Microbiological food safety challenges in the Indian dairy industry

Theme:
Session 2: Microbiological Sampling and Testing: Food Safety Management

FSSAI-ICMSF-CHIFSS Symposium On Microbiological Food Safety Sampling And Testing In Food Safety Management

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Emergence of microbiological food safety concerns and challenges

Major trends

- Increased awareness among consumers on food safety and quality
- Food consumption patterns:- minimal processed foods , preference for processed ready to eat foods
- Use of new additives /ingredients and development of new products
- Shift in agricultural production , manufacturing and distribution practices in food chain
- International travel and trade - transportation of infectious agents
- Globalization of food supply chain
- Detection, reporting and surveillance system
- Acquisition of virulence and antibiotic genes by pathogenic bacteria-Emergence of antimicrobial resistance in bacteria (AMR)
- Microbial adaptation and enhanced survival of pathogens in food

Risk profiling of pathogens in milk and milk Products

Organism	Shed directly in milk#	Contaminant of raw milk##	Survives pasteurization	Severity of illness §	Dairy products implicated in food-borne illness
Aeromonas spp.	×	✓	×	Serious	+
Brucella spp.	✓	✓	×	Severe	+
Clostridium botulinum	×	✓	*	Severe	+
Clostridium perfringens	×	✓	✓	Moderate	+
Corynebacterium spp.	✓	✓	×	Serious	+
Coxiella burnetii	✓	✓	×	Serious	+
Cryptosporidium	×	✓	×	Severe	+
Mycobacterium avium subs. *paratuberculosis*	×	✓	×	–	–
Mycobacterium bovis	✓	✓	×	Severe	+
Shigella spp.	×	✓	×	Serious	+
Streptococcus spp.	✓	✓	×	Serious	+
Yersinia enterocolitica	×	✓	×	Serious	+
Bacillus cereus	×	✓	✓	Moderate	++
Staphylococcus aureus	✓	✓	×**	Moderate	++
Campylobacter jejuni / coli	×	✓	×	Serious	++
Salmonella spp	×	✓	×	Serious	++
Enterobacter sakazakii	×	✓	×	Severe^	++
Pathogenic *E. coli*	×	✓	×	Severe	++
Listeria monocytogenes	✓	✓	×	Severe^	++

Transmission through udder; mastitis etc; ## via faeces, the environment etc; *Neurotoxin is heat labile; ** Enterotoxin is heat stable; ^ for vulnerable populations; § based on ICMSF (2002) severity ranking; + Reported, but rare; ++ More commonly associated with food-borne illness; – No data/unknown; ✓ = yes; X = no

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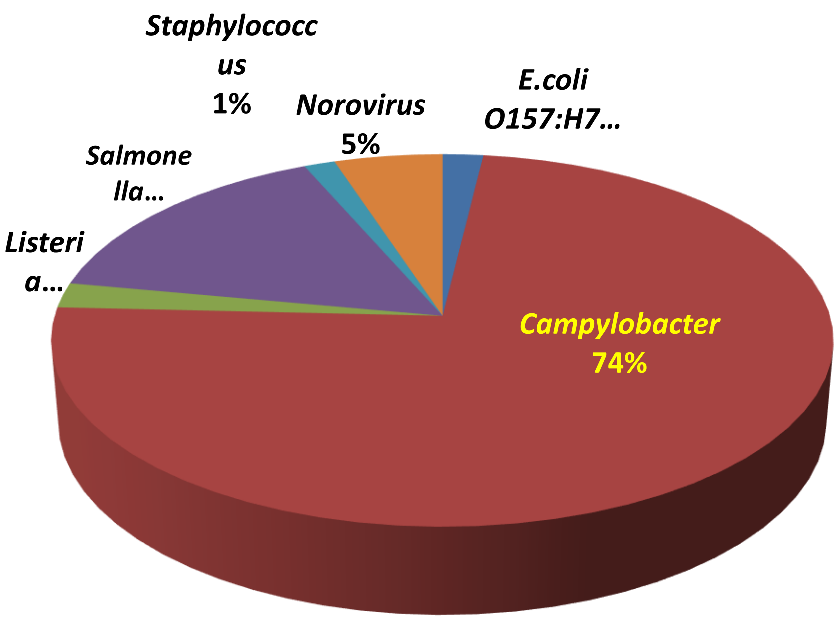
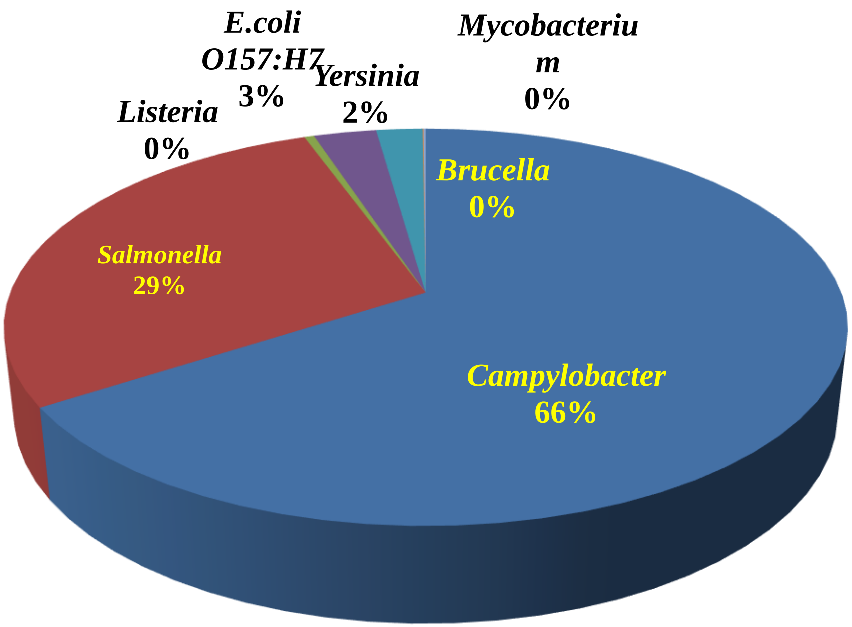
Outbreaks associated with dairy products reported in US :2000-2013



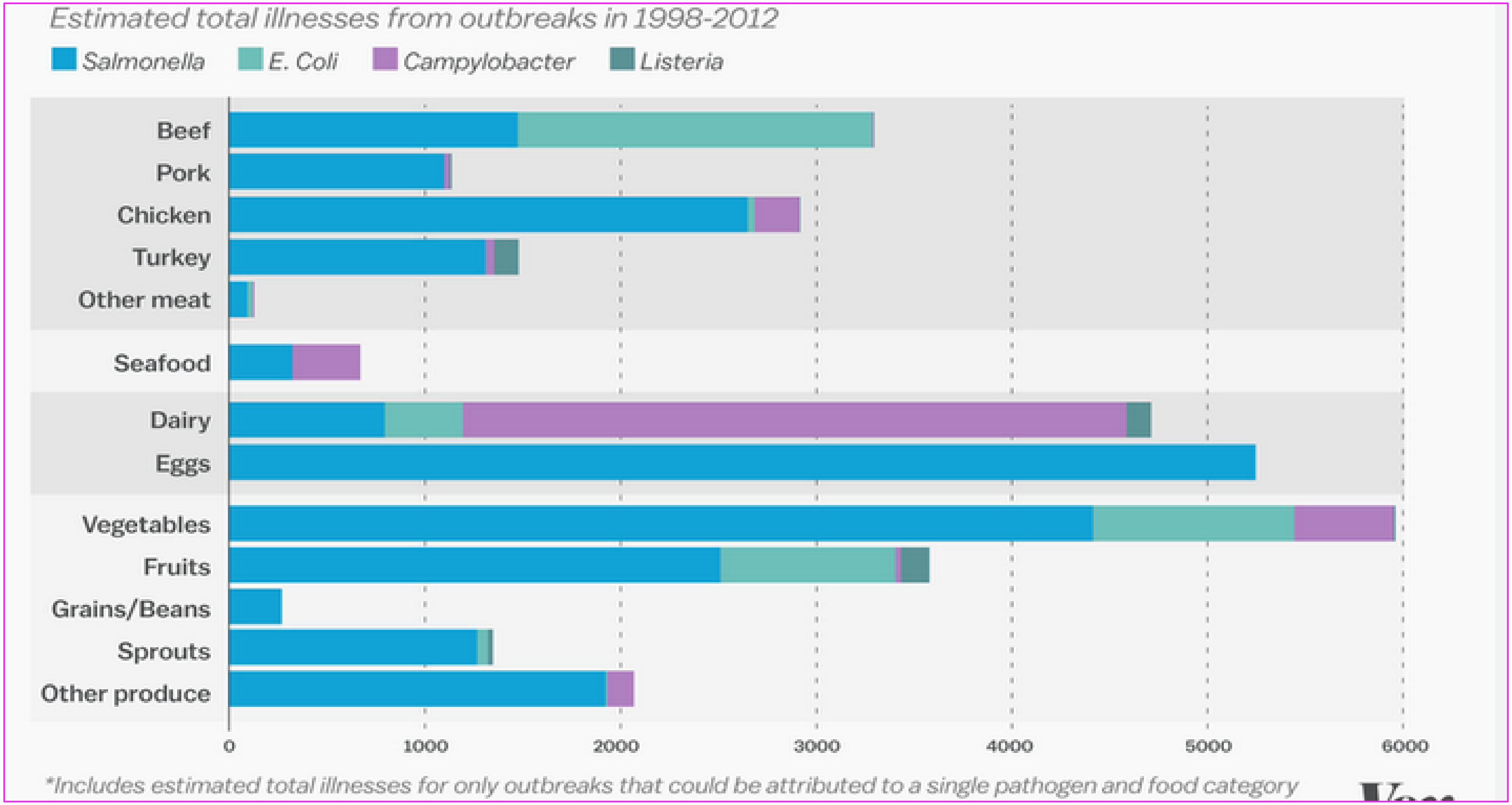
EU Report on Food borne Outbreaks -2011



Raw milk, Pasteurized milk , Cheeses and Powdered milk

www.realrawmilkfacts.com

COMMON SOURCES OF FOOD POISONING



Source: Centre for Disease control and prevention

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Outbreaks associated with *Campylobacter jejuni*

