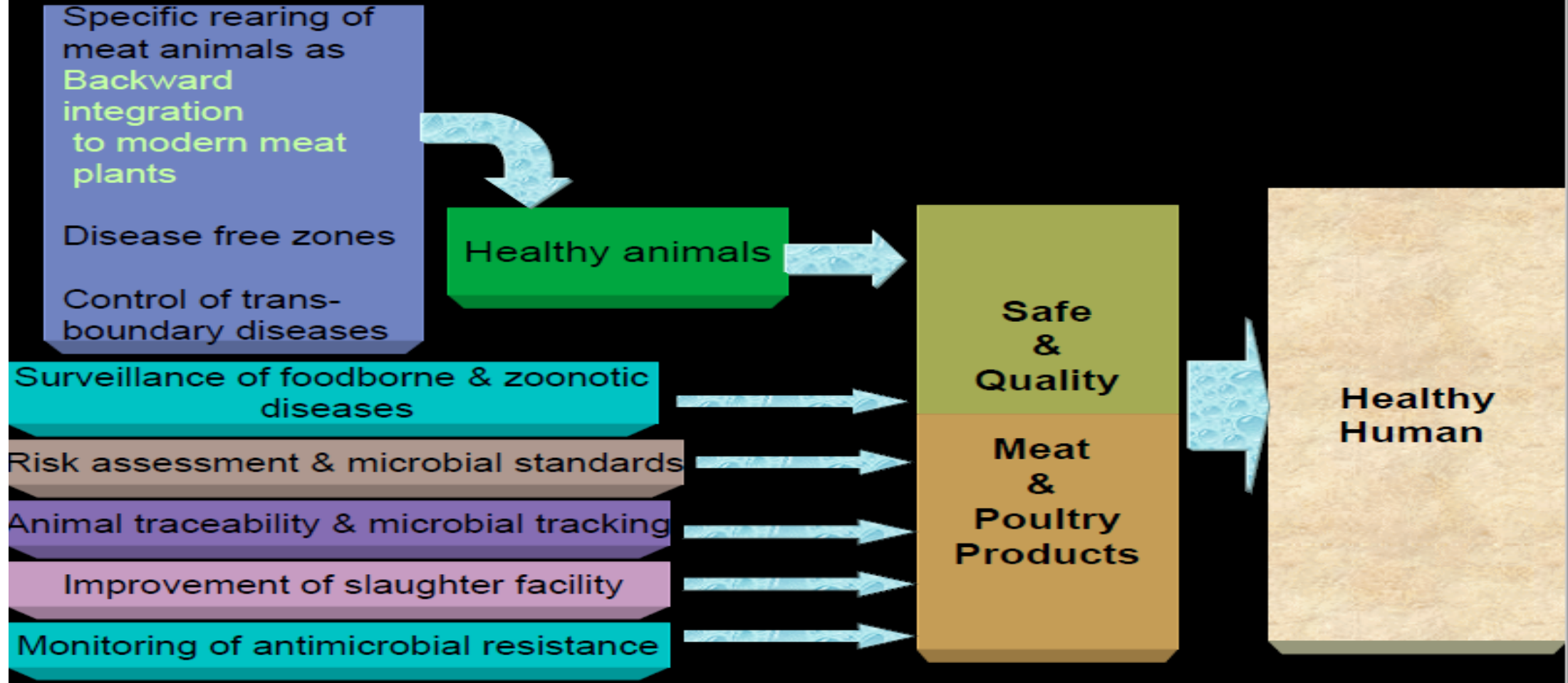
❖ Hydatidosis: Buffalo : 0.76%, Sheep : 0.20%,

Goat : 0.07% & Pig : 0.33%

➤ Trichinelosis: Pig: 0.13%



# Challenges ahead



## Advantages / Strength....

- ❖ Excellent veterinary infrastructure : 48 Veterinary Colleges, 16 Veterinary Universities, 67,000 Veterinarians.
- ❖ Scientific & Trained manpower
- ❖ Network projects on foodborne diseases, drug and pesticide residues.
- ❖ Absence of some important trade and food safety related diseases in Indian livestock
- ❖ Availability of modern and integrated export oriented meat processing units which are HACCP certified, ISO 22000 certified.
- ❖ NABL Accredited Laboratories : 2547
- ❖ A well organized poultry sector.
- ❖ Indian eating/cooking habit
  - ❖ Fresh meat preferred
  - ❖ Meat : Pressure cooked/high temperature

