


# Raw meat-based diets are upon us: How do we ensure their safety?

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## A review of food additives to control the proliferation and transmission of pathogenic microorganisms with emphasis on applications to raw meat-based diets for companion animals

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Research Paper

**Application of Encapsulated and Dry-plated Food Acidulants to Control *Salmonella enterica* in Raw Meat-based Diets for Dogs**

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## What are Raw Meat-Based Diets (RMBDs)

- RMBDs are a segment of minimally processed pet food different from conventional diets (Kiprotich & Aldrich, 2022).
- Minimally processed pet foods can be classified as “Minimally Processed Commercial Diets” (MPCD) or “Minimally Processed Home Diets” (MPHD) (Raditic, 2021).
- Raw diets consist of uncooked/unpasteurized animal proteins obtained from beef, poultry, veal, venison, lamb, pork and organ meats.
- The market share was estimated at \$120 million in 2021.



[\(1\) Best Raw Dog Food - Bing Images](#)

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## What makes raw diets unique?

- Raw diets are defined by AAFCO as; “feed or feed ingredient derived solely from plant, animal or mined sources, in its unprocessed state.”
- Therefore, raw diets cannot be;
  - Frozen, cooked, rendered, fermented, hydrolyzed or purified.
- Raw diets have water activity of >0.98, pH range of 5.5-6.5
- Without a “true kill-step”, RMBDs are often contaminated with enteric foodborne pathogens.
- Some of the ingredients used in making RMBDs inherently contain pathogens e.g., *Salmonella* in chicken
- Currently, pasteurization techniques of RMBDs are high-pressure processing or irradiation and are either costly or inefficient.

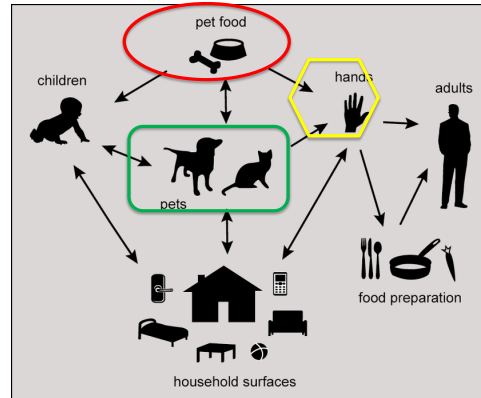
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## Contamination and recall of Raw Diets

- The following pathogens have been isolated from RMBDs; *Salmonella spp.*, *Campylobacter jejuni*, *Listeria spp.*, *Yersinia spp.* and *Escherichia coli*.
- RMBDs have also directly resulted into at least 6 foodborne disease outbreaks in North America with some being underreported (Morley *et al.*, 2006).
- RMBDs have also been implicated in the transmission of multi-drug resistant bacterial strains, thus increasing public health concerns (Nüesch-Inderbinen *et al.*, 2019).
- There have been over 80 commercial product recalls resulting from bacterial contamination reported by the FDA from 2017 to date (FDA, 2022).

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## Why should we care about RMBDs?



Lambertini et al., (2015)

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## Prevalence of contamination in RMBDs

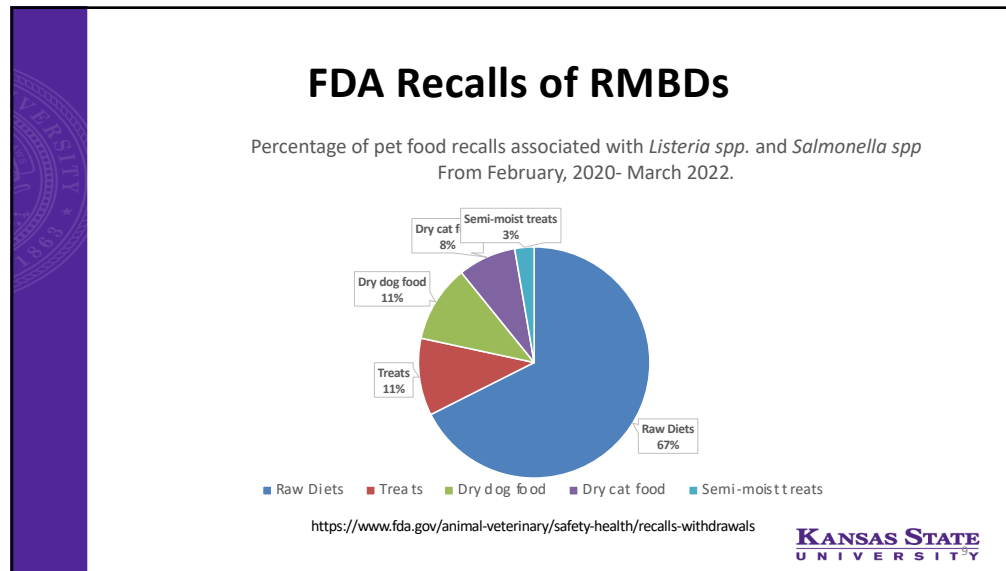
Types of pet food samples that tested positive for *Salmonella* and *Listeria monocytogenes* (Years 2010-2012) in an FDA study