Year	Country	Cases	Product	Causative agent	Cause	Ref.
2003	USA	13	Raw milk	*C. jejuni*	Unpasteurised milk	(Peterson, 2003)
2000	Austria	38	Unpasteurized milk	*C. jejuni*	Unpasteurised milk distributed by a local dairy	(Lehner *et al.*, 2000)
1998	Hungary	52	Raw milk	*C. jejuni*	Unpasteurised milk	(Kalman *et al.*, 2000)
1996	UK	33	Unpasteurized milk	*C. jejuni*	Educational farm visit, exposure to raw milk	(Evans *et al.*, 1996)
1992	USA	50	Raw milk	*C. jejuni*	Consumed at church	(CDC 2002)
1995	UK	110	milk	*C. jejuni*	Inadequately pasteurized milk from a local dairy	(Fahey *et al.*, 1995)

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Major Outbreaks associated with *Salmonella* spp.

Year	Country	Cases	Product	Causative agent	Cause	Ref.
2000	USA	38	Pasteurized milk	*Salmonella typhimurium*	Likely contaminated containers or milk contact surfaces after pasteurisation because of environmental conditions in plant	(Olsen *et al,* 2004)
2003	USA	62	Raw milk	*Salmonella typhimurium*	Unpasteurised milk at dairy/petting zoo	(Mazurek *et al.,* 2004)
1998	UK	40	Pasteurized milk	*Salmonella*	Pasteurisation failure	(Brown, 1998)
1999	Washing ton	17	Raw-Milk Cheese	*Salmonella typhimurium* DT 104	Infection due to consumption of un-pasteurised milk	(Villar *et* al.,.1999)

Outbreaks associated with *Listeria monocytogenes*

Year	Country	Reported cases	Causes
PASTEURIZED MILK			
1986	Austria	28	Consumption of raw milk
2006-07	USA	5	At the plant where the milk was processed, inspections revealed no evidence of improper pasteurization
1997	USA	54	
CHEESE			
2003	France	18	Cheese was made from the Un-pasteurised milk / Environmental contamination
2003	Sweden	15	
2002	Canada	17	
2001	Soft cheese	45	
2000	USA	13	
1995	Switzerland	57	
2013	USA	22	Ricotta Salata Cheese
2014	USA	5	Soft cheese made from pasteurized milk
BUTTER AND BUTTER PRODUCT			
2003	UK	17	Listeria isolated from a dairy drain / butter

Pathogenic bacteria isolated from different Indian foods

BFJ
114,5

670

Type of food	Bacteria
Milk	*Listeria monocytogenes, Yersinia enterocolitic Bacillus cereus, Srteptococcus feacalis, Escherichia coli*
Meat	*Bacillus cereus, Escherichia coli Stahylococcus aureus, Vibrio parahaemolyticus*
Beef sample	*Escherichia coli 0157:H7*
Sweets	*Salmonella Newport, Salmonella enteritidis*
Dahi (yogurt), Khoa	*Escherichia coli, Enterobacter aerogenes Salmonella Newport, Salmonella enteritidis, Fecal coliforms*
Prawns	*Vibrio parahaemolyticus*
Cooked and uncooked rice	*Bacillus cereus*
Poultry	*Campylobacter jejuni, Salmonella bornum*
Fish	*Staphylococcus, Escherichia coli*
Samosa	*S.aureus*
Batatawada	*S.aureus*
Tamarind	*Salmonella, Staphylococcus, Shigella*
Butter milk	*Yersina enterocolitica*

Table III. Pathogenic bacteria isolated from different Indian foods

Source: Vemula *et al.*, 2010

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Common foodborne pathogens and their percentage of contamination in Indian foods

Type of food	Bacteria	% of contamination
Milk	*B.cereus*	16-50
	L.monocytogenes	6
	Yersinia	5-59
	Aeromonas	7
	Vibrio	8
Meat	*Salmonella spp*	3-5
	Staphylococcus spp	21
	E.coli	9-14
	Aeromonas	13
	B.cereus	35
Poultry	*C.jejuni*	41
	Salmonella spp	11
	Aeromonas	28
Fish	*E.coli*	7
	Vibrio	16-32
	Shigella	4
Seafoods	*Salmonella spp*	1
	Vibrio spp	1
	Listeria	1
Beef	*E.coli 0157:H7*	60
Rice	*B.cereus*	28-46
Vegetables	*B.cereus*	24
	Coliforms	75
	E.coli	75
	Listeria	12
	C.jejuni	3
Lassi	*B.cereus*	5
Khoa	*Staphylococcus spp*	20-36
	Salmonella spp	5
	E.coli	9

Table IV. Common foodborne pathogens and their percentage of contamination in Indian foods

Source: Vemula *et al.*, 2010

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Two stage enzyme assay for rapid detection of *L. monocytogenes* in milk

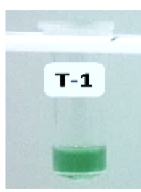
Inoculate 25 mL of sample in LSEM and incubate at 37ºC

Observe color change from yellow to black

Stage 1: Presumptive detection of *Listeria* spp.

From stage 1- Inoculate 250 µL of cell suspension after centrifugation (in duplicate) into 50 µL of ESM in T-1 & T-2

Incubate T-1 & T-2 at 37ºC

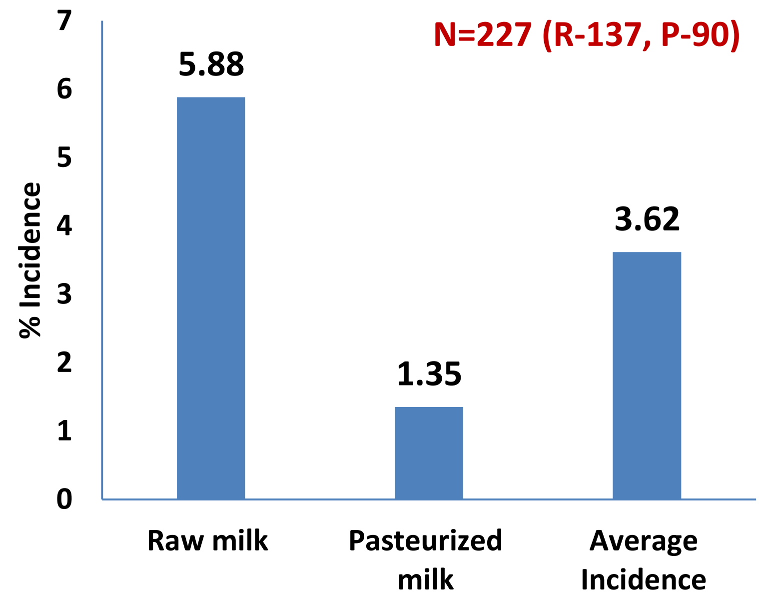


Green color within 4.30 h of incubation confirms *L. monocytogenes*

Yellow color within 2.30 h of incubation further indicates the presence of genus *Listeria spp.*

Stage 2: Confirmatory detection of *L. monocytogenes*

% Incidence of Listeria monocytogenes in raw and pasteurized milk samples



Results Validated with ISO procedure

Conventional method -ISO: 11290 Part-1:1996 (5-7 days Protocol)

IP Status: Patent Reg. No. 1357/DEL/2013

Two stage enzyme assay for detection of *E. coli* in milk

Lyophilized ECSM tube

Reconstituted tube with 0.9 mL of sterile water

Aseptically add 0.1 mL of milk sample

Incubate at 37±1 ºC for 12 ±1 h

Blue color indicates presence of *E.coli*

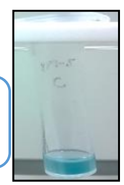
Stage-1 Presumptive detection of *E.coli* in milk

