

Poultry Production and Food Safety: An International Perspective

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The logo for the Center for Food Safety (CFS) features the letters 'CFS' in a bold, italicized, sans-serif font. The 'C' and 'F' are red with a white outline, while the 'S' is white with a red outline.

CENTER FOR FOOD SAFETY

College of Agricultural and Environmental Sciences

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Overview

- Salmonellosis in humans
- *Salmonella* surveillance in poultry slaughter plants in U.S. and E.U.
- What can be done to reduce the risk of *Salmonella* in poultry production?
 - Pre-harvest interventions
 - Post-harvest interventions

Incidence of Salmonellosis

- *Salmonella* is a leading cause of foodborne disease worldwide (~94 M cases /year)

Country/Region	Salmonellosis incidence per 100,000 population*
USA	17.6
EU-25	42.2
-UK	24.3
-Denmark	28.5
-Sweden	39.7
-The Netherlands	9.4
Australia	43.6
Japan	32.0
UAE	?

*USA: 2010, EU: 2004, Australia: 2009, Japan: 2004

U.S.A. Healthy People 2020 Objectives

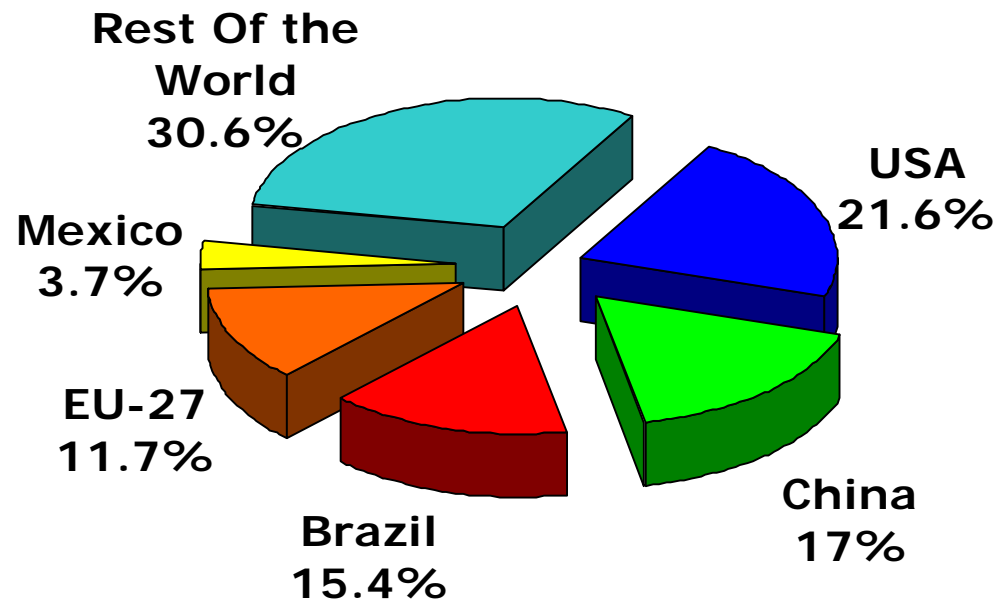
Pathogen	2006-08 incidence	2010 incidence	2020 Objective
<i>Campylobacter</i>	12.7	13.6	8.5
<i>Escherichia coli</i> O157	1.2	0.9	0.6
<i>Salmonella</i>	15.2	17.6	11.4
<i>Listeria</i> <i>monocytogenes</i>	0.3	0.3	0.2