Type of Dog Food	No. of Samples tested	<i>Salmonella</i> positive samples	<i>Listeria</i> positive samples
Raw pet food	196	15	32
Dry exotic pet food	196	0	0
Jerky type treats	196	0	0
Semi-moist pet food	196	0	0
Semi-moist cat food	196	0	0
Dry dog food	196	0	0
Dry cat food	196	1	0

<https://www.fda.gov/animal-veterinary/animal-health-literacy/get-facts-raw-pet-food-diets-can-be-dangerous-you-and-your-pet>

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## The Nature of the Challenge

Unlike meat and poultry products, RMBDs have the following challenges:

- Variable contamination of raw materials
- No thermal process
- Combination of meat, vegetables, additives
- Ingredients are blended, and stored via refrigeration
- Cold transportation shortfalls
- Simple packaging- Is it adequate? Time to explore MAP CAP?
- Adequacy of antimicrobial interventions “kill-steps” or hurdles?



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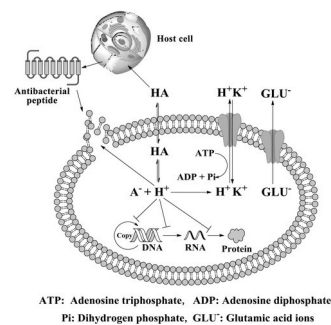
## Pasteurization of RMBDs using organic acids

- Organic acidulants like GDL, citric and lactic have antimicrobial properties (Mani-López *et al.*, 2012) and have been challenged against numerous pathogens in meat and poultry products.
- However, direct acid application results into undesirable changes in the product quality i.e., color, texture, syneresis and lipid oxidation (Over *et al.*, 2009).
- In encapsulation, organic acids are coated with an edible film of vegetable oil.
- Encapsulation allows for the slow release of acid into the meat product, avoiding acid shock, mitigating the undesirable effects of rapid acidification caused by addition dry-plated acids (Harris *et al.*, 2006).

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## Mechanism of action of organic acids

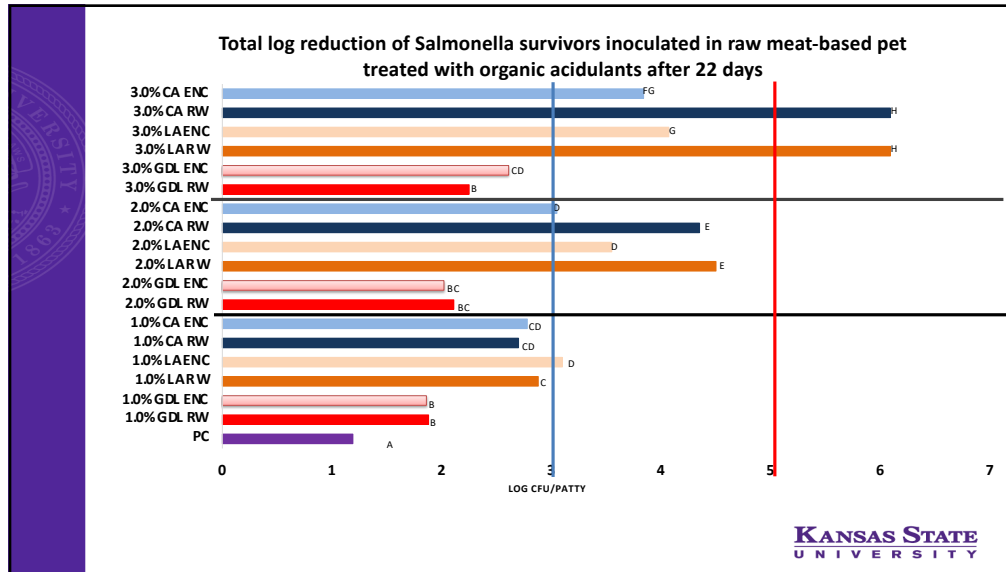


Zhang *et al.*, (2011)

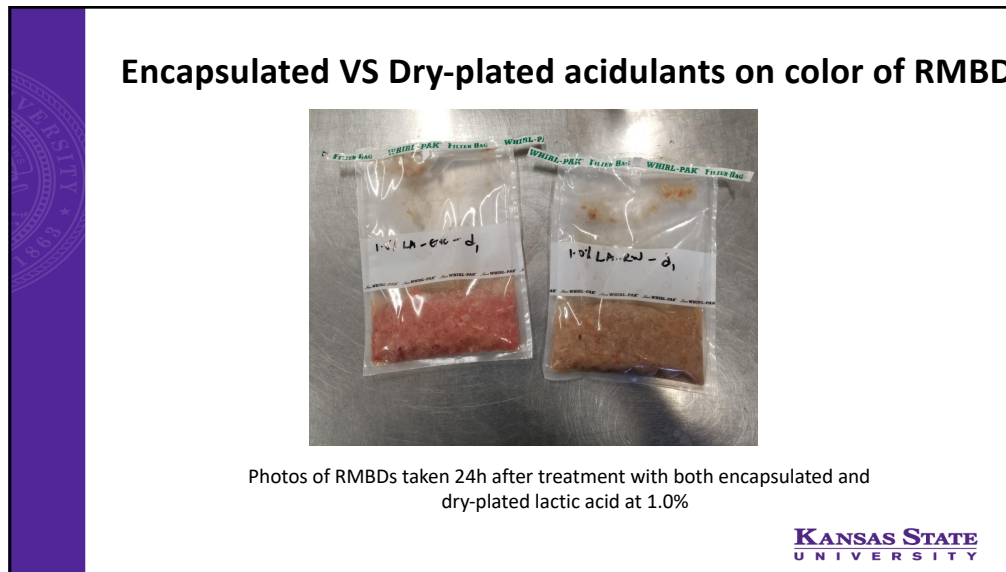
The antibacterial action of lactic acid is largely, but not totally, assigned to its ability in the undissociated form to penetrate the cytoplasmic membrane, resulting in reduced intracellular pH and disruption of the transmembrane proton motive force