Centrifuge and wash pellet twice with PB

Wipe the tubes with sterile cotton swab

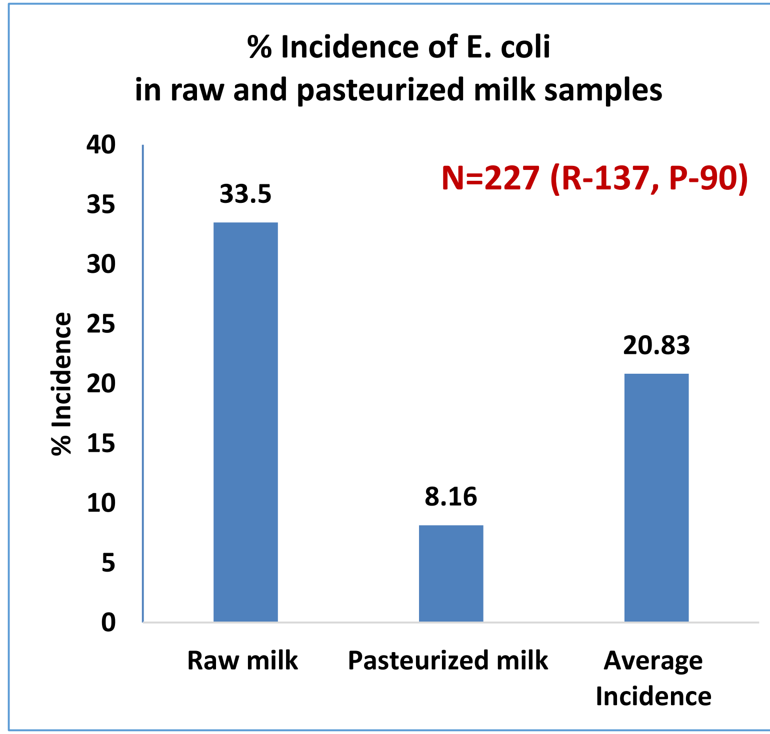
Reconstitute lyophilized ESM tube and transfer the content to washed pellet

Incubate at 37±1 ºC for 3.0 ± 0.15h



Blue color confirms presence of *E.coli* in milk samples

Stage-2 Confirmatory detection of *E.coli* in milk



Results Validated with ISO procedure

Conventional method -IS:5887 Part-I:1976
(4-5 days Protocol)

IP Status: Patent Reg. No. 2214/DEL/2014

Rapid detection of coliform in milk

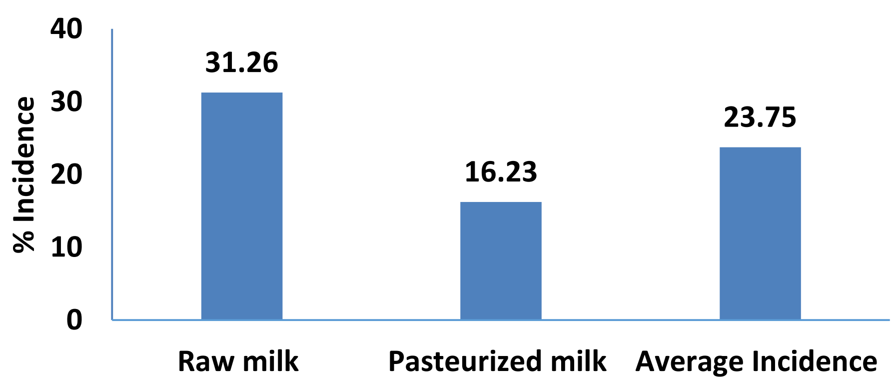
Lyophilized CSM tube

Reconstitute with 0.9 mL of sterile water

Aseptically add 0.1 mL of milk sample

Incubate at 37±1 °C for 12 ±1h

Yellow color confirm coliform



Results Validated with ISO procedure

Conventional method –ISO:4832:2006 (4-5 days Protocol)

IP Status: Patent Reg. No. 2214/DEL/2014

Two stage enzyme assay for *Enterococci* in milk

Lyophilized EBSAM tubes

Reconstitute with 0.9 mL of sterile water

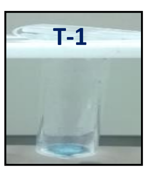
Aseptically add 100 µL of milk sample

Incubation at 37°C for 18h

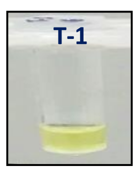
Appearance of black color

Stage 1: Presumptive detection of *Enterococci* in milk

From stage 1- Inoculate 300 µl of cell suspension after centrifugation (in duplicate) into T-1 & T-2

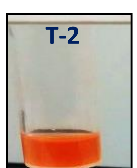


Incubate T-1 & T-2 at 37±1°C for 3.30±0.30 h



Appearance of yellow color

Add 2-3 drops of lyophilized reagent after reconstitution in T2

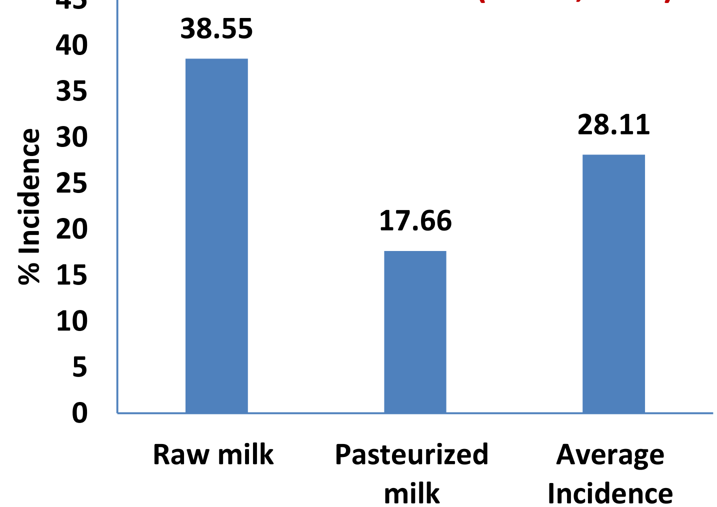


Appearance of orange red color

Stage 2: Confirmatory detection of *Enterococci* in milk

Incidence of *Enterococci* in raw and pasteurized milk samples

N=227 (R-137, P-90)