Incidence per 100,000 population

Salmonellosis associated with poultry

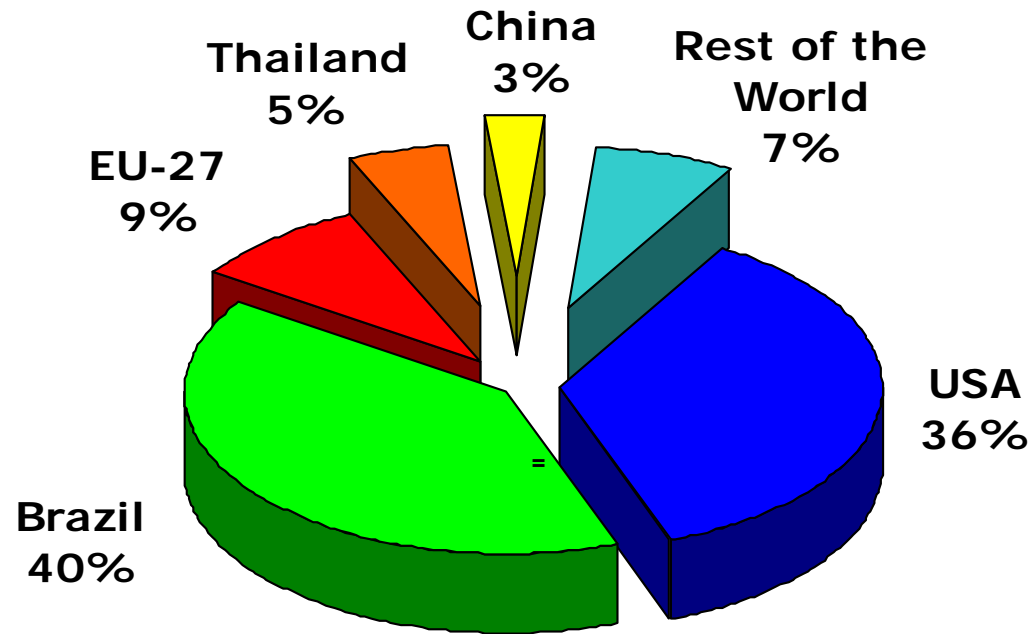
- 22-29% of human salmonellosis cases have been attributed to poultry consumption in the U.S. (*USDA., 2008; Braden, 2006*)
 - Based on outbreak and surveillance data

