Using grain-based diets to maximize pet food safety

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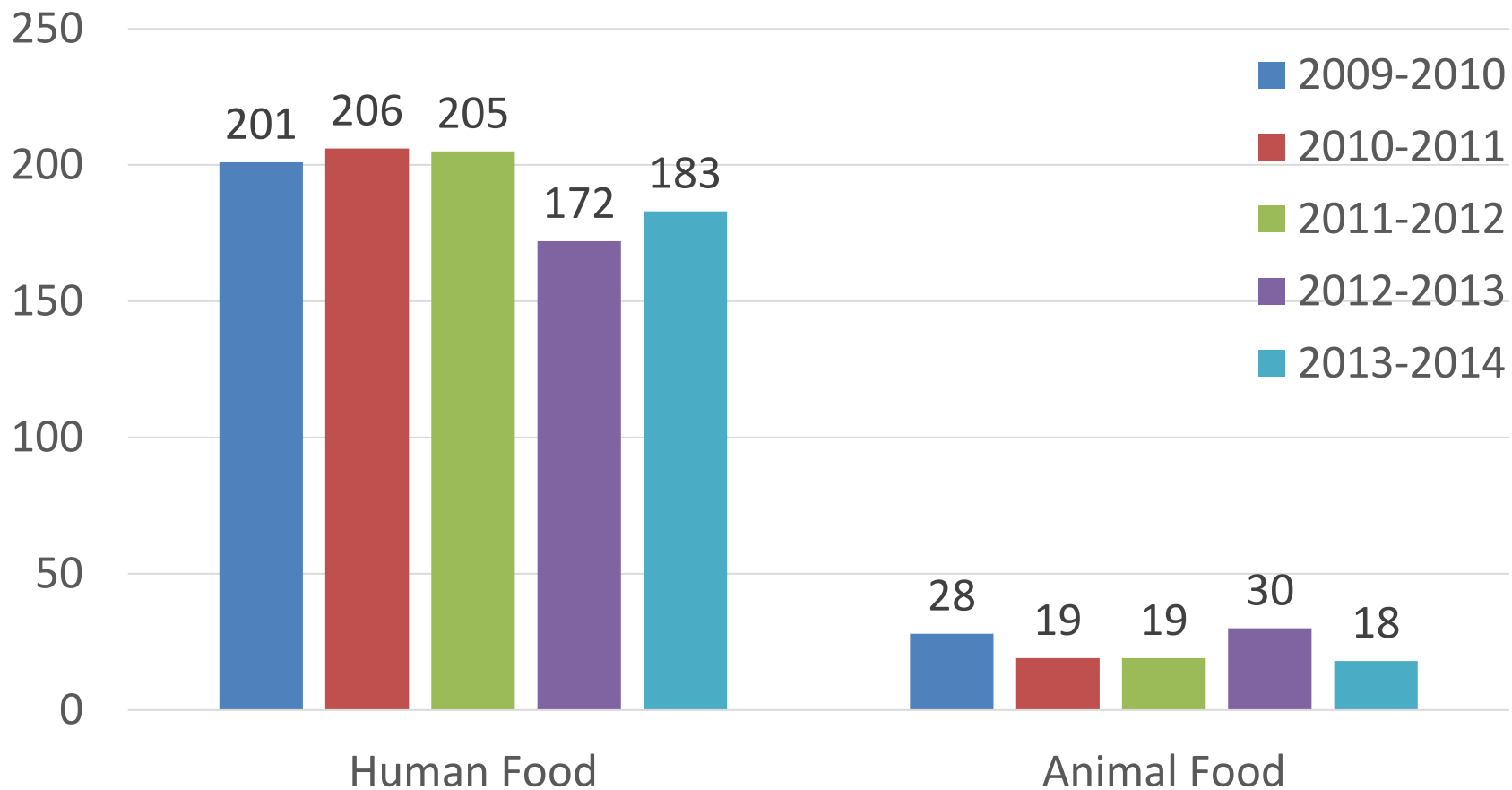
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Take Home Messages

- United States pet food is safe.
- The biggest opportunities for further improving pet food safety include addressing:
  - *Salmonella* spp.
  - *Listeria monocytogenes*
  - Nutrient deficiencies/toxicities
  - Aflatoxin
- Grain-based pet food is not exempt from hazards, but may be lower risk than grain-free diets.
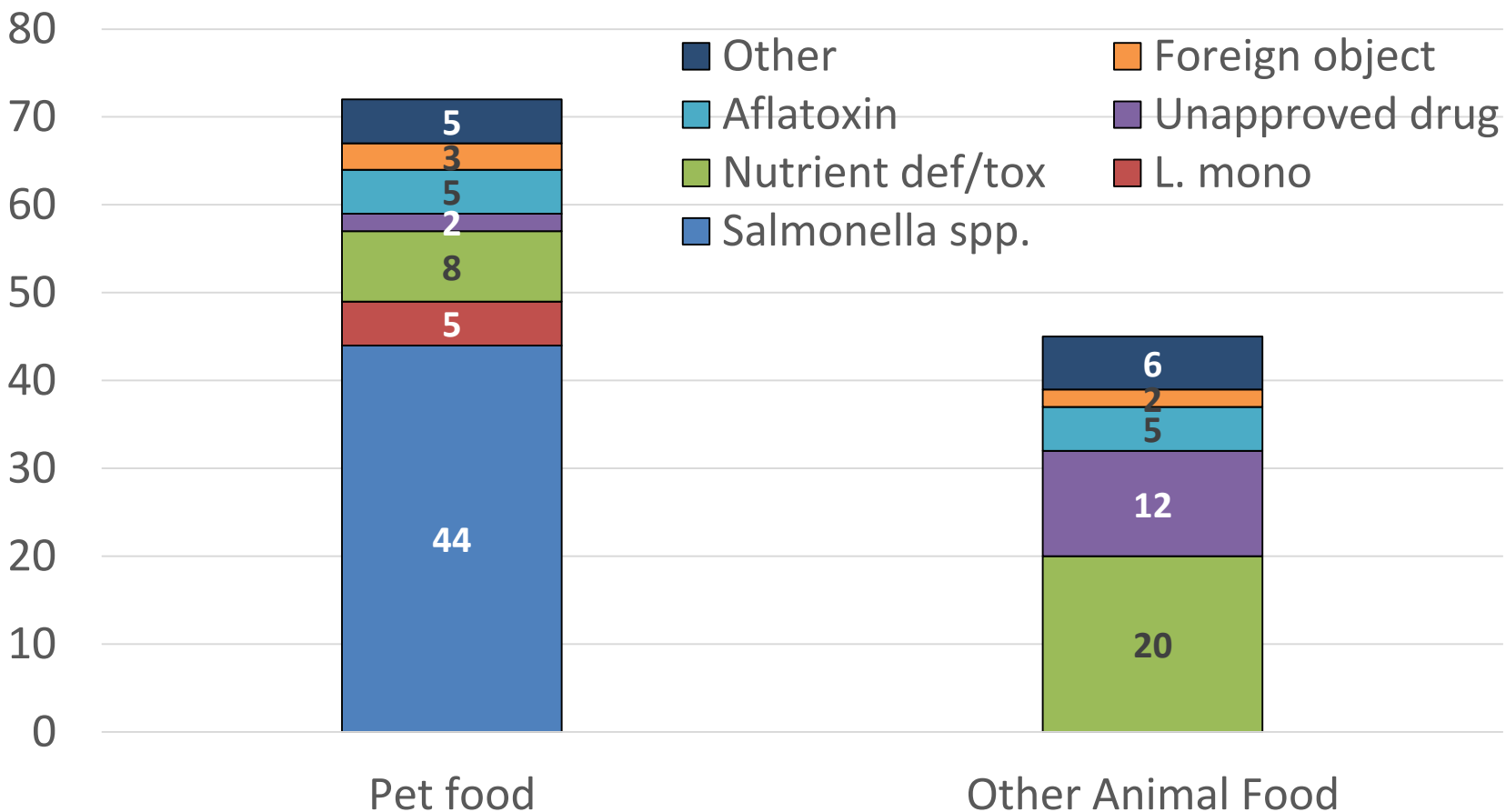
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Safety of US Pet Food