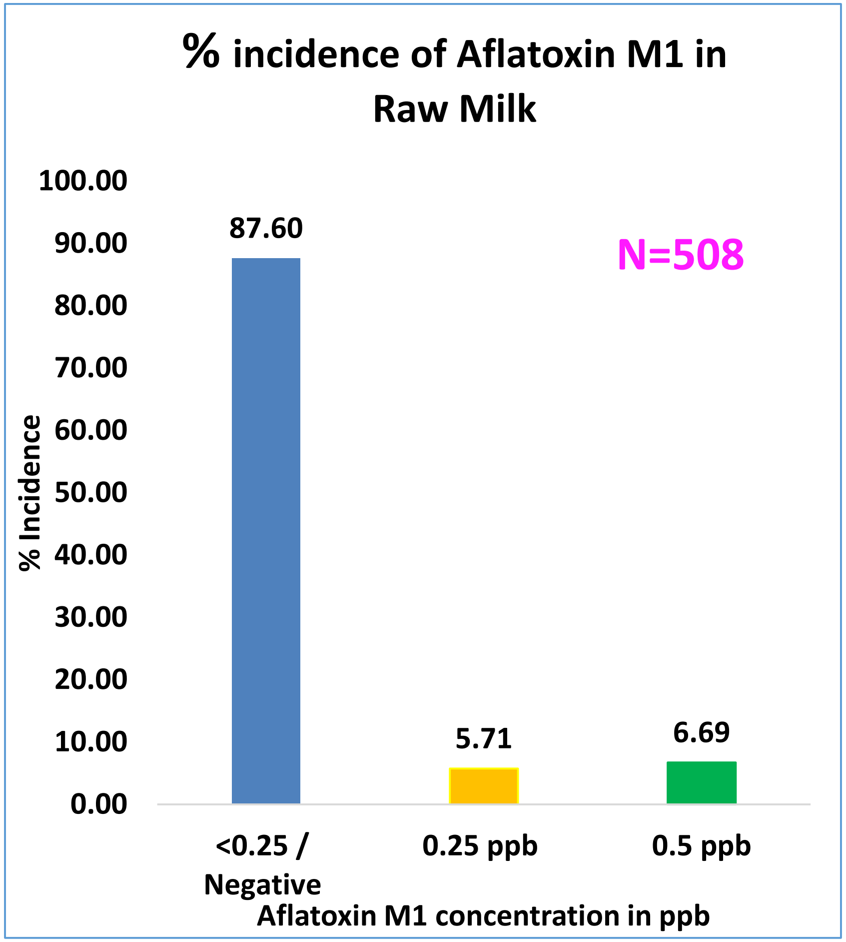


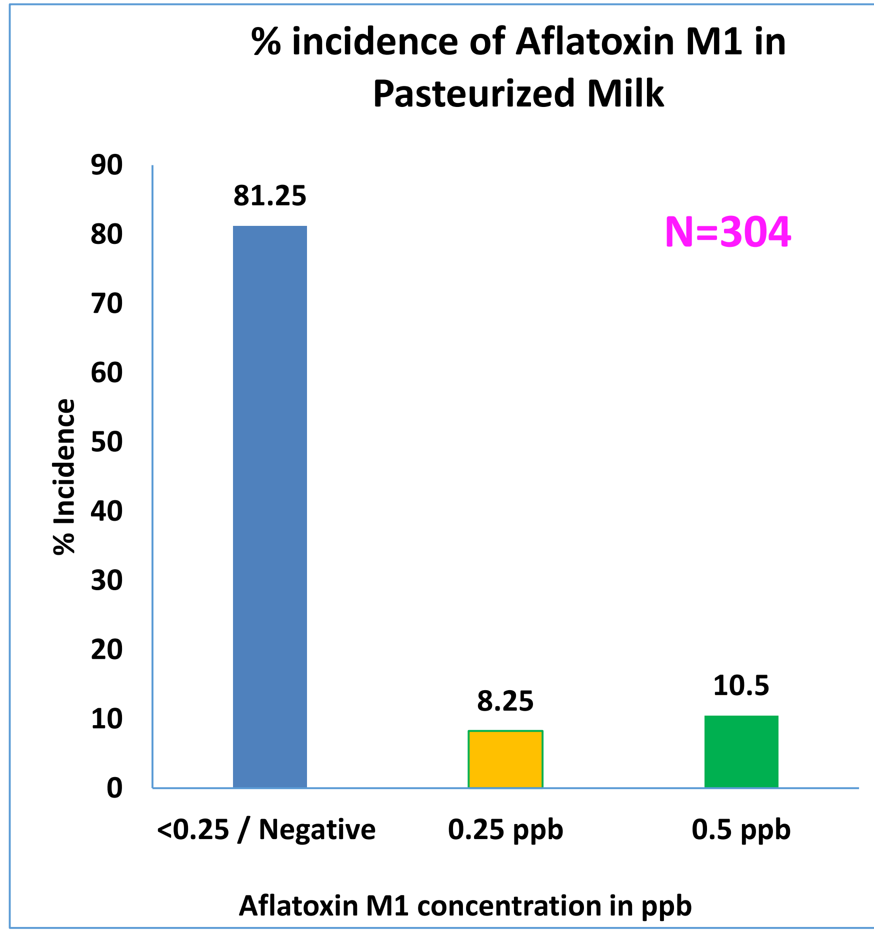
Results Validated with ISO procedure

IP Status: Patent Reg No 119/DEL/2012

Conventional method :IS 5887 Part-2: 1976 (3-4 days Protocol)

Incidence of Aflatoxin M1 in Milk samples





Source: Outreach project 2010-16

Risk profiling of dairy pathogens : ICMSF 2002

Classification on basis of dose response

Classification on basis of exposure response

Severe → ***Listeria monocytogenes*** **Pathogenic *E. coli*** ***Brucella, Enterobacter sakazakii*** → **Raw milk/ cheeses Raw milk/ Meat products, Infant milk formula**

Serious → ***Campylobacter jejuni Salmonella Yersinia enterocolitica*** → **Raw milk /Broiler meat products / Poultry/ Ice-cream**

Moderate → ***S. aureus B. cereus*** → **Khoa based sweets**

Severe: **Life threatening, or substantial sequelae, prolong duration**

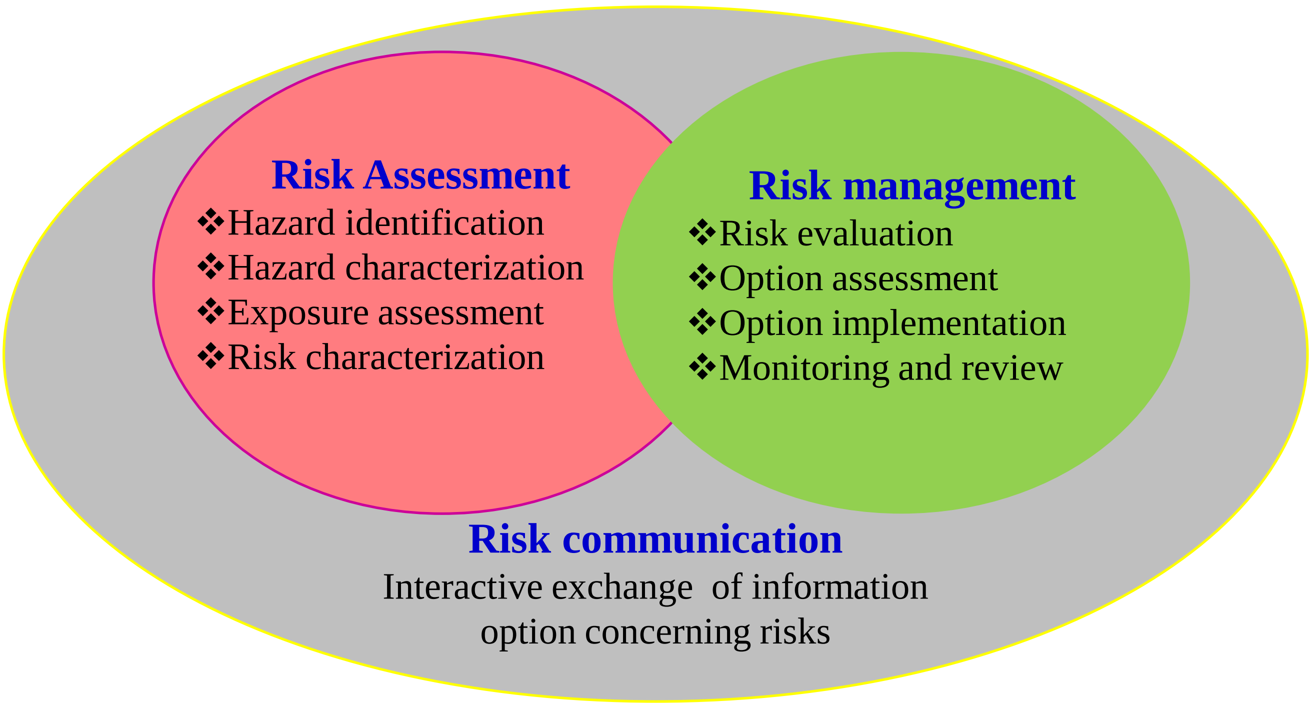
Serious: **In capacitating but not life threatening; sequelae infrequent; moderate duration**

Moderate: **Not usually life threatening; nosequelae ; short duration; self-limiting; severe discomfort**

FSSAI Microbiological criteria approved for Milk & milk Products

Micro-organisms

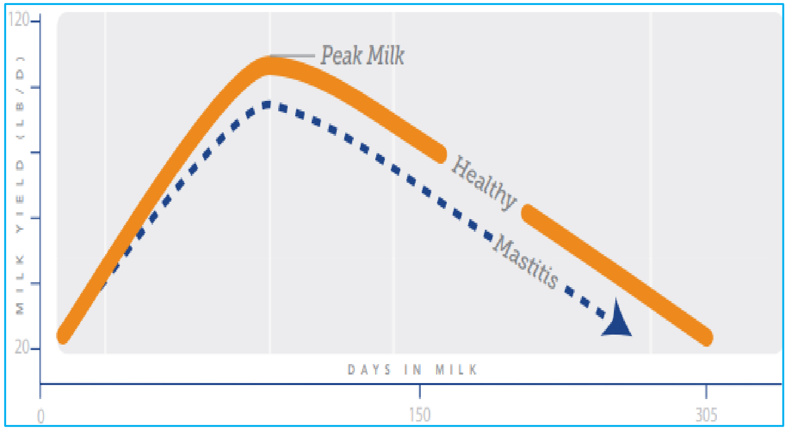
1. Total Plate Counts
2. Coliform
3. Yeast and Mold Counts
4. *Staph aureus*
5. *Bacillus cereus*
6. *E. coli*
7. *Salmonella*
8. *Listeria monocytogenes*
9. *Enterobacter sakazakii*
10. *SRC*

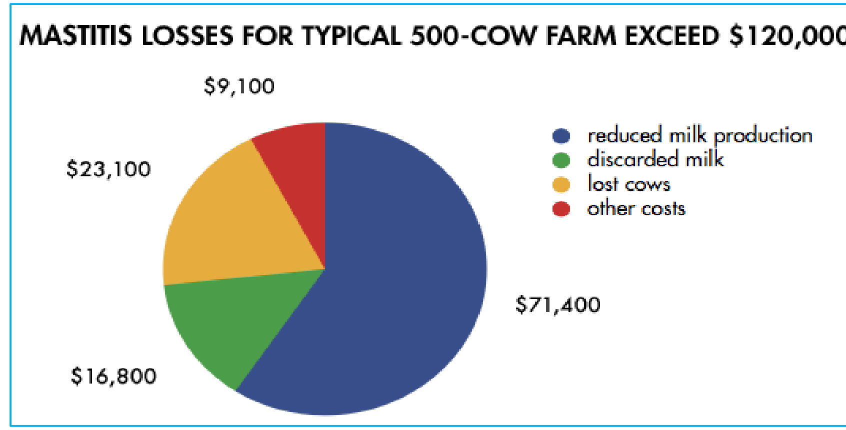


Codex Alimentarius Risk Assessment frame work

Generation of scientific data on hygiene/ safety indicators in milk and milk products through National surveillance network Project