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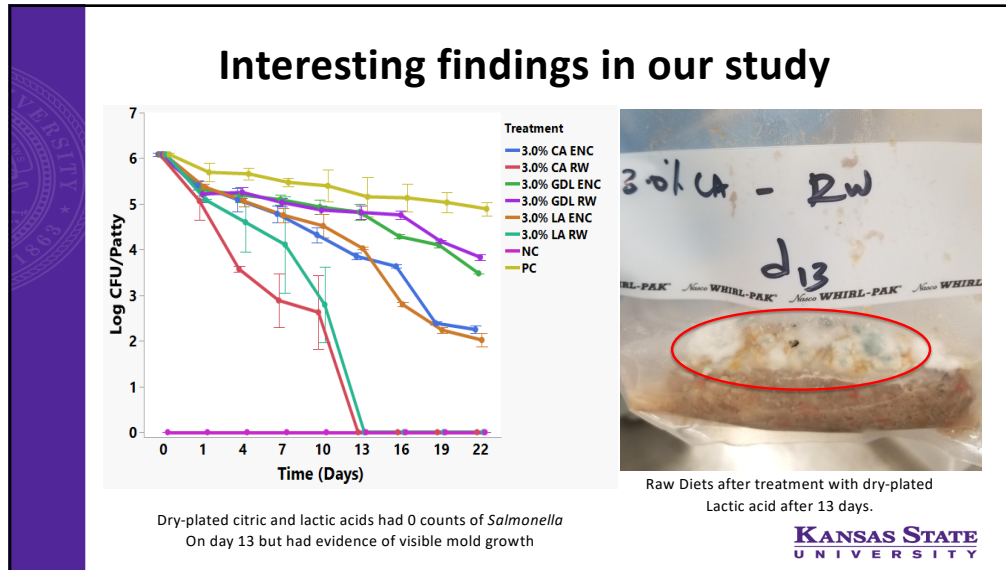
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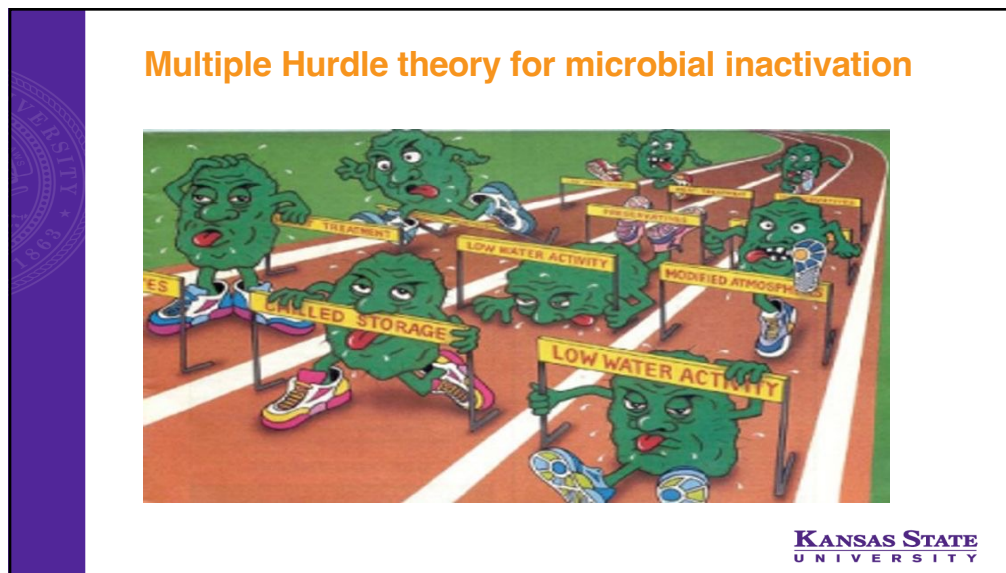
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## On-going and Future Research

1. Evaluation of synergies from combinations of food acidulants.
2. Predictive modelling for the survival of pathogens in RMBDs treated with food acidulants.
3. Microbial Shelf-life and product quality studies
4. Palatability studies of RMBDs treated with food acidulants
5. Control of foodborne pathogens in freeze-dried diets treated with food acidulants.