Poultry Production around the World



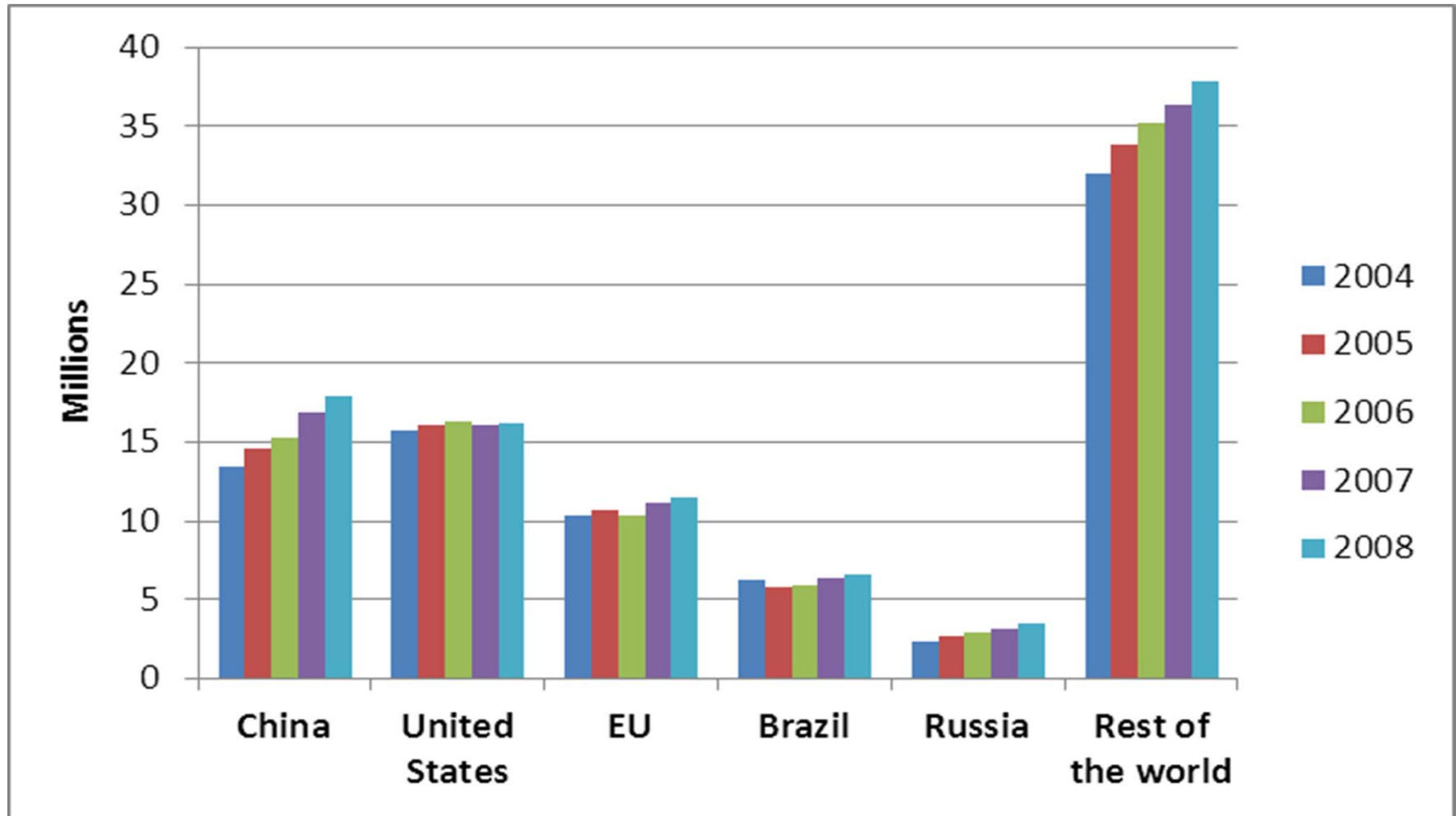
Source: USDA, 2010

Poultry Exporting



Source: USDA, 2010

Poultry Meat Consumption (in million tons) 2004-2008



Salmonella Prevalence on Raw Chicken Meat

Country	% <i>Salmonella</i> Slaughter*	% <i>Salmonella</i> Retail
USA	5.2 (n=3,275)	4.2 (n=212)
United Kingdom	3.6 (n=401)	4.0 (n=877)
Sweden	0.3 (n=410)	0.0 (n=40)
Spain	14.4 (n=389)	35.8 (n=198)
Belgium	18.7 (n=380)	36.0 (n=772)
China	-	52.2 (n=1,152)
Russia	-	31.2 (n=698)
Vietnam	-	45.9 (n=1,000)
Colombia	-	27.0 (n=1,003)
Australia	36.7 (n=408)¥	43.3 (n=859)

*2008, ¥2010

Salmonella Surveillance in Broiler Production in **USA**

- United States Department of Agriculture-Food Safety and Inspection Service (USDA-FSIS)
 - Inspect poultry slaughter facilities
 - Collect one chicken carcass per day, rinsed, and rinsate sent for *Salmonella* analysis
 - Carcasses selection continue for 51 days or until 51 carcasses have been tested
 - >5 positives/51 samples; indicate a failure
 - Poultry slaughter plant have 30 days to correct failure

Salmonella Surveillance in Broiler Production in **USA**

- After 30 days, testing (another 51 days) begins again
- After a second failure, poultry plant must write a detailed plan for corrective action to reduce *Salmonella* prevalence and prevent recurring
- Testing again begin after 30 days
- A third failure results in closing the slaughter/processing plant (USDA, 1996)