Mastitis and its impact in India





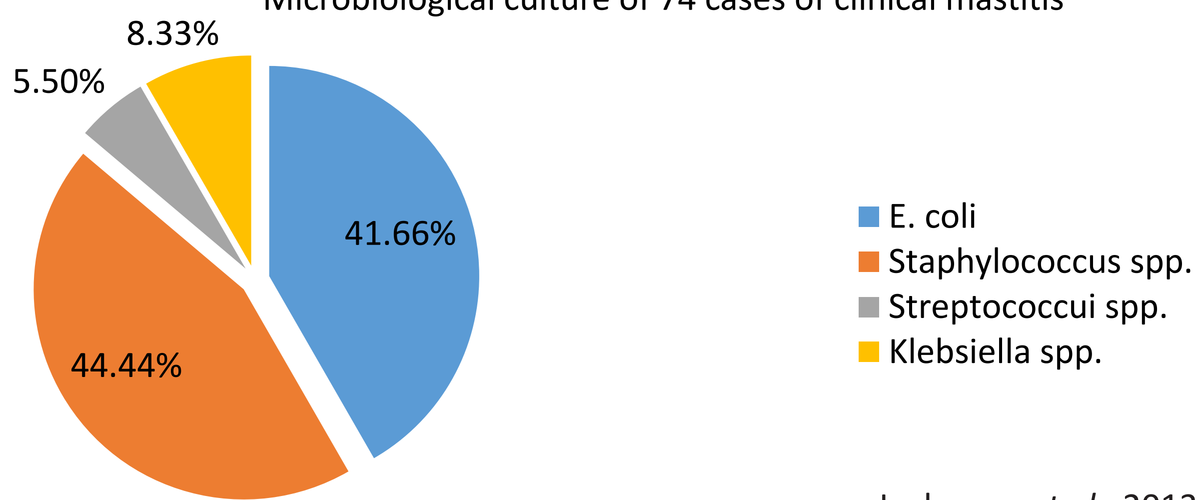
Source of loss	Loss per cow($)	Percent of total(%)
Reduced production	121.00	66.0
Discarded milk	10.45	5.7
Replacement cost	41.73	22.6
Extra labour	1.14	0.1
Treatment	7.36	4.1
Veterinary services	2.72	1.5
Total	184.40	100

- **In India annual losses in dairy industry due to mastitis has been reported approximately 1670 Cr / 231.2 Million USD (Jingar, et al, 2017)**

Microorganisms involved in mastitis

Environmental pathogens	Contagious pathogens	Others
Escherichia coli (40%)	*Staphylococcus aureus* (40-70%)	Staphylococcus epidermidis (1.3%)
Klebsiella pneumonia	*Streptococcus agalactiae* (8-10%)	Staphylococcus simulans (1.0%)
Arcanobacteriumpyogenes	*Streptococcus dysgalactiae* (1.6%)	Staphylococcus chromogens (0.7%)
Yeast spp.	Corynebacterium spp.	
	Mycoplasma spp. (5-12%)	

Microbiological culture of 74 cases of clinical mastitis



Jeykumar *et al.*, 2013

Types of mastitis and Diagnostic methods for its identification

Sub-clinical | **Clinical** | **Chronic**

Test	Identification of mastitis milk	Identification of pathogen	Time of detection	Test location	Sample type
California mastitis test	**√**	**X**	Minutes	**Farm**	**Fresh milk**
Somatic cell count	√	X	Minutes	Lab	Fresh milk
Bacterial culture	√	√	Days	Lab	Fresh milk
ELISA	X	√	Hours	Lab	Fresh, Frozen, Preserved
MULTIPLEX PCR	√	√	Hours	Lab	Fresh, Frozen, Preserved

Availability of diagnostic for early detection of mastitis will be a great help in sustainability of dairy farm business and controlling AMR

Global trends of antimicrobials use in livestock

- **63151** tones in 2010
- **67%** increase in 2030
- **100%** increase in **BRICS** countries

Large consumers of antimicrobials in animals in 2010 and 2030

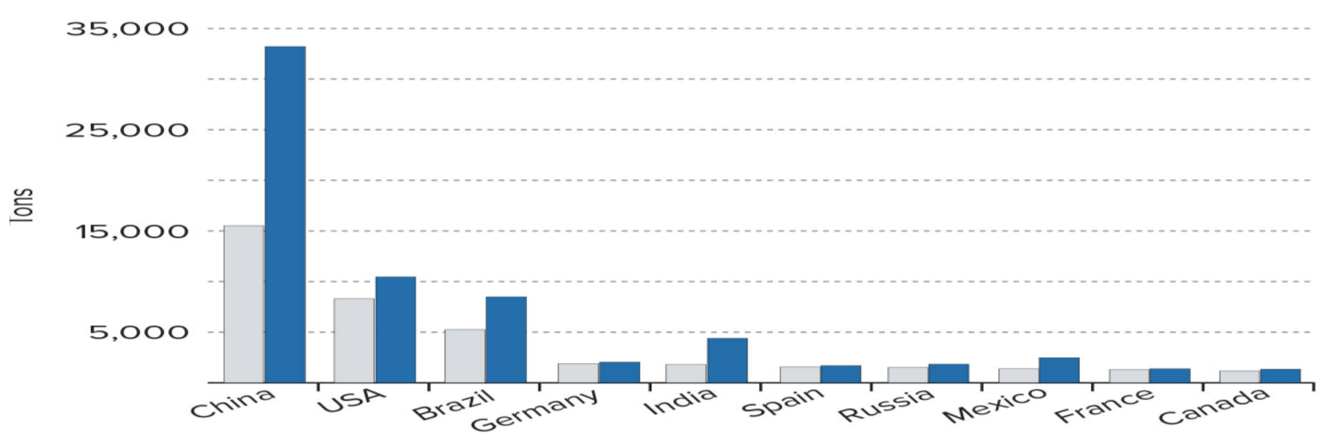
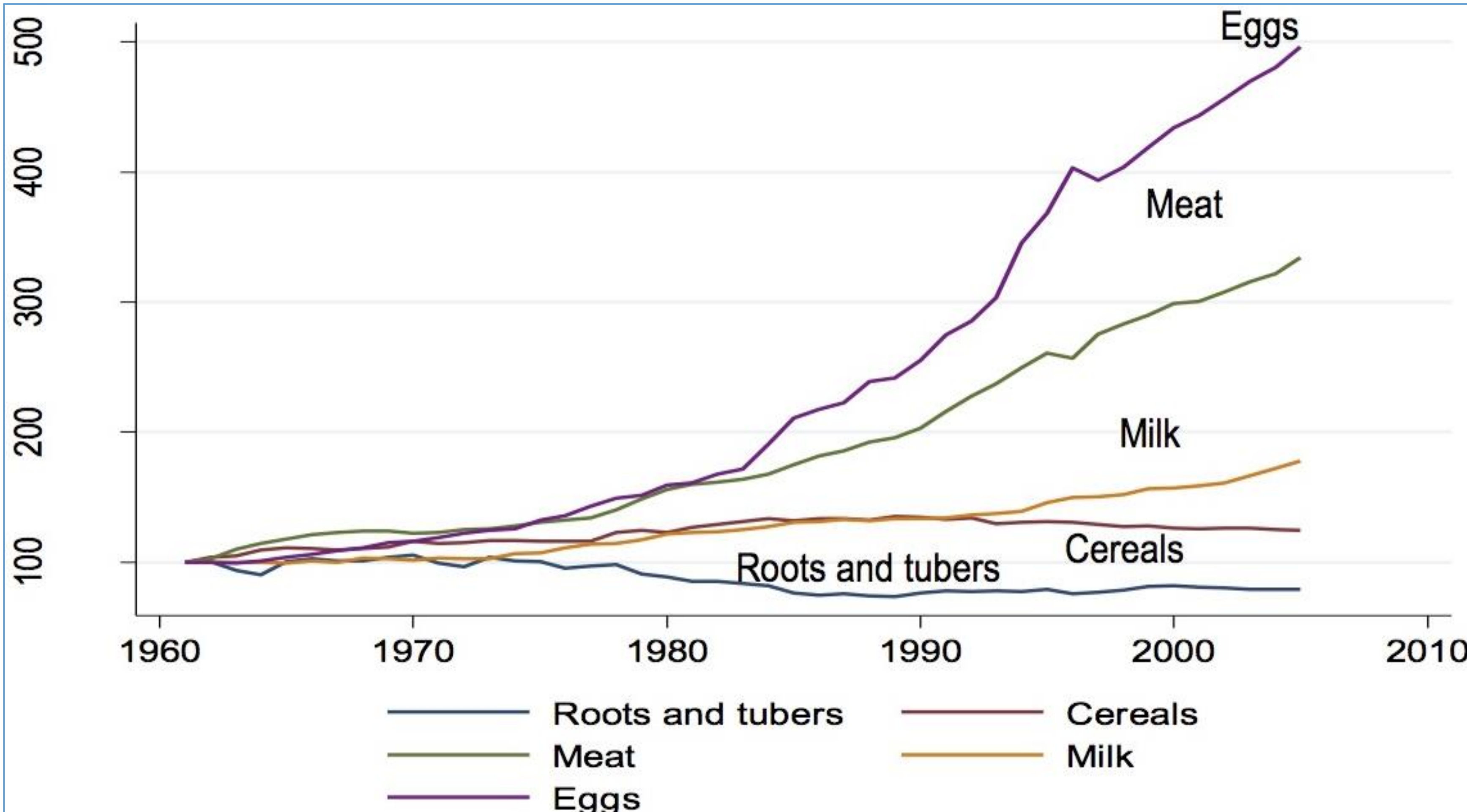