Reportable Food Registry Reports 2009-2014

Legend:
- 2009-2010
- 2010-2011
- 2011-2012
- 2012-2013
- 2013-2014

Human Food: 201, 206, 205, 172, 183

Animal Food: 28, 19, 19, 30, 18
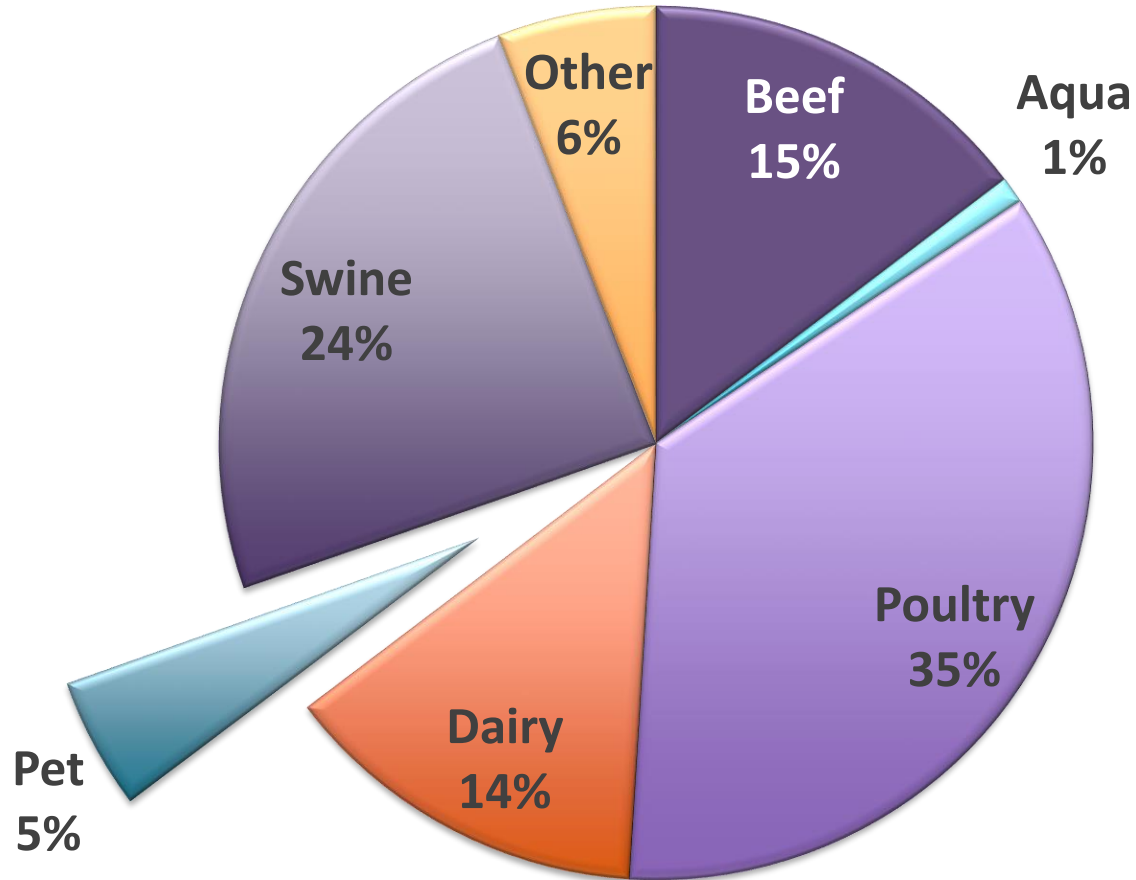
5th Reportable Food Registry Annual Report, FDA, 2016

Safety of US Pet Food

Reportable Food Registry Reports 2009-2014

Safety of US Pet Food

US Animal Food Production by Species

Pie chart: US Animal Food Production by Species
- Other 6%
- Beef 15%
- Aqua 1%
- Swine 24%
- Poultry 35%
- Dairy 14%
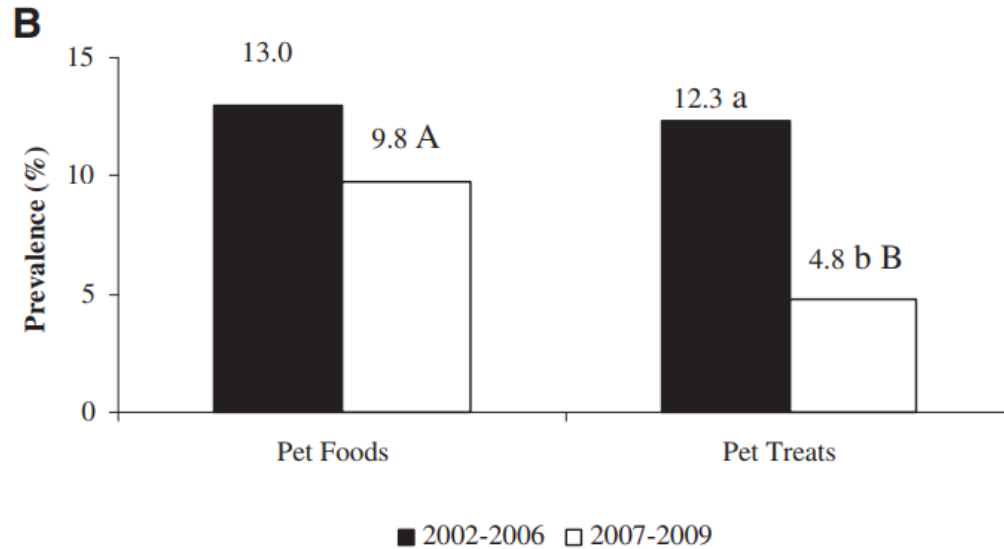- Pet 5%

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Opportunities to Improve Pet Food Safety