Salmonella Surveillance in Broiler Production in **EU**

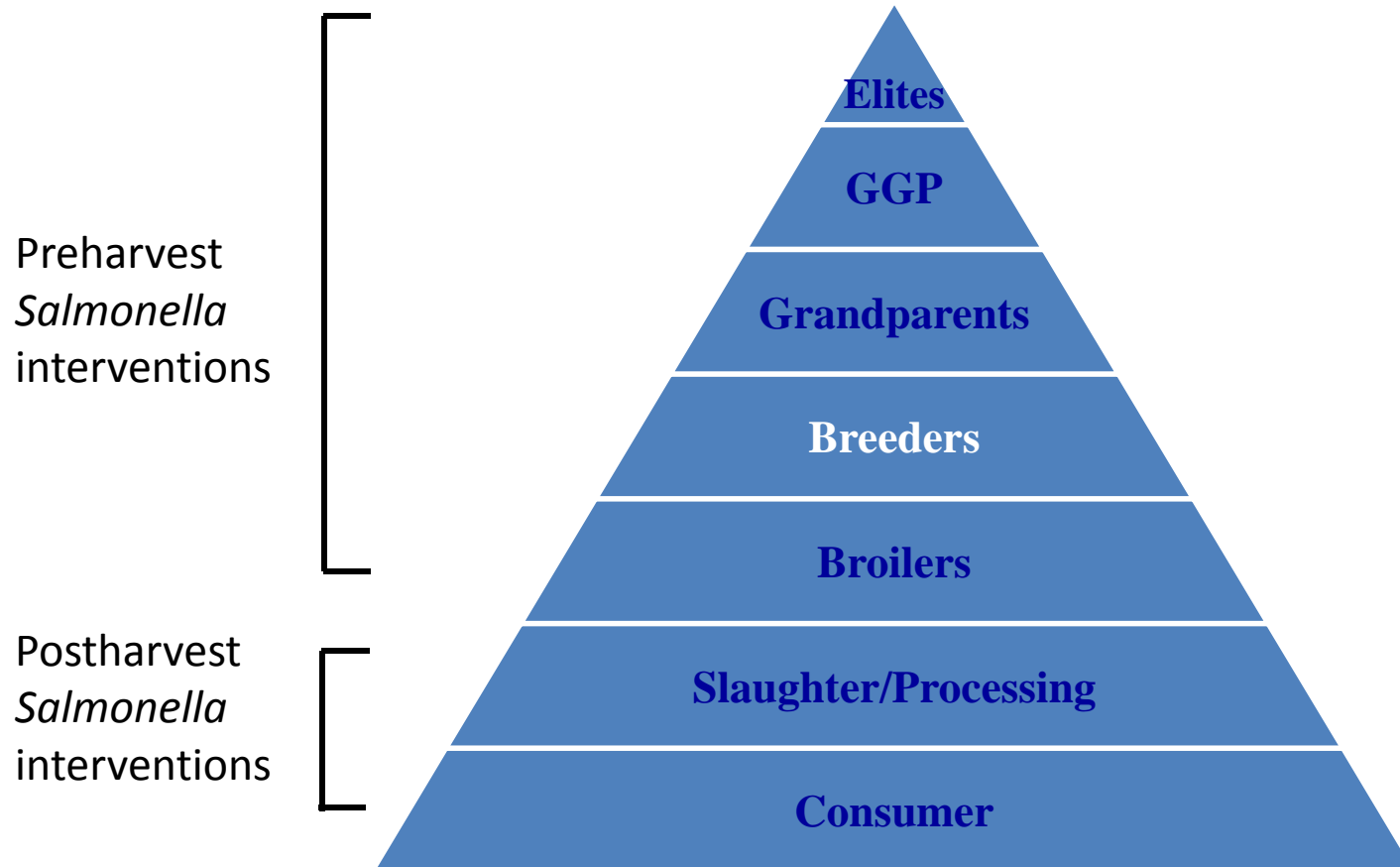
- One day a week, 15 neck skin samples from broiler carcasses (post-chill)
- Pool them into 5 samples (3 neck skin each- 25g per pool) and test for *Salmonella*
- If **positive**, improvement in slaughter hygiene and review of process controls, origin of the birds and bio-security measures in the farm of origin, are required