Figure 0-3: Antibiotic consumption by livestock, top ten countries 2010-2030 (projected for 2030)
Source: Van Boeckel et al. 2015

Antibiotic consumption is growing rapidly…



Reddy *et al.*, 2014

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Existing diagnostic for detection of <u>Antimicrobial Residues</u> in milk

Name of test	Concept / principle	Manufacturer	Time per test	Cost of the test	Antibiotic tested	Application
Delvo test	Microbial inhibition based	Gist brocades/ DSM	2 :30 min	Rs. 150 per test	Broad spectrum	Qualitative screening test use in few multinational companies / bigger dairy farms in India
DPA based assay	**Microbial inhibition based / Color change**	NDRI Karnal	**3.0-3.15 h**	**Rs. 50 per test**	Broad spectrum	Qualitative screening test (semi-quantitative test) are in use in few multinational companies / bigger dairy farms in India
Paper strip based assay	**Spore germination / enzyme / color change**	NDRI Karnal	**1.00 h**	**Rs. 75 per test**	Broad spectrum	
Penzym Test	Enzyme colorimetric	Neogen Corporation	15 min	Rs. 200 per test	β -lactams	Not in use
Tetra sensor	Antigen antibody based	Different companies	5-10 min	~Rs. 200 for one antibiotic	Individual antibiotics / group	Used in research institutions for quantitative estimation, rarely in big dairies
Snap Test	Receptor binding assay	IDEXX	10 min	Rs. 300 per test	Family specific	Not in use

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Impact of Antimicrobial Resistance

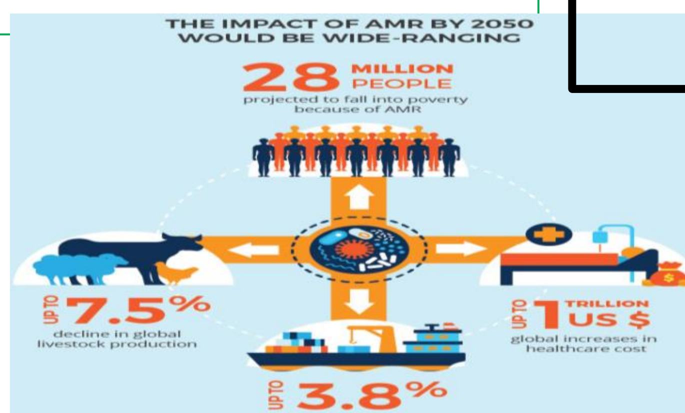
- **700,000**

  Annual deaths currently
- **10 million**

  Projected deaths in 2050
- **$ 100 trillion**

  Loss to global economy till 2050
- **3.5%**

  Reduction in global GDP in 2050



AMR is now

- Economic problem
- Food security risk
- Development Issue
- Political challenge

  UNGA, WHO. FAO, OIE, G8, G20, G77, ASEAN, OPEC, EU
- ✓ **Implementation of National Action Plan on AMR**

(Jim O’Neill Report)

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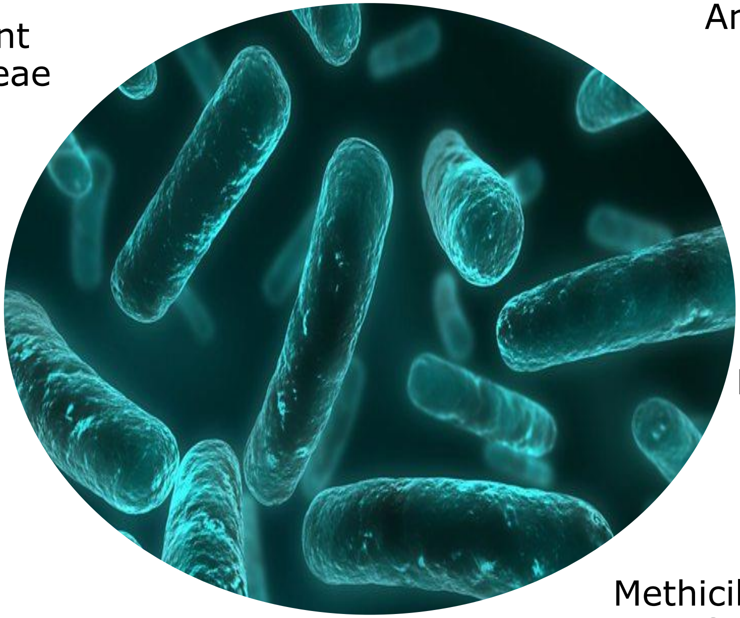
ANTIMICROBIAL RESISTANCE- A THREAT

The Bad Bugs ……

Extended spectrum β-lactamase producers

Colistin resistant Enterobacteriaceae

AmpC type β-lactamase producers



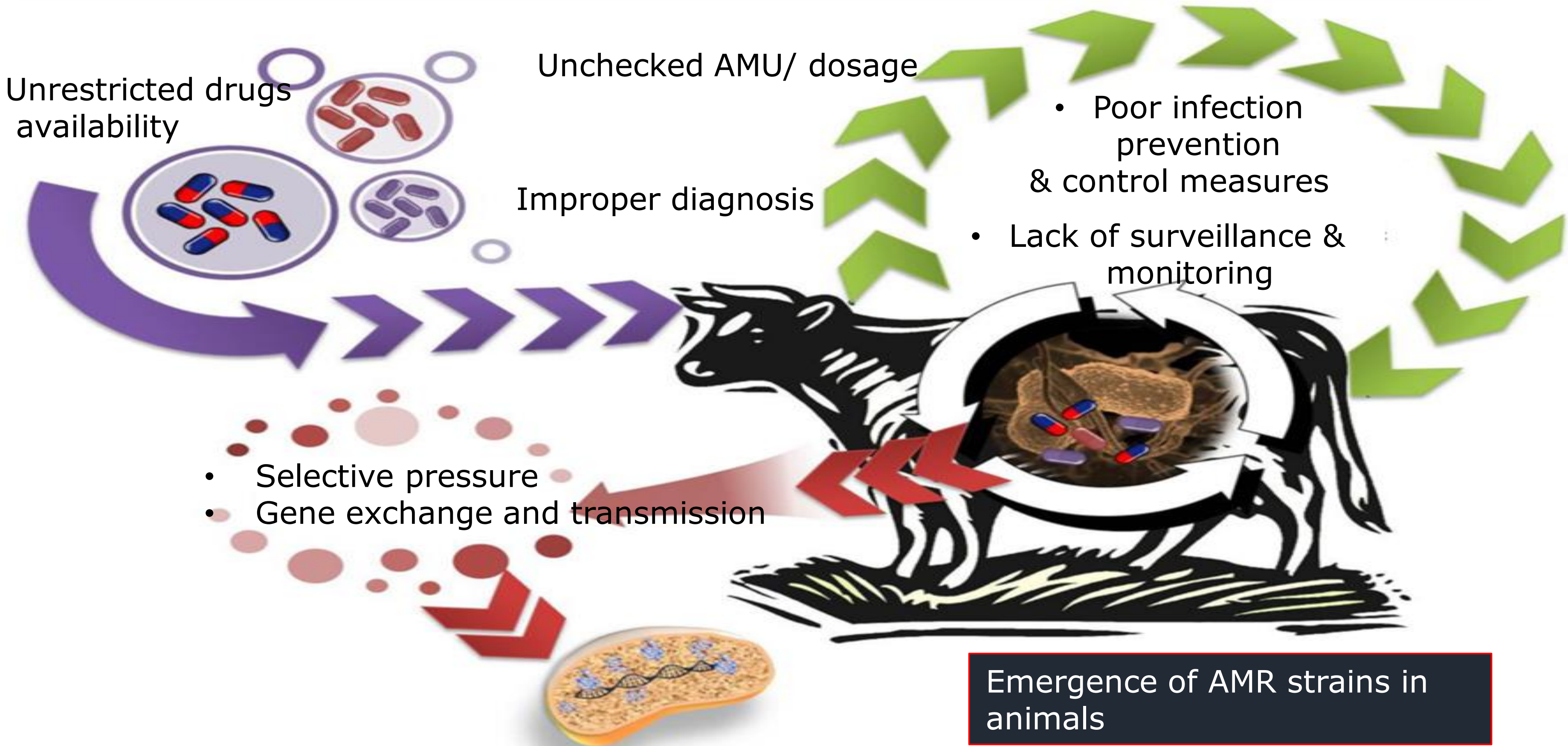
Vancomycin resistant and intermediate *S. aureus*

Fluroquinolone resistant Enterobacteriaceae

Mettalo-β-lactamase producing *Enterobacteriaceae*

Methicillin resistant *S. aureus*

Factors leading to antimicrobial resistance (AMR) in dairy animals



Sharma *et al*, 2018

WHO PRIORITY LIST OF PATHOGENS global action plan on AMR

Priority 1: CRITICAL

- Carbapenem-resistant *Acinetobacter baumannii*
- Carbapenem-resistant *Pseudomonas aeruginosa,*
- 3rd generation cephalosporin-resistant, ESBL-producing carbapenem-resistant Enterobacteriaceae