- *Salmonella* spp.
  - Pathways to illness
    - Animal salmonellosis through direct consumption
    - Human salmonellosis through cross-contamination when stored in the home
  - Regulatory perspective
    - Considered adulterated when contaminated and will not undergo commercial heat step or other process
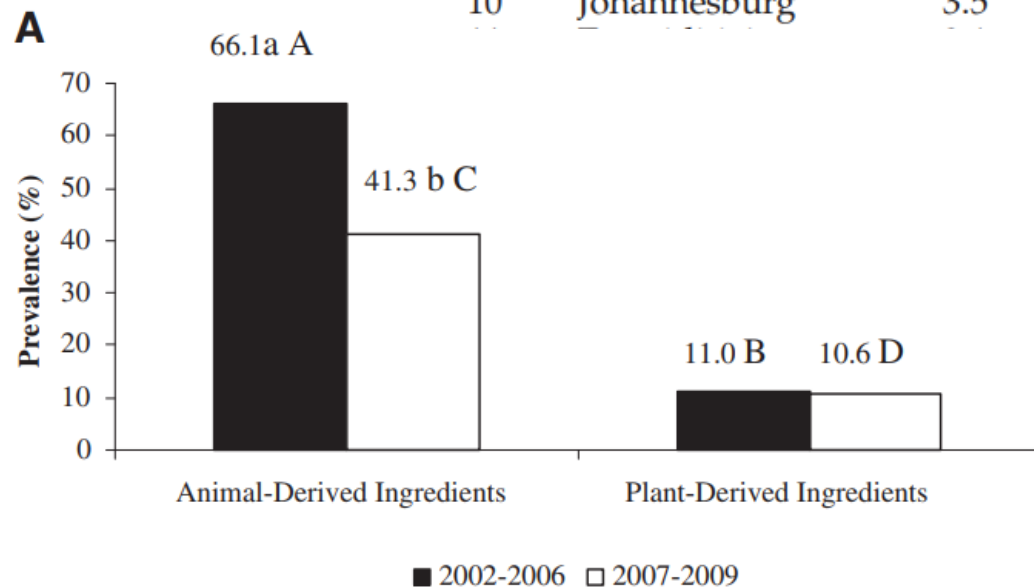   - Regardless of serotype, level of contamination

FDA Compliance Policy Guide Sec. 690.800
Salmonella in Food for Animals

Salmonella spp. in pet food

Li et al., 2012

Salmonella spp. in pet food

Ge et al., 2013

Feed type[a]	No. of samples	Salmonella
Animal derived	122	42 (34.4)
Meat and bone meal	72	28 (38.9)[A]
Poultry meal	17	3 (17.6)[A]
Blood meal	16	5 (31.3)[A]
Feather meal	10	1 (10)
Fish meal	5	4 (80)
Bone meal	2	1 (50)
Plant derived	79	4 (5.1)
Alfalfa meal	13	—
Oilseed byproducts	49	4 (8.2)
Soybean meal	31	3 (9.7)[a]
Cottonseed meal	8	1 (12.5)[a]
Sunflower meal	5	—
Linseed meal	3	—
Canola meal	2	—
Corn products	17	—
Corn gluten	10	—
Corn meal	5	—
Corn germ	1	—
Hominy	1	—
Total	201	46 (22.9)

Salmonella spp. in pet food

Facility surfaces with *Salmonella* spp.   *P* = 0.03
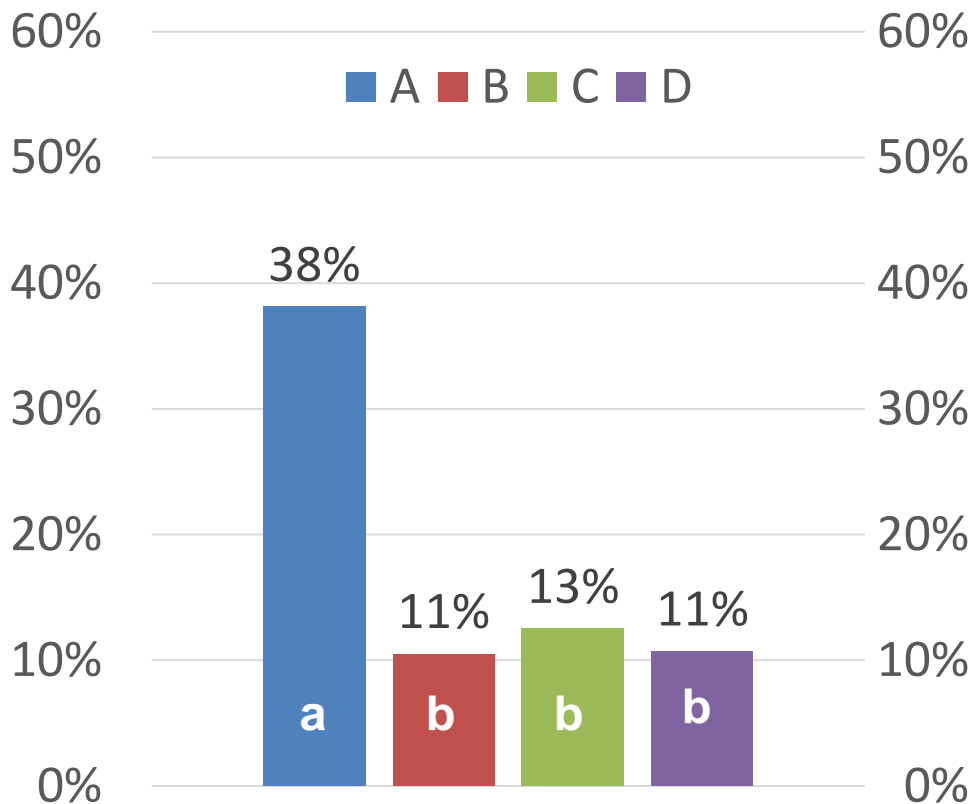
Surface types with *Salmonella* spp.   *P* = 0.01

Jeffrey et al., 2016

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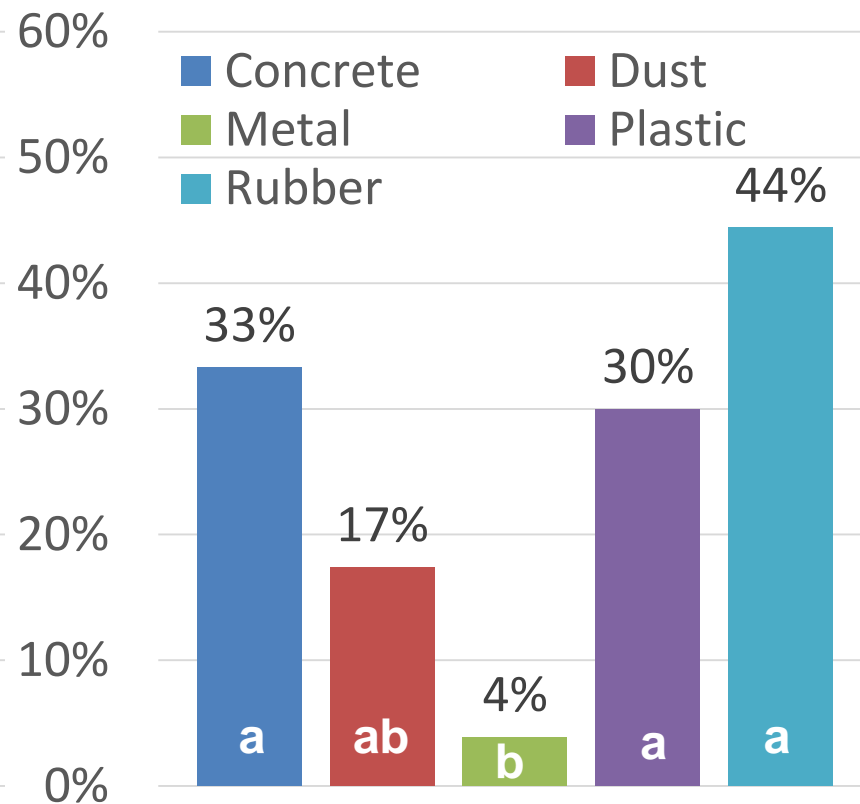
Salmonella spp. in pet food