UAE Poultry Production

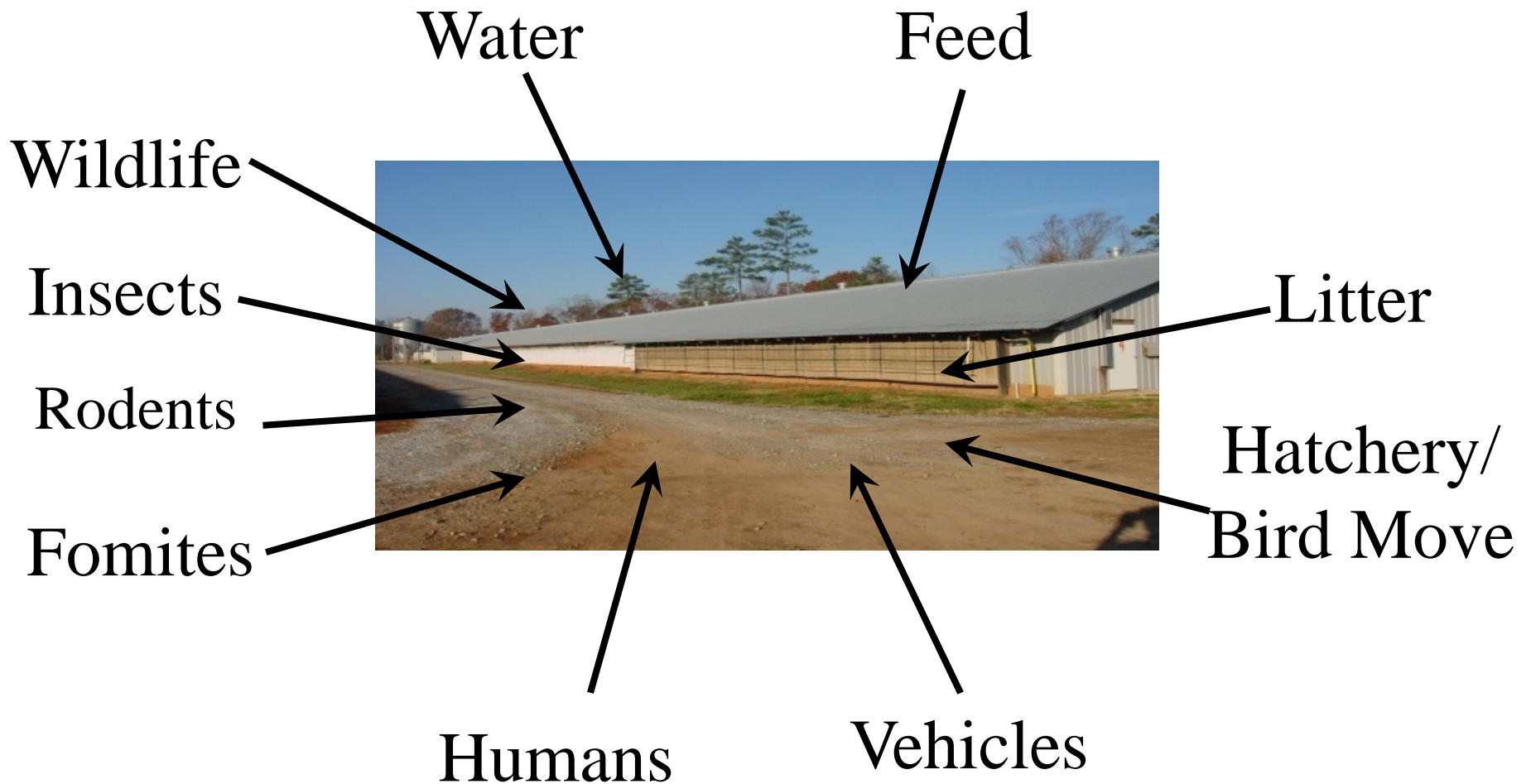
- Annual chicken meat production: 35,000 MT (20% of UAE market demand)
- Annual import: 146,000 MT
- Six large-sized farms (65%) and four medium-sized farms (20%) accounted for most of the UAE production
- Feed ingredients and chicks (mostly) are imported
- Prevalence of *Salmonella* on raw chicken meat at retail in Dubai 46.7% (n=60) *Khan et al. (2010)*