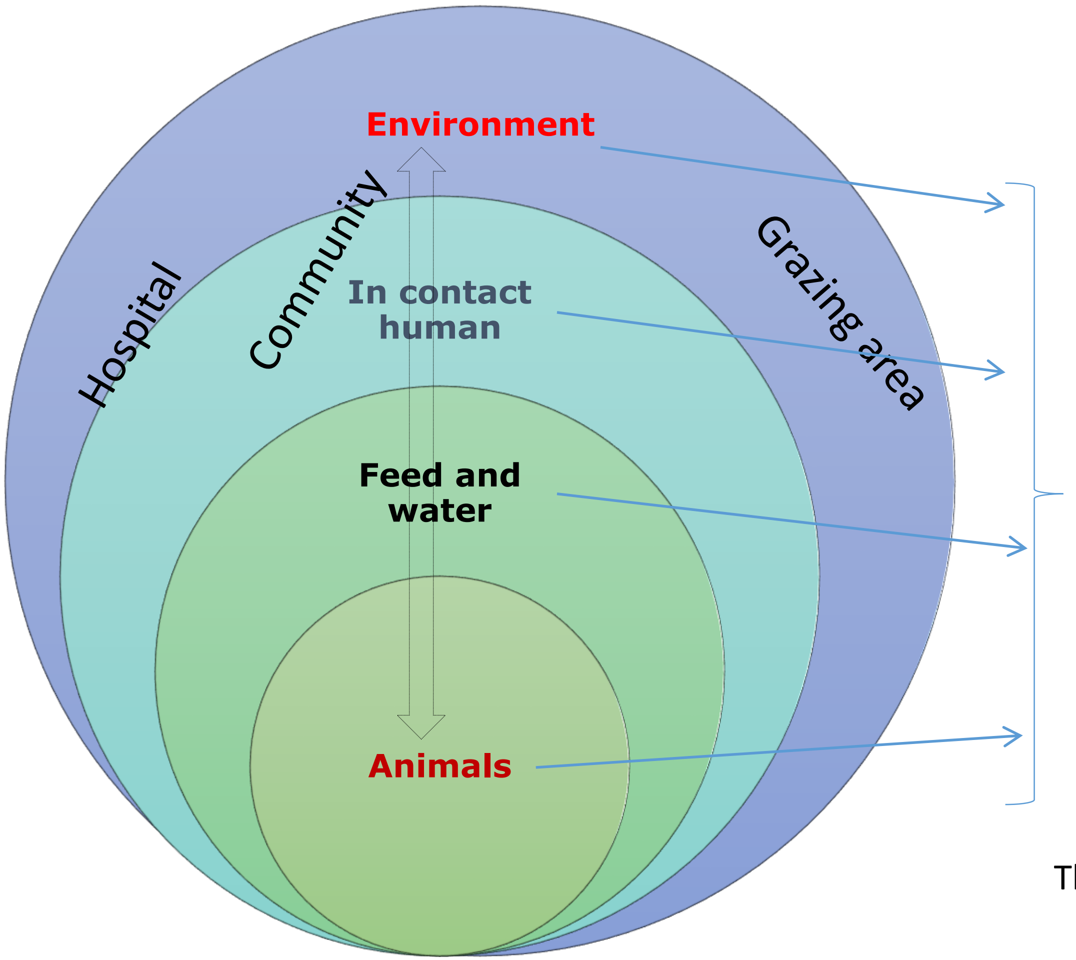
Priority 2: HIGH

- *Enterococcus faecium*
- vancomycin-resistant *Staphylococcus aureus,* Vancomycin resistant *Helicobacter pylori*
- Fluoroquinolone-resistant *Neisseria gonorrhoeae*

Priority 3: MEDIUM

- *Streptococcus pneumoniae*
- Penicillin-non-susceptible *Haemophilus influenzae*
- Ampicillin-resistant *Shigella* spp.

AMR – where to look and what to look?



Indicators

- ***E. coli***
- ***Staph***
- *Enterococcus*
- *Pseudomonas*
- *Salmonella*
- *Klebsiella*
- *Campylobacter*

The list is not comprehensive

Proposed draft guidelines on integrated surveillance of antimicrobial resistance

CODEX ALIMENTARIUS COMMISSION

Food and Agriculture Organization of the United Nations

World Health Organization

Viale delle Terme di Caracalla, 00153 Rome, Italy - Tel: (+39) 06 57051 - E-mail: codex@fao.org - www.codexalimentarius.org

Agenda Item 5

CX/AMR 17/5/6
September 2017

JOINT FAO/WHO FOOD STANDARDS PROGRAMME

***AD HOC* CODEX INTERGOVERNMENTAL TASK FORCE ON ANTIMICROBIAL RESISTANCE**

Fifth Session

PROPOSED DRAFT GUIDELINES ON INTEGRATED SURVEILLANCE OF ANTIMICROBIAL RESISTANCE

Prepared by the Electronic Working Group led by the Netherlands and co-chaired by Chile, China and New Zealand

Codex members and Observers wishing to submit comments at Step 3 on the proposed draft Guidelines (Appendix I to this document) should do so as instructed in CL 2017/82-AMR available on the Codex webpage/Circular Letters 2017: http://www.fao.org/fao-who-codexalimentarius/circular-letters/en/.

Report of the electronic working group for the drafting of the Guidelines on integrated monitoring and surveillance of Antimicrobial Resistance

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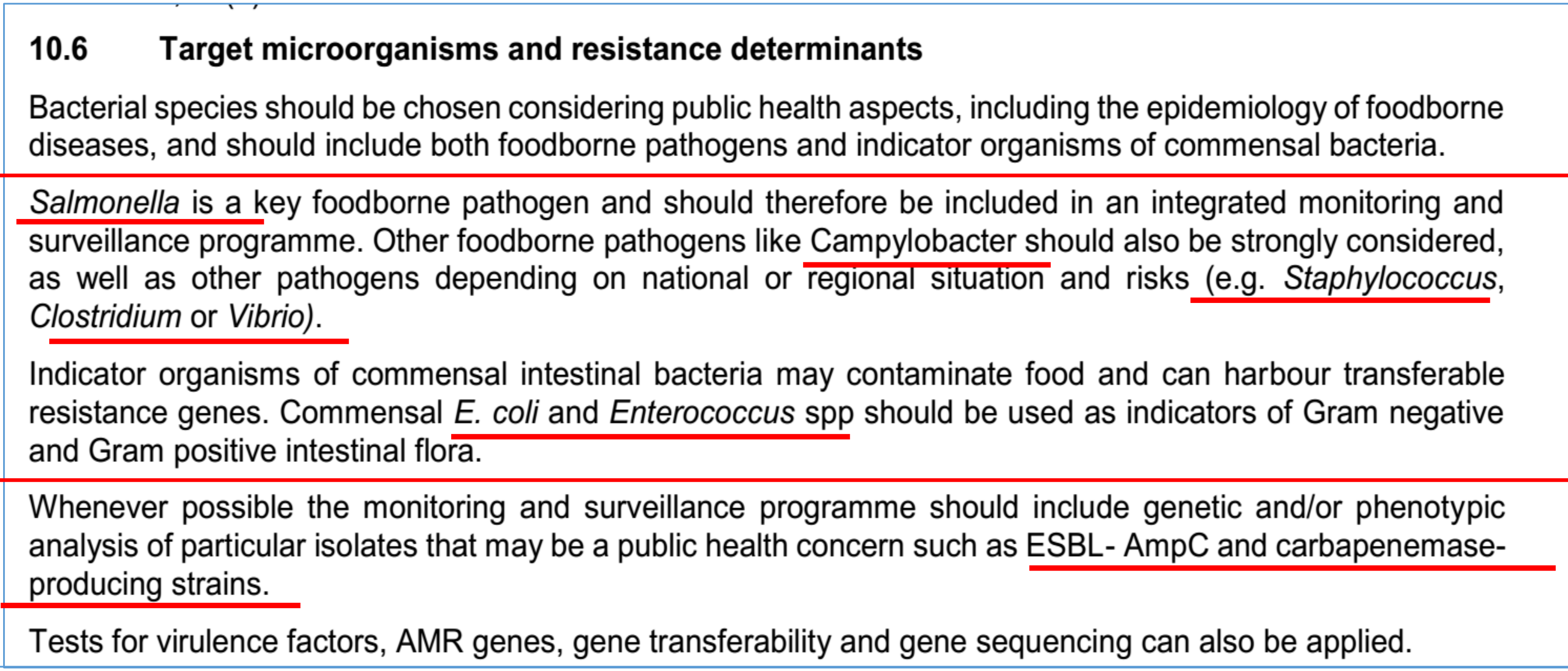
Target microorganisms and resistance determinants



10.6 Target microorganisms and resistance determinants

Bacterial species should be chosen considering public health aspects, including the epidemiology of foodborne diseases, and should include both foodborne pathogens and indicator organisms of commensal bacteria.

Salmonella is a key foodborne pathogen and should therefore be included in an integrated monitoring and surveillance programme. Other foodborne pathogens like Campylobacter should also be strongly considered, as well as other pathogens depending on national or regional situation and risks (e.g. *Staphylococcus*, *Clostridium* or *Vibrio*).