## Microbiological Standards for Meat and Meat Products- Process Hygiene Criteria

S. No.	Product Category <sup>1</sup>	Aerobic Plate Count				Yeast and Mold Count				<i>Escherichia coli</i>				<i>Staphylococcus aureus</i> (Coagulase +ve)			
		Sampling Plan		Limits (cfu/g)		Sampling Plan		Limits (cfu/g)		Sampling Plan		Limits (cfu/g)		Sampling Plan		Limits (cfu/g)	
		n	c	m	M	n	c	m	M	n	c	m	M	n	c	m	M
(1)	Fresh meat/ Chilled meat <sup>2</sup>	5	3	1x10 <sup>6</sup>	5x10 <sup>6</sup>	5	2	1x10 <sup>4</sup>	5x10 <sup>4</sup>	5	2	1x10 <sup>2</sup>	1x10 <sup>3</sup>	5	2	1x10 <sup>2</sup>	1x10 <sup>3</sup>
(2)	Frozen meat <sup>2</sup>	5	2	1x10 <sup>5</sup>	5x10 <sup>6</sup>	5	2	1x10 <sup>3</sup>	1x10 <sup>4</sup>	5	2	1x10	1x10 <sup>2</sup>	5	2	10	1x10 <sup>2</sup>
(3)	Raw marinated/minced/comminuted meat <sup>2</sup>	5	2	5x10 <sup>5</sup>	5x10 <sup>6</sup>	5	2	1x10 <sup>2</sup>	1x10 <sup>3</sup>	5	2	1x10 <sup>2</sup>	1x10 <sup>3</sup>	5	2	1x10 <sup>2</sup>	1x10 <sup>3</sup>
(4)	Semi-cooked /Smoked Meat/ meat food Product <sup>2</sup>	5	2	1x10 <sup>4</sup>	1x10 <sup>5</sup>	5	2	10	1x10 <sup>2</sup>	5	2	10	1x10 <sup>2</sup>	5	2	10	1x10 <sup>2</sup>
(5)	Cured/Pickled meat	5	2	5x10 <sup>2</sup>	5x10 <sup>3</sup>	5	2	1x10 <sup>2</sup>	1x10 <sup>3</sup>	5	2	10	1x10 <sup>2</sup>	5	1	1x10 <sup>2</sup>	1x10 <sup>3</sup>
(6)	Fermented meat products	NA	NA	NA	NA	NA	NA	NA	NA	5	2	10	1x10 <sup>2</sup>	5	1	1x10 <sup>2</sup>	1x10 <sup>3</sup>
(7)	Dried/dehydrated meat product	5	2	1x10 <sup>3</sup>	1x10 <sup>4</sup>	5	2	1x10 <sup>2</sup>	1x10 <sup>3</sup>	5	2	10	1x10 <sup>2</sup>	5	1	10	1x10 <sup>2</sup>
(8)	Cooked Meat Products	5	2	1x10 <sup>3</sup>	1x10 <sup>4</sup>	5	1	10	1x10 <sup>2</sup>	5	2	10	1x10 <sup>2</sup>	5	1	10	1x10 <sup>2</sup>
(9)	Canned/Retort pouch Meat Products	NA	NA	NA	NA	NA	NA	NA	NA	5	0	Absent	NA	5	0	Absent	NA
	<b>Test Methods<sup>3</sup></b>	<b>IS: 5402/ISO 4833</b>				<b>IS: 5403/ISO 21527</b>				<b>IS: 5887 Part1 or ISO 16649-2</b>				<b>IS 5887 : Part 2 or IS 5887 Part 8 (Sec 1)/ ISO : 6888-1 or IS 5887 Part 8 (Sec 2)/ISO 6888-2</b>			

## Microbiological Standards for Meat and Meat Products- Food Safety Criteria

Sr. No.	Product Category <sup>1</sup>	<i>Salmonella</i>			<i>Listeria monocytogenes</i>			Sulphite Reducing Clostridia				<i>Clostridium Botulinum</i>				<i>Campylobacter Spp</i> *			
		Sampling Plan		Limits (cfu/25g)	Sampling Plan		Limits (cfu/25g)	Sampling Plan		Limits (cfu/g)		Sampling Plan		Limits (cfu/g)		Sampling Plan		Limits (cfu/g)	
		n	c	m M	n	C	m M	n	c	m	M	n	c	m	M	n	c	m	M
1.	Fresh meat / Chilled meat <sup>2</sup>	5	0	Absent	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2.	Frozen meat <sup>2</sup>	5	0	Absent	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.	Raw marinated/minced/comminuted meats <sup>2</sup>	5	0	Absent	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4.	Semi-cooked /Smoked Meat/meat food Product <sup>2</sup>	5	0	Absent	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5	0	Absent	
5.	Cured/Pickled meat	5	0	Absent	5	0	Absent	5	2	5x10 <sup>2</sup>	5x10 <sup>3</sup>	NA	NA	NA	NA	NA	NA	NA	NA
6.	Fermented meat products	5	0	Absent	5	0	Absent	5	2	5x10 <sup>2</sup>	5x10 <sup>3</sup>	NA	NA	NA	NA	NA	NA	NA	NA
7.	Dried/dehydrated meat product	5	0	Absent	5	0	Absent	5	2	5x10 <sup>2</sup>	5x10 <sup>3</sup>	NA	NA	NA	NA	NA	NA	NA	NA
8.	Cooked Meat Products	5	0	Absent	5	0	Absent	5	1	1x10 <sup>2</sup>	1x10 <sup>3</sup>	NA	NA	NA	NA	5	0	Absent	
9.	Canned/ Retort pouch Meat Products	5	0	Absent	5	0	Absent	5	0	Absent		5	0	Absent		5	0	Absent	
	<b>Test Methods<sup>3</sup></b>	<b>IS: 5887 Part 3/ ISO 6579</b>			<b>IS: 14988, Part 1 &amp;2/ISO 11290-1 &amp; 2</b>			<b>ISO 15213</b>				<b>IS:5887, Part 4 or ISO 17919</b>				<b>ISO 10272-1&amp;2</b>			