Facility surfaces with *Salmonella* spp.
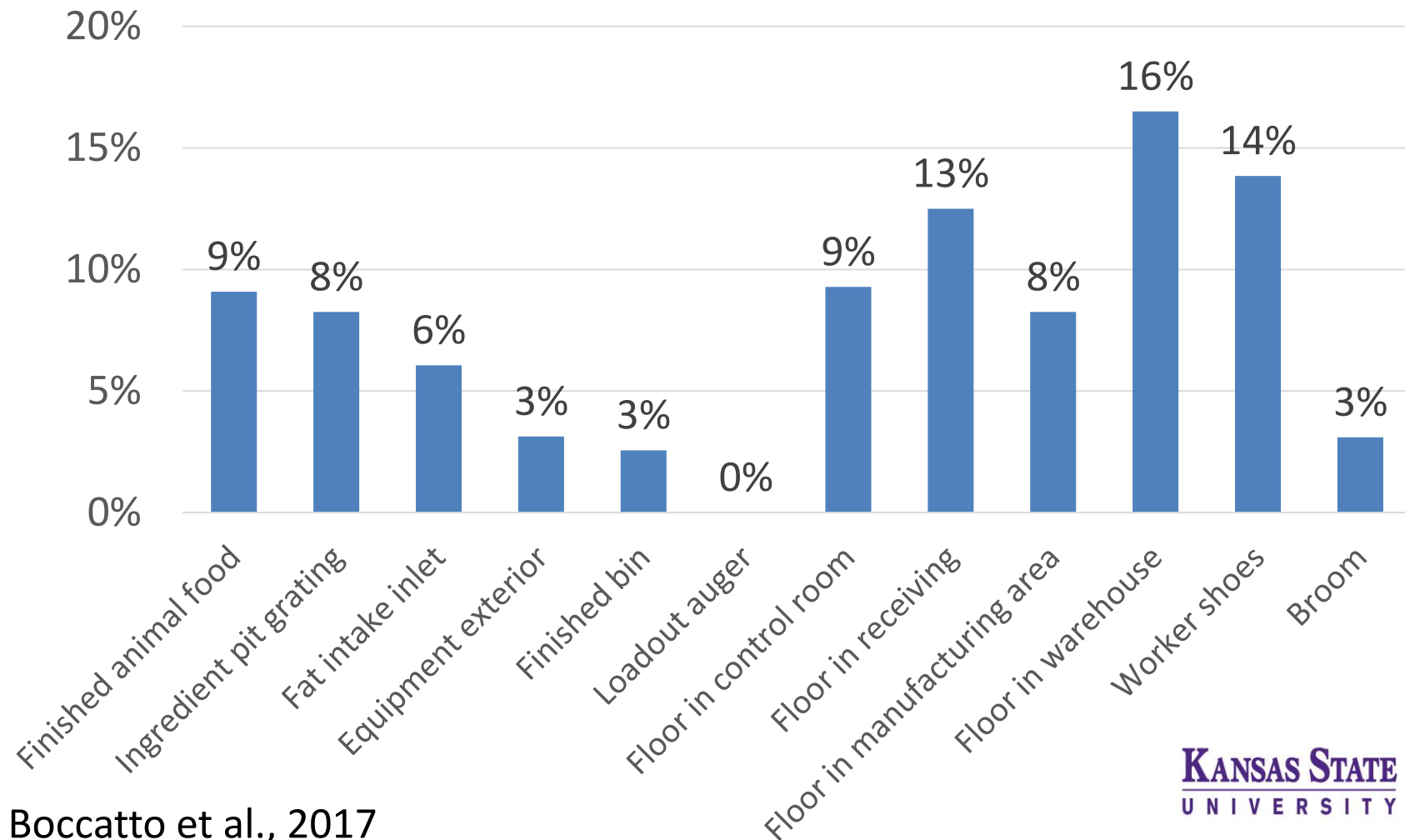
Boccatto et al., 2017

Salmonella spp. in pet food

Effect of surface type on *Salmonella* Typhimurium

$P = 0.0006$

Salmonella Log_{10} CFU/cm^2

Surface	Value	Group
Plastic	8.1	a
Polyethylene tote	6.4	bc
Rubber	6.7	c
Stainless	8.0	a
Tire	7.2	ab

Muckey et al., 2016

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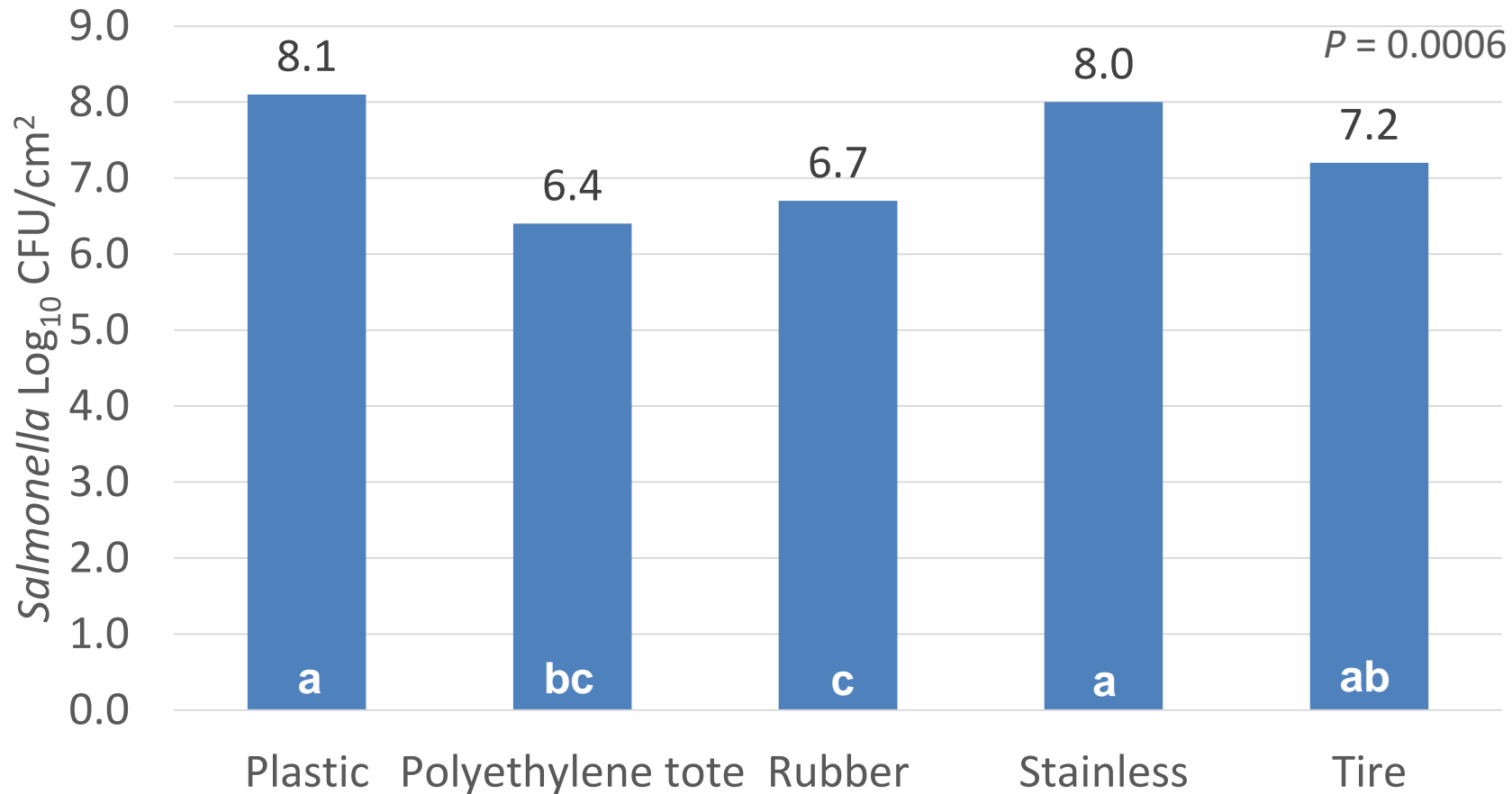
Salmonella spp. in pet food