Indicator organisms of commensal intestinal bacteria may contaminate food and can harbour transferable resistance genes. Commensal *E. coli* and *Enterococcus* spp should be used as indicators of Gram negative and Gram positive intestinal flora.

Whenever possible the monitoring and surveillance programme should include genetic and/or phenotypic analysis of particular isolates that may be a public health concern such as ESBL- AmpC and carbapenemase-producing strains.

Tests for virulence factors, AMR genes, gene transferability and gene sequencing can also be applied.

http://www.fao.org/fao-who-codexalimentarius/sh- roxy/it/?lnk=1&url=https%253A%252F%252 Fworkspace.fao.org%252Fsites%252Fcodex%252FMeetings%252FCX-804-05%252FWD%252Fam05_06e.pdf

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CARBAPENEM RESISTANCE IN FOOD ANIMAL ECOSYSTEM

The European Food Safety Authority (EFSA), 2013 in association with the Panel on Biological Hazards (BIOHAZ) states that

- Carbapenemases are now seen as a new and potentially emerging problem in food-producing animals
- All isolates of *Salmonella spp.* and *E. coli* should be screened for Carbapenem resistance
- Isolates which are resistant to 3rd or 4th generation cephalosporins should be subjected to phenotypic testing and characterization of the carbapenemase genes
- Carbapenem resistance in dairy cattle and raw milk samples should also be addressed because of specific use of cephalosporins in dairy cattle, and to the risk posed by potential consumption of raw milk

AMR surveillance in India

- WHO Global Antimicrobial Resistance Surveillance System (GLASS)
- MoHFW /NCDC : AMR surveillance network (10 labs)
- ICMR : AMR Surveillance Network (4 institutions/6 labs)
- INFAAR: Indian Network for Fishery and Animals Antimicrobial Resistance (13 institutions)

Prevalence of Antibiotic resistant bacteria in animals Indian scenario

PLACE	SAMPLE TYPE	ISOLATES	RESISTANCE		RESISTANCE MECHANISM	REFERENCE
			MDR positive	Carbapenem positive		
West Bengal	Mastitis milk	8 (*E. coli*)	**5**	**1**	Horizontal transmission from human or environmental sources	Ghatak *et al*., 2013
	Bovine mastitis	7 (*E. coli*)	**3**	**-**	Emergence of antimicrobial resistance among bovine mastitis pathogens	Bandyopadhyay *et al*., 2015
	Mastitis milk	50 gram negative (Enterobacteriaceae)	**24**		Extensive use of β-lactam antibiotics	Das *et al*., 2017
Odisha	Poultry (fecal) Cattle (milk)	252 64 (*E. coli*)	**16** **2**	**4** **1**	Indiscriminate antibiotics use	Kar *et al*., 2014
Hyderabad	Meat, Egg, Raw milk	22 (*E. coli*)	**6**	**1**	Widespread use of antibiotics	Rashmeed *et al*., 2014
Kolkata	Mastitis milk	291 (*Klebsiella*)	**23**	**4**	Cross transmission between the human and animal	Koovapra *et al*., 2016
Haryana (NDRI)	Raw milk,	139 (*E. coli*)	**11**	**-**	Transmission and acquisition of antibiotics resistance gene by plasmid and mobile genetic element	Amarjeet *et al*., 2018

Diagnosis for AMR cont..

Method / name of test		Based on	Reference	Time	Cost	Application
Determination of Susceptibility / resistance	Disk diffusion assay	Growth based with pure isolates	Reference method (as per CLSI / EFSA guidelines)	Overnight 10-12 hr.	~ Rs. 500-1500/ test	R&D institutes / referral centers / regulatory agency / veterinary hospitals
	Dilution test					
	E test					
	Automated AST systems	Convenientional / microdilution / automated plates	Vitek System, Micronaut Phoenix	4-12 hrs	Rs.2000-3000/ test	R&D institutions and laboratories only
Detection of metabolic activity	Carba NP test	Colour from red to yellow Due to pH shift	Growth based enzyme assay with pure isolates	30-60 min	Rs. 250 per test	Different settings of dairy food chain / dairy farms/ veterinary hospitals / milk reception docks etc.
	Nitrate reductase analysis; Resazurin microplate assay	Color change of growth medium due to pH change due to bacterial growth				
Genotypic Methods		PCR; Microarray and other Modifications	Different Biotechnological companies	3-4 hours	5000-10000 per sample	Clinically / research laboratories / not suitable for different setting in dairy supply chain

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Food Supply chain

From farm				From fork
Agricultural production	Sale of commodities /raw material local, national international	Manufacturing packaging of food products	Sale of food products import wholesale retail trade	Consumer

Stake holders responsibilities for food safety and quality

GAP	GDP	GMP	GDP

GHP

FARM TO FORK™

FOOD SAFETY COMPLIANCE SERVICES

Factors linked with farm to fork

- Un-organized milk production system
- In sufficient awareness about clean milk production, hazards and risks involved (HACCP system)
- Inadequate power supply/ or cold chain
- Poor linkage between milk producers and dairy processers because of active role of middle man
- No regulatory intervention during milk production and reception of milk at dairy units
- Lack of rapid field levels kits for monitoring of different microbial contaminants in milk for conducting risk assessments work and regulatory compliance are lacking
- Manual handling leading to post pasteurization contamination
- Level of automation during processing

Development of Sector wide food safety guidelines (GAP/GDP/GHP/GMP) during entire dairy supply chain involving all stake holders for regulatory compliance

Integrated FOOD LAW

The Government established the Food Safety and Standards Authority of India (FSSAI) under the Food Safety and Standards Act, 2006 (FSSA) with the mandate to lay down science based standards for food products and to regulate their manufacture, storage, distribution, sale and import, to ensure availability of safe and wholesome food

Main features of Integrated food law

- Harmonization with international standards such as CODEX
- Shift from a regulatory regime to self compliance
- To lay down scientific standards and ensure availability of safe food
- Single reference point for all issues related to food safety and standards
- Clear procedures for food recall

Key Microbial Food safety Challenges

- ✓ Awareness creation
- ✓ Capacity building
- ✓ Infrastructure creation
- ✓ Building Research & Development Capacity
- ✓ Certification of Raw Material
- ✓ Traceability system

Awareness Creation

Effective awareness creation programs need to be carried out by the Governmental agencies for smooth transition from the current food safety laws to the proposed system, specifically by keeping the small and medium enterprises abreast of the salient features of the law and practical issues that are likely to be faced by the manufacturers and their solutions

Poor general awareness towards the hazards associated with unsafe food practices and the best practices to be followed

Capacity building programme for enhanced food safety at different stages in dairy supply chain (FBO/ regulators)

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Infrastructure creation

Lack of basic supporting infrastructure such as testing labs

- One of the critical links in the successful implementation of FSSAI is food testing laboratories.
- Under the new law the manufacturers need to get their products tested every month and keep a certificate.
- Hence, building up a sufficient number of accredited laboratories is of paramount importance

Establishment of referral centre /BSL-2 laboratory for food safety monitoring / FSSAI standard compliance

Insufficient technical expertise and skilled manpower for implementation of legislation at the grass root level

- **Massive efforts are required for capacity building in order to successfully implement the proposed FSSAI at the grass root level**
- **Well evolved training programs need to be conducted for the state, district and block level enforcement agencies**
- **The programs would have to equip the implementing officers with knowledge on international standards of food safety and quality thus enabling regulators to make judicious decisions relating to food contamination**

Certification of Raw Material

- **One of the major sources of contamination in food systems occurs during the primary production stage - which is kept out of the ambit of the FSSAI**

Exclusion of primary producers from the purview of the law thus putting the onus of preventing food hazards on the manufacturers or processors

- **Successful and holistic implementation of Food safety system would require an extensive campaign that encourages implementation of Good Agricultural Practices (GAP) at the farm level**

Problems in traceability of product especially in the upstream processors of the food chain – from the farm gate to the processing unit

Organized manufacturers should be encouraged to take pro-active steps to ensure that GAP is adhered to by their suppliers, and a traceability system including geographic application is placed at the back-end thus reducing the risk of food contamination

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Concluding remarks

- ✓ **Generation of scientific data on hygiene/ safety indicators in milk and milk products through National surveillance network project.**
- ✓ **Establishment of codex cells for development of food safety standards based on risk analysis**
- ✓ **Development of food safety guidelines (GAP/GDP/GHP/GMP) during entire dairy supply chain involving all stake holders**
- ✓ **Compulsory implementation of QMS and HACCP for dairy industry to ensure domestic as well as export standard compliance**
- ✓ **Capacity building programme for enhanced food safety at different stages in dairy supply chain (FBO/ regulators)**
- ✓ **Establishment of referral center /BSL-2 laboratory for food safety monitoring / FSSAI standard compliance**
- ✓ **Stronger interaction between industry and R & D institutions for enhanced innovation and know how transfer leading to better productivity in dairy sector**
- ✓ **Adoption of new technologies developed by R & D institutions by FSSAI for their regulatory compliance**
- ✓ **Development of rapid diagnostics for addressing the issues of residues , mastitis , AMR and dairy pathogen detection in dairy food chain**

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