- What can be done to reduce the risk of *Salmonella* in poultry production?
 - Pre-harvest interventions
 - Post-harvest interventions

Top-down *Salmonella* control



Potential Sources of *Salmonella*



Poultry Feed

- **USA:**
 - Feed ingredient source
 - Pest (i.e., Rodent/insect) control
 - Feed decontamination
 - Organic acid (propionic, formic, acetic, and butyric)
 - Formaldehyde
- **EU:**
 - Feed must be *Salmonella*-free.
 - This is achieved through:
 - Import control on raw materials and testing
 - Mandatory heat treatment of compound feeding stuff for poultry
 - HACCP-based *Salmonella* control in the feed industry

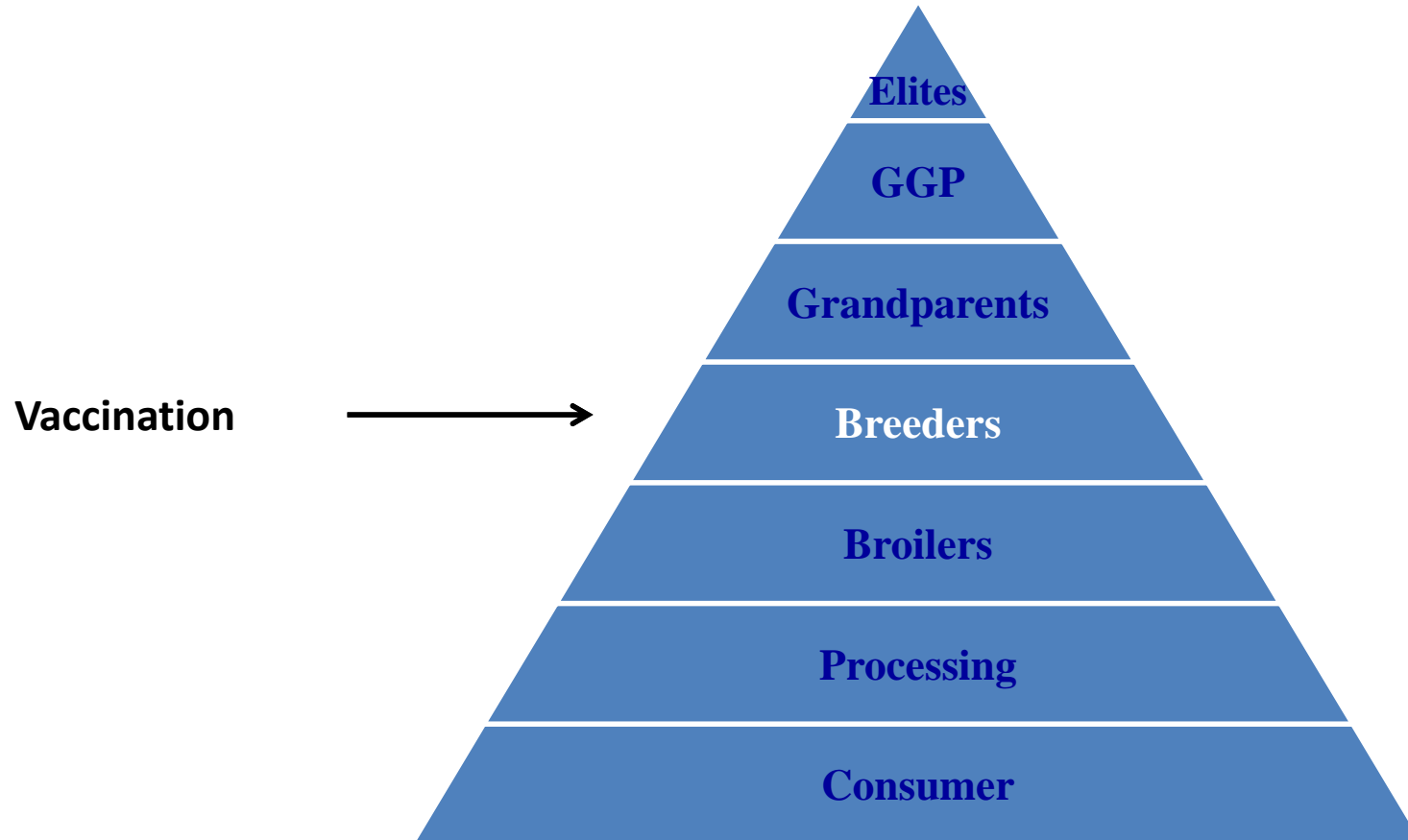


Breeders

- **USA:**

- Many poultry companies vaccinate for *Salmonella*
 - Live-attenuated vaccine more effective than killed.
- *Salmonella* monitoring program of the breeders' environment (voluntary): *S. Enteritidis*
- Broiler eggs are held in a pest-proof, temperature-controlled environment
- Limited use of probiotic/competitive exclusion
 - Effectiveness
 - Cost

Top-down *Salmonella* control



Breeders

- **EU:**
 - Many countries vaccinate for *Salmonella*
 - Many countries use probiotic/competitive exclusion for *Salmonella*
 - Scandinavian countries (e.g., Denmark, Sweden, Norway) test regularly breeder flocks for *Salmonella*
 - Slaughter the flock if positive for *Salmonella*
 - Works for countries with relatively small poultry industry

Hatchery

- A source of contamination and dissemination of *Salmonella* to newly hatched chicks
- Dust spreads *Salmonella* in the hatchery to many chicks
- **USA and EU:**
 - Some use competitive exclusion for *Salmonella*
 - Control of *Salmonella* in environment by disinfection (e.g., UV light, ozone, and other chemicals)

Biosecurity

- Pest management program to control:
 - Rodents, insects, and wildlife
- Develop a biosecurity program in writing and implement
- Cleaning and disinfecting
- In **EU**:
 - Test flocks 2 weeks before slaughter