Surface × Trt P = 0.002
Dry vs. Liquid P < 0.0001

Effect of sanitizer on stainless steel surfaces

Muckey et al., 2016

Salmonella spp. in pet food

Surface × Trt *P* = 0.002
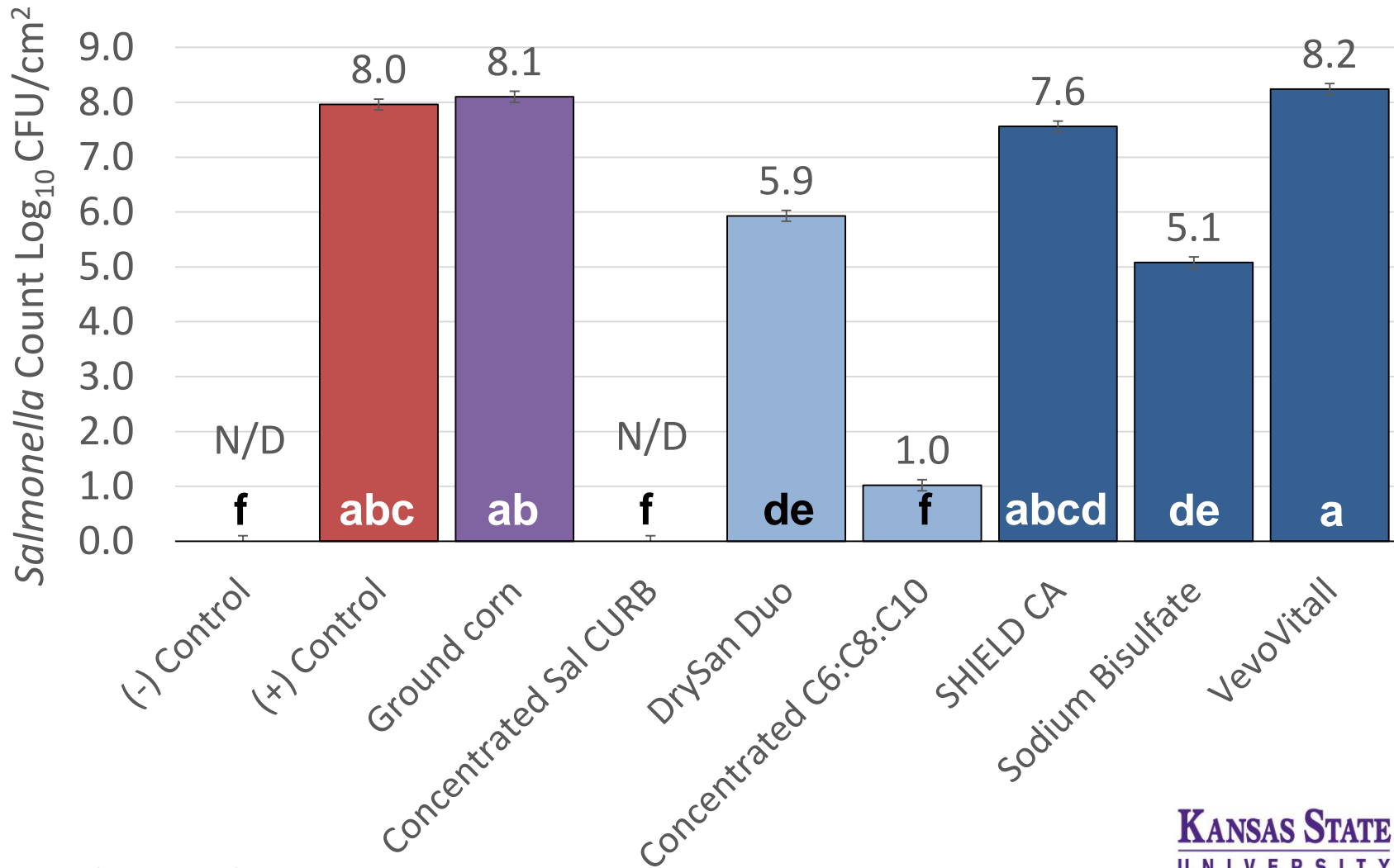Dry vs. Liquid *P* < 0.0001

Effect of sanitizer on plastic surfaces

Y-axis: *Salmonella* Count Log_{10} CFU/cm^2

Bar values and labels:
- (-) Control: N/D, e
- (+) Control: 8.1, ab
- Ground corn: 7.9, abc
- Concentrated Sal CURB: N/D, e
- DrySan Duo: 1.6, d
- Concentrated C6:C8:C10: 2.0, d
- SHIELD CA: 7.6, abc
- Sodium Bisulfate: 6.4, bc
- VevoVitall: 8.1, ab

Muckey et al., 2016

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U N I V E R S I T Y
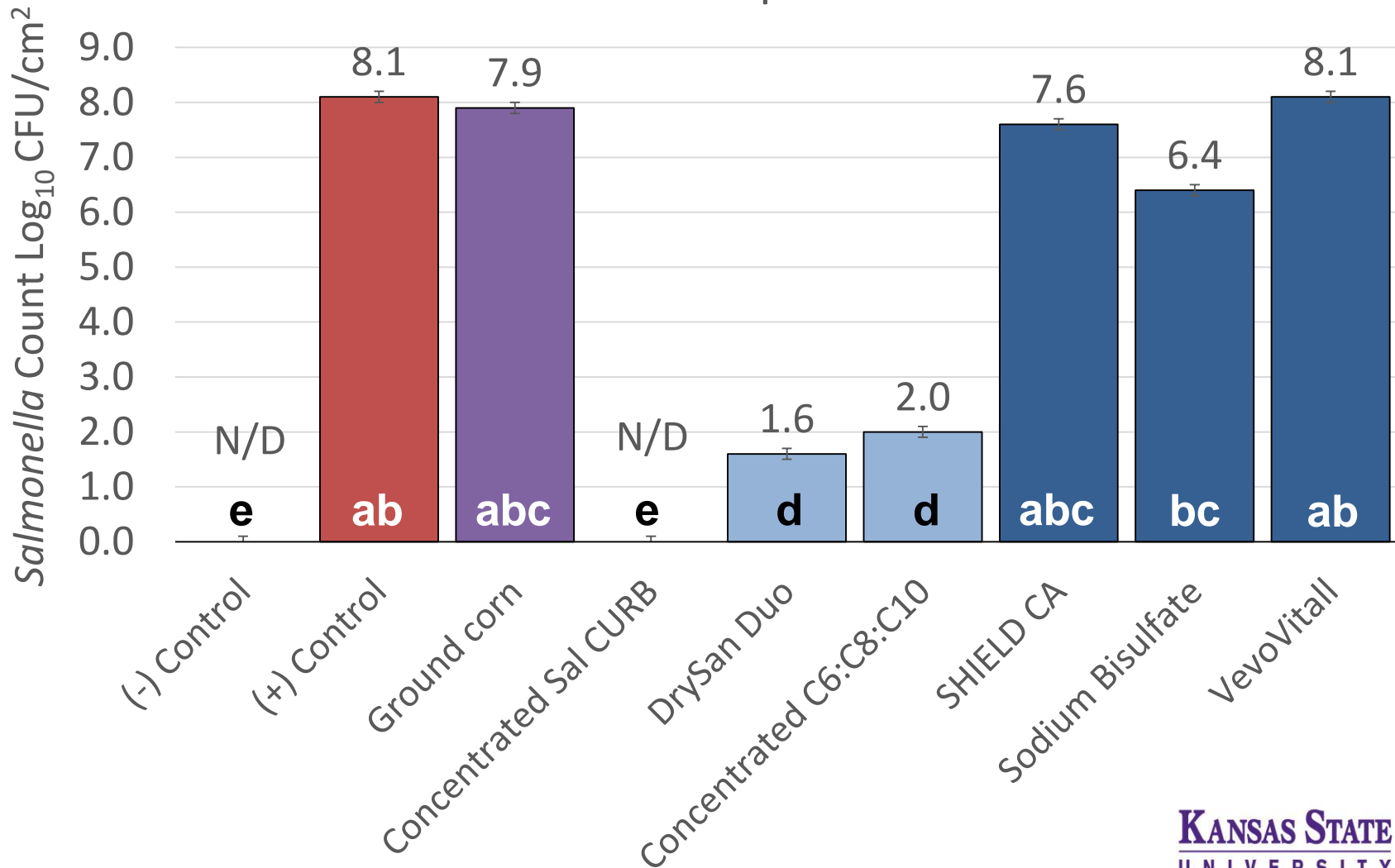
L. monocytogenes in pet food