# *Role of Government agencies*





## **✚ Ministry of Food Processing Industries**

- ✚ Under 12th Plan Five Year Plan the Ministry had launched a Centrally Sponsored Scheme (CSS) – National Mission on Food Processing (NMFP) for implementation through State / Union Territory Governments.
- ✚ Under the Mission, funds were shared on **75:25** basis by Government of India and States; **90:10** in North Eastern States and **100%** grants for Union Territories.
- ✚ This scheme includes the Scheme for Modernization of Abattoirs and Modernisation of Meat shops.
- ✚ Under Scheme for Agro-Marine Processing and Development of Agro-Processing Clusters (SAMPADA) which is under execution from 2016-2020.



## ***✚ Agricultural and Processed Food Products Export Development Authority (APEDA)***

- ✚ It was established under the APEDA Act in December, 1985.***
- ✚ The agency is involved in Carrying out inspection of meat and meat products in slaughter houses, processing plants, storage premises, conveyances or other places where such products are kept or handled for the purpose of ensuring the quality of such products.***
- ✚ The agency is also involved in licensing of export abattoir.***
- ✚ At present APEDA approved 29 Meat Processing Units and 80 Abattoir cum Meat Processing Units for Export Purpose.***

## **Export Inspection Council (EIC)**

-  It was set up by the Government of India in order to ensure sound development of export trade of India through Quality Control and Inspection.
-  Specify the type of quality control and / or inspection to be applied to such commodities.
-  Issues certificates of origin to exporters under various preferential tariff schemes for export products.
-  At present 15 Meat and Poultry Products Units are approved for Export Purpose.

## **Food Safety and Standards Authority of India (FSSAI)**

-  It has been established under Food Safety and Standards ACT, 2006 which consolidates various acts & orders that have hitherto handled food related issues in various Ministries and Departments.
-  FSSAI has been created for laying down science based standards for articles of food and to regulate their manufacture, storage, distribution, sale and import to ensure availability of safe and wholesome food for human consumption.



## *Role of Veterinarian in Food Safety*

- ✚ Veterinarians have a major responsibility of epidemiological surveillance of animal disease and ensuring the safety and suitability of meat
- ✚ Application of the risk analysis process
- ✚ To provide livestock producers with information, advice and training on how to avoid, eliminate or control food safety hazards
- ✚ Control and /or reduction of biological hazards of animal and public health importance by ante and post mortem meat inspection is a core responsibility of the veterinary services

- ✦ As on today, it has become the need of the hour for bringing in improvements in the existing food safety scenario in India
- ✦ Match by the quality standards of food with those of the other countries in the world
- ✦ There is an urgent need for setting up of the state of the art advanced centres of excellence to undertake the analytical research work to cater to the requirements of industries, policy makers, regulators and consumers
- ✦ Collaborative effort between Centre, states and the private sector along with effective consumer awareness, alone can address the challenge of food safety in the country
- ✦ Once the FSSAI has all its technical and administrative infrastructure in place, **ONLY THEN** tangible improvements in food safety can be expected.



**FutureScope**

*Future of food safety*

# Conclusions



- ✦ The food safety act will help to create culture of food safety with integrated control from farm to fork
- ✦ FSSAI is Evidence-based: Standard setting and compliance and enforcement authority with focus on prevention while enabling effective reaction
- ✦ Due to regulatory compliance industries have to show commitment to continued learning with prompt response to emerging food hazards
- ✦ Despite having a legal framework in place, India still struggles with enforcing food safety norms and standards effectively, effective implementation is sought with plentiful challenges
- ✦ Currently there are limited numbers of Food Safety Officers coupled with shortage of quality laboratories lacking uniformity of standard
- ✦ There is also an urgent need to upgrade the infrastructure in most of our food testing laboratories
- ✦ Need to encourage private sector participation in the setting up and maintenance of laboratories

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THANK  
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