 - If positive, slaughter/process separately



Source: Chuck Hofacre

Litter

- Bedding materials in broiler house
- **USA:**
 - Litter from a previous broiler flock is reused for successive flocks (up to one year)
 - Litter amendments used to control ammonia showed a significant reduction in *Salmonella* prevalence
 - Evidence suggests that *Salmonella* survives less well in used litter than in fresh
- **EU:**
 - The whole litter is removed from a house after each flock
 - House needs to be cleaned thoroughly, disinfected, and dried before new litter

Feed withdrawal

- Feed withdrawal (8 to 12 h) before slaughter
 - Least of amount of feces in the bird gut
 - Reduce the risk that carcasses contaminated with *Salmonella* during processing
- However, feed withdrawal has been shown to increase the number of *Salmonella* contaminated crops and cecae

Feed withdrawal

- **USA:**

- Poultry industry use a number of interventions in drinking water during feed withdrawal:
 - Organic acid blend (Parker et al., 2007)
 - Lactic acid (Byrd et al., 2001)
- Issue with inflamed intestine and lower water consumption
- Innovative use of Essential Oil-Mix that reduce *Salmonella* prevalence in crop, and enhance bird health

Poultry Processing

USA:

- Bird washers:
 - Post-picker wash
 - Inside/outside bird wash
 - Final bird wash
- Chlorine used as well as other chemicals
 - Prevent *Salmonella* cross-contamination
- Water immersion chilling
 - Chlorine is used
 - Reduce *Salmonella* prevalence by 50%



Poultry Processing

EU:

- Bird washers:
 - No chemicals are used
- Air-chilling:
 - No chemicals are used



Summary and conclusions

- Surveillance for *Salmonella* on raw poultry is important
- Data can then be used to establish a performance standard and improve the safety of poultry products
- Both pre- and post-harvest interventions are needed to control *Salmonella*
 - No silver bullet
 - No single solution

Thank You

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