Animal food types on *Listeria monocytogenes*

Nemser et al., 2014
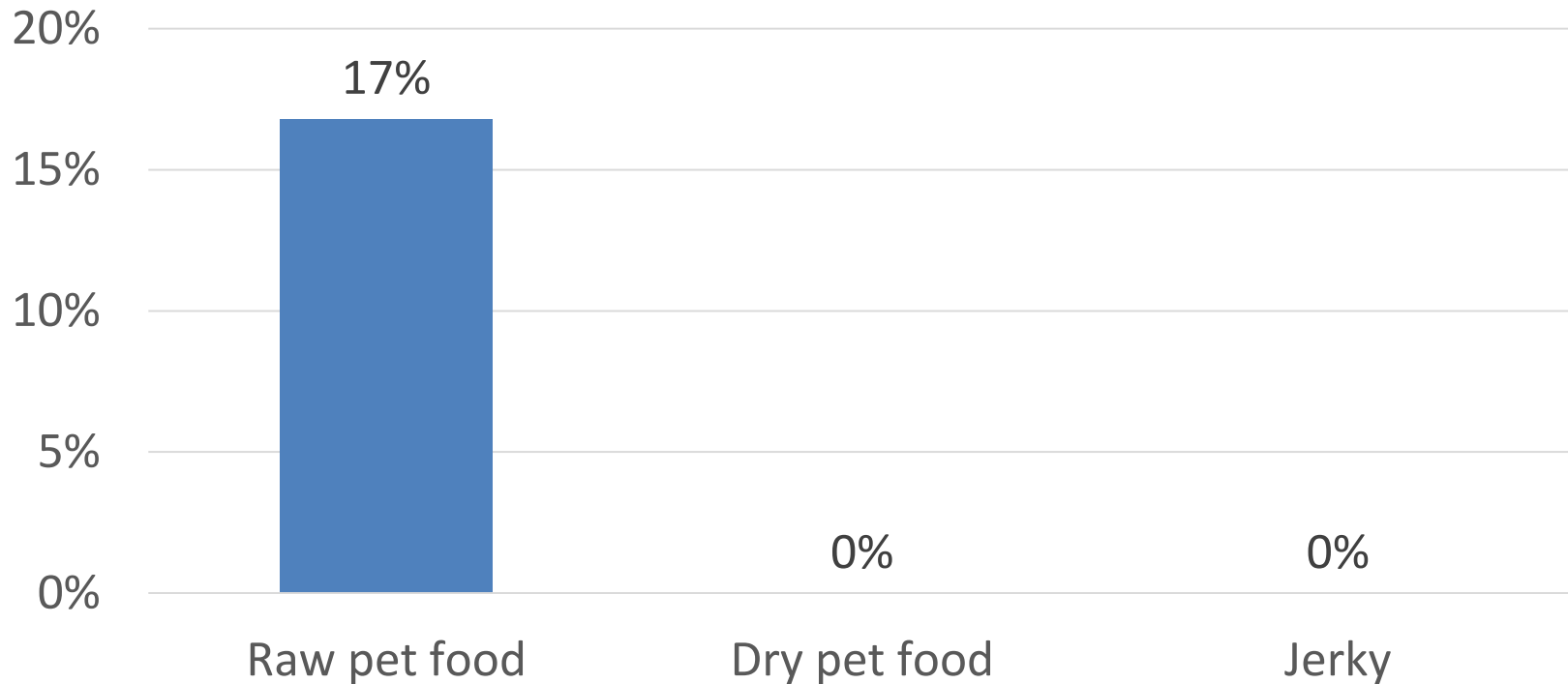
Nutrient deficiencies/toxicities in pet food

- Vitamin D toxicity
  - Typical cause: formulation and/or production error
  - Limited impact of ingredient

- Thiamine deficiency
  - Typical cause: thermal processing, storage, preservatives, formulation and/or production error
  - High thaminase ingredients (unprocessed freshwater fish and shellfish)

Molnar et al., 2017

Aflatoxin in pet food

- Mycotoxins
  - Specific growing conditions (cool/wet or hot) in some grains encourage the growth of various mold species.
  - molds, such as aspergillus and fusarium, produce mycotoxins during specific conditions.
  - Mycoto... illness in humans and animals at very ...
  - Severity depends upon a... base of production.
- Regulatory perspective: 20 ppb max...

- 20 ppb for corn, peanut products, cottonseed meal, and other animal feeds and feed ingredients intended for dairy animals, for animal species or uses not specified above, or when the intended use is not known;*

CPG Sec. 683.100 Action Levels for Aflatoxins in Animal Feeds

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Aflatoxin in pet food

- Distribution of fungal genera from raw materials and finished pet food

Substrate	Strains*	Fungal genera	Frequency†
Corn grains	43	*Aspergillus* spp.	65
		Mucor spp.	30.4
		Eurotium spp.	4.6
Corn meal	95	*Aspergillus* spp.	73.7
		Penicillium spp.	10.5
		Fusarium spp.	10.5
		Acremonium spp.	4.2
		Yeast spp.	1.1
Sorghum meal	617	*Aspergillus* spp.	75.3
		Alternaria spp.	22.3
		Fusarium spp.	2.4
Corn meal and gluten	275	*Aspergillus* spp.	89
		Fusarium spp.	7.8
		Penicillium spp.	3.2
Ready pet food	19	*Aspergillus* spp.	89
		Yeast spp.	11

*Number of strains isolated from each substrate.
†Percentage of strains of each genus present in each substrate (strains of each genus × 100/total strains).

Campos et al., 2008

Aflatoxin in pet food

- Distribution of *Aspergillus* spp. from raw materials and finished pet food

Campos et al., 2008

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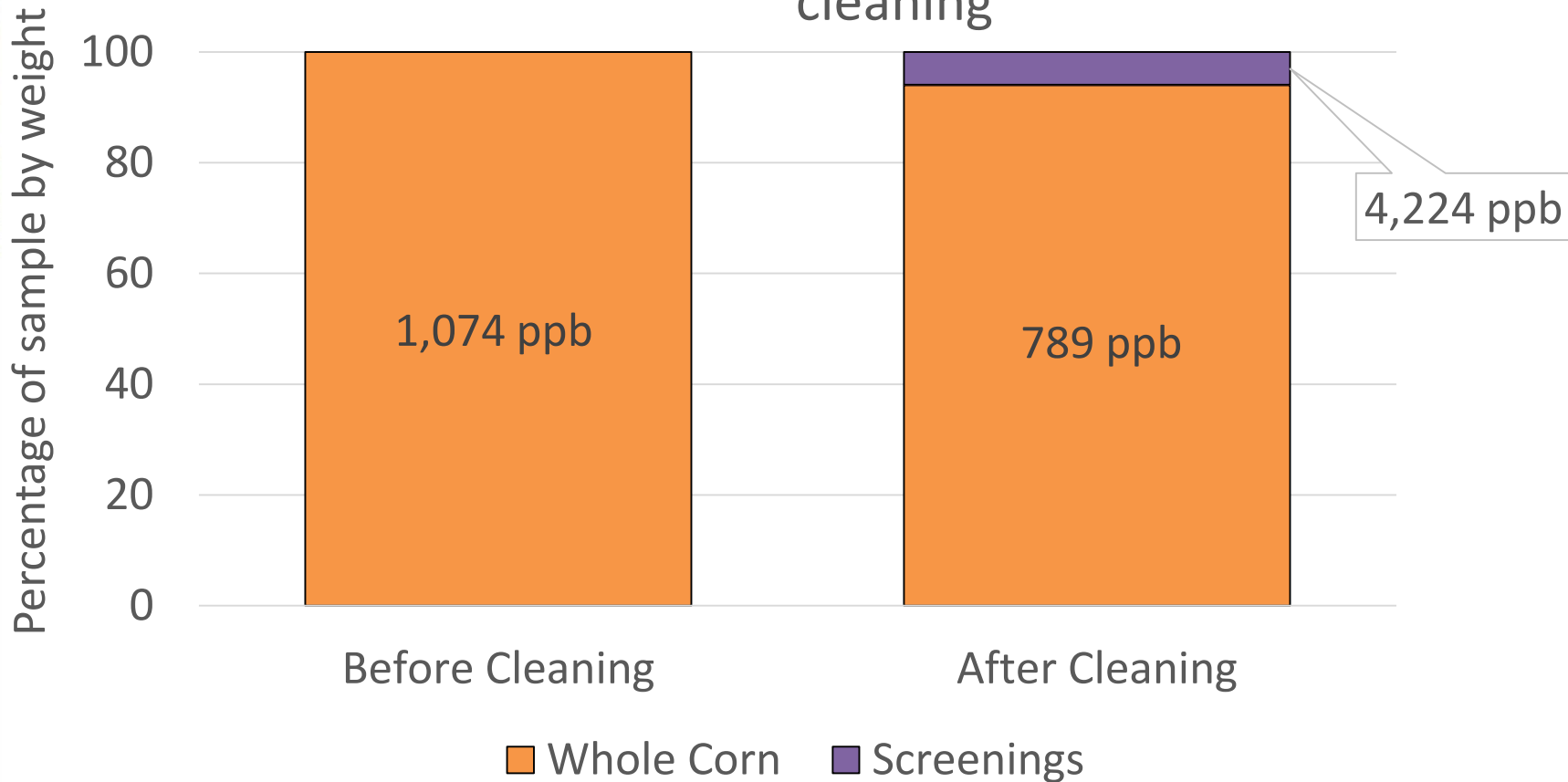UNIVERSITY
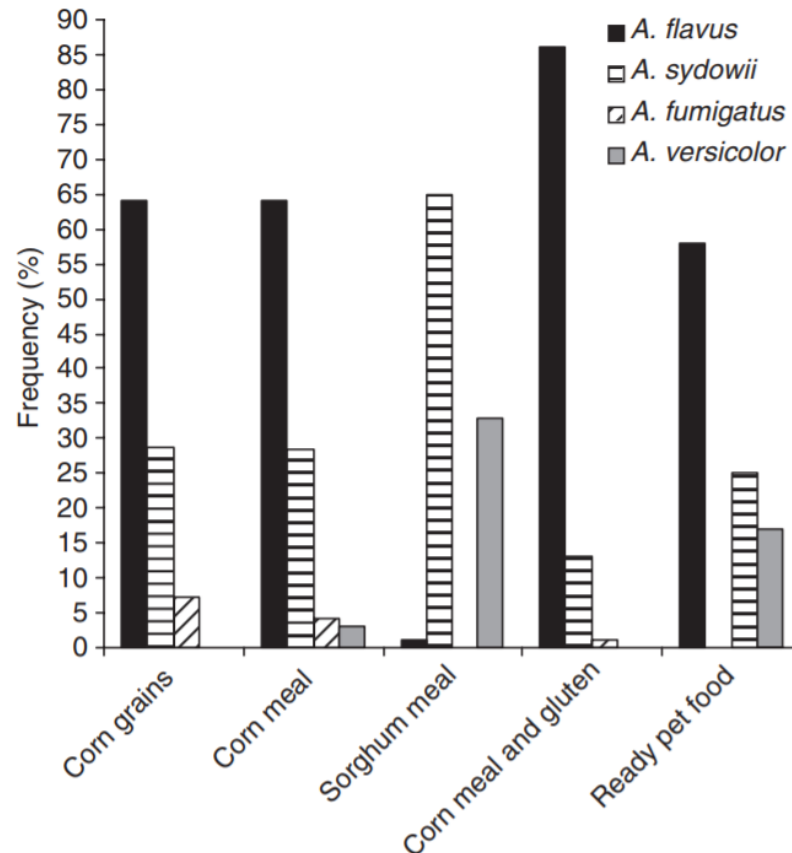
Aflatoxin in pet food

- Percentage of *Aspergillus flavus* strains ability to produce aflatoxins

Campos et al., 2008
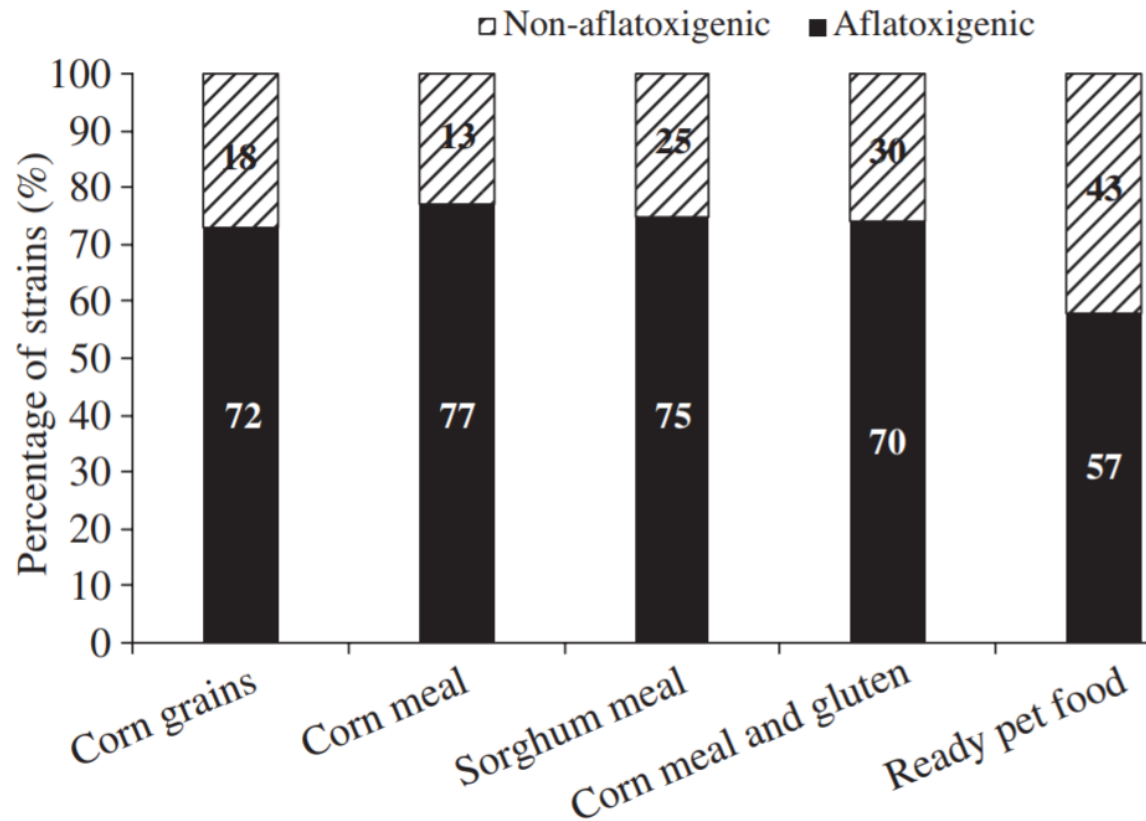
Aflatoxin in pet food

Aflatoxin content in corn fraction before and after cleaning

Before Cleaning: 1,074 ppb
After Cleaning: 789 ppb
Screenings: 4,224 ppb

Whole Corn ■ Screenings ■

Percentage of sample by weight

Yoder et al., 2017

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Aflatoxin in pet food

Aflatoxin level in corn before and after cleaning

Yoder et al., 2017
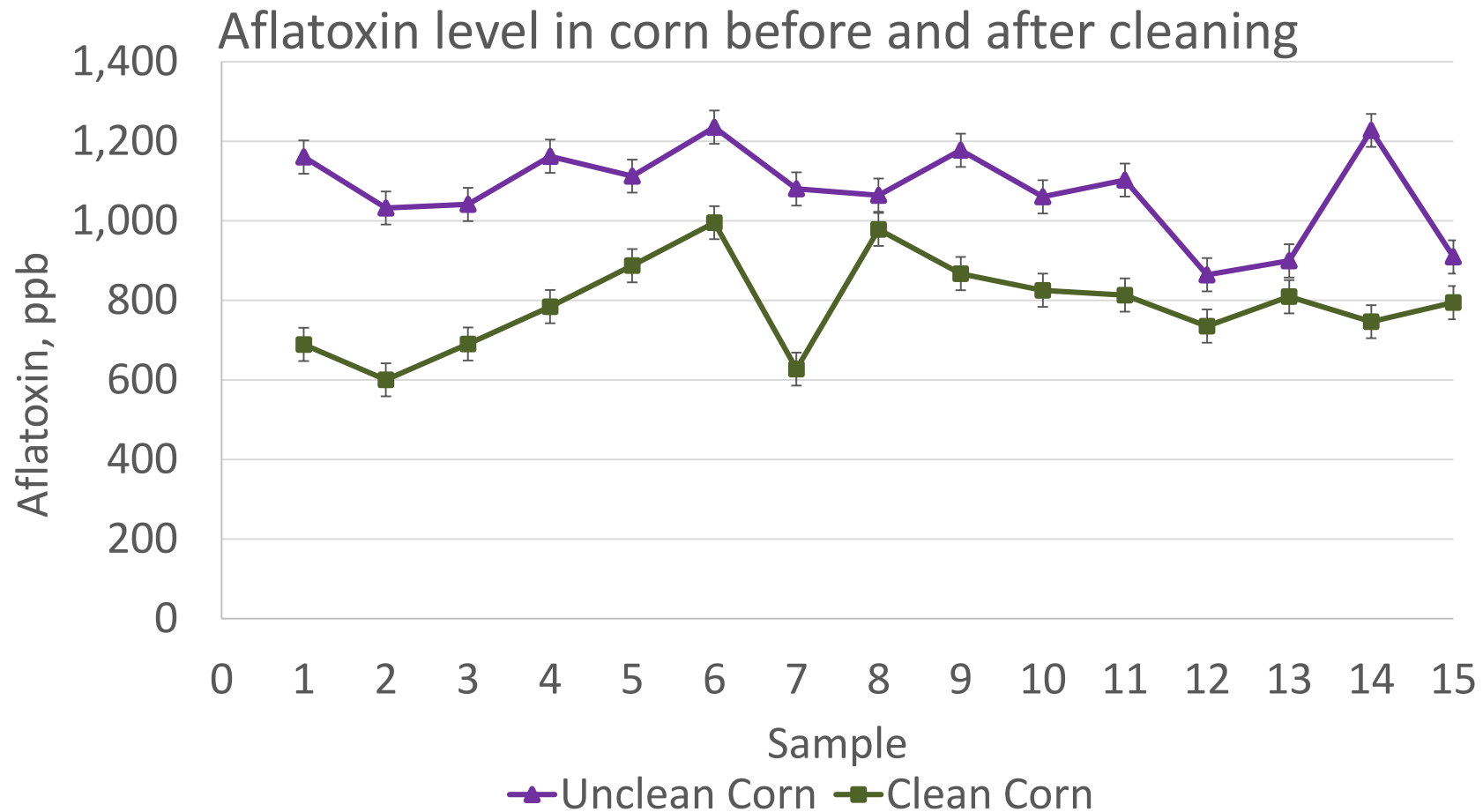
Allergens in pet food

- Regulatory perspective:

(Comment 259) Some comments ask us to consider revising the proposed rule to include food allergens in animal food much in the same way that they have been proposed in the human food rule.

(Response 259) We decline this request. We are not aware of evidence indicating that foodborne allergens pose a significant health risk to animals (78 FR 64736 at 64771). Animals with actual food allergies typically have digestive disorders or dermatologic conditions, not the anaphylactic reaction that humans have to the major food allergens (defined in section 201(qq) of the FD&C Act).

21 CFR 507 – Preamble of the *Preventive Controls for Animal Food* rule

Allergens in pet food

- Sources of allergens in pet foods

Case number	Dietary allergens
1	Beef
2	Lamb
3	Pork, beef, chicken, lamb, milk, egg, corn, soya, gluten
4	Beef
5	Beef, egg
6	Beef
7	Beef, milk
8	Lamb
9	Beef
10	Beef, pork, lamb

Case number	Dietary allergens
11	Chicken
12	Beef
13	Beef
14	Gluten
15	Beef, gluten
16	Egg
17	Gluten
	Beef, gluten
18	
19	Beef
20	Egg, lamb

Dog No.	Offending food allergens	Positive skin test results
1	Beef	None
2	Milk, wheat	None
3	Beef wheat	Wheat
4	Beef, milk soybean, thicken, whole egg	Pork, soybean, wheat
5	Beef, soybean	Soybean
6*	Beef, milk Beef	None Barley, carrot, corn, potato wheat
3 r	Beef, chicken commercial dry diet	Corn
9	Beef, milk wheat	None
10	Beef	None
11*	Beef, chicken	None
12	Beef, milk, wheat, soybean, whole egg, commercial dry diet	None
13	Beef	None

Paterson, 1995; Jeffers et al., 1991

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