The Antimicrobial Properties of a Vinegar-based Ingredient on *Salmonella* Typhimurium and Psychrotrophs inoculated in Ground Chicken Breast Meat and stored at $3 \pm 1^\circ$ C for 7 days

C.M. Harris*, S.K. Williams*¹
PhD Candidate
Department of Animal Sciences
Meat and Poultry Processing and Food Safety
INTRODUCTION

The CDC estimates that each year roughly 48 million people get sick from a foodborne illness that leads to 128,000 hospitalizations, and 3,000 deaths (CDC, 2017).
Organic acids such as lactic acid, acetic acid, and citric acid are effective at reducing microorganisms such as *E. coli*, *Salmonella* spp., coliforms and aerobic bacteria in poultry and meat processing.

Desai et al., 2014
A proprietary blend of vinegar (source of acetic acid) and natural flavorings with applications in the meat and poultry industry

• FSIS Directive 7120.1 rev. 46 p 30
• 95% vinegar
• Generally Recognized as Safe (GRAS)
• Labeled “Safe and Suitable”
• Considered as a clean label product
OBJECTIVES

• To determine the antimicrobial effects of DefenStat™, against *Salmonella* Typhimurium on skinless ground chicken breast meat

• To establish the effects of the DefenStat™ on pH
MATERIALS AND METHODS
Sample: Skinless chicken breast

- Purchased from a local supermarket
- Purchased on day of arrival to store
- Transported to the Meat Research Laboratory
- Chicken was stored in cooler (3 ± 1°C for maximum of 24 h prior to treatment
Sample: Skinless chicken breast

- Grind Chicken Breast
- 250 g sample per treatment
- Inoculate meat with *Salmonella* Typhimurium
- Let set for 10 min and treat with Defenstat™
- Packaged aseptically in sterile WhirlPak bags containing one 25g sample per bag, stored at 3±1 C
*Salmonella* Typhimurium strain ATCC 13311

- Stored frozen at -80°C
- Thawed at room temperature under running cold tap water
- Transferred loopful into 9 mL sterile Tryptic soy broth
- Incubated for 18h at 35°C
- Inoculum (10⁷ CFU/mL) for ground chicken
The Defenstat™ product was tested at three different levels

• 1%
• 2%
• 3%
SERIAL DILUTIONS

- Analyze at day 0, 1, 3, 5, and 7
- *Salmonella*, psychrotrophs, and pH
- Media used:
  - Tryptic Soy Agar
  - XLT-4 Media
STATISTICAL ANALYSIS

• A completely randomized block design with two replications was used to test the treatment effects ($P<0.05$) of DefenStat™ and storage days of microbial counts and pH.
• General Linear Models (GLM) procedures of SAS.
• Means were generated using LS Means and separated with the PDIFF of GLM.
• Means were considered significantly different at $P<0.05$. 
RESULTS AND DISCUSSION
### Table 1: Psychrotrophic bacteria count (log cfu/g) for ground chicken breast treated with DefenStat™

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Day 0</th>
<th>Day 1</th>
<th>Day 3</th>
<th>Day 5</th>
<th>Day 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meat only</td>
<td>4.61\textsuperscript{c,w}</td>
<td>4.45\textsuperscript{c,w}</td>
<td>5.54\textsuperscript{b,w}</td>
<td>6.01\textsuperscript{b,w}</td>
<td>7.00\textsuperscript{a,w}</td>
</tr>
<tr>
<td>Meat + Inoculum</td>
<td>4.31\textsuperscript{c,w}</td>
<td>4.37\textsuperscript{c,w}</td>
<td>5.79\textsuperscript{b,w}</td>
<td>6.02\textsuperscript{b,w}</td>
<td>7.13\textsuperscript{a,w}</td>
</tr>
<tr>
<td>Meat + 1% Defenstat</td>
<td>4.59\textsuperscript{b,w}</td>
<td>4.60\textsuperscript{b,w}</td>
<td>5.44\textsuperscript{a,w}</td>
<td>5.35\textsuperscript{a,x}</td>
<td>4.92\textsuperscript{ab,y}</td>
</tr>
<tr>
<td>Meat + 2% Defenstat</td>
<td>4.53\textsuperscript{ab,w}</td>
<td>4.03\textsuperscript{b,w}</td>
<td>5.48\textsuperscript{a,w}</td>
<td>5.26\textsuperscript{a,x}</td>
<td>5.27\textsuperscript{a,y}</td>
</tr>
<tr>
<td>Meat + 3% Defenstat</td>
<td>4.51\textsuperscript{b,w}</td>
<td>4.44\textsuperscript{b,w}</td>
<td>5.62\textsuperscript{a,w}</td>
<td>5.46\textsuperscript{a,x}</td>
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\textsuperscript{a,b,c} Means within a row lacking a common superscript differ (\(P<0.05\))

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<tbody>
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<td>0</td>
<td>0</td>
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<sup>w,x,y</sup> Means within a column lacking a common superscript differ (P < 0.05)
### Table 3: pH for ground chicken breast treated with DefenStat™

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• DefenStat™ retarded the growth of psychrotrophic bacteria, which suggested that DefenStat™ might extend the shelf life of the product beyond 7 days. However, a shelf life study is needed.

• DefenStat™ was effective in reducing *Salmonella* Typhimurium on days 0, 1, 5, and 7

• The results indicated that treating the ground chicken meat with DefenStat™ retarded the growth of *Salmonella* Typhimurium and psychrotrophs during seven days storage at 3 ±1°C

• The decrease in pH could be due to the acid tolerance response (ATR)
THANK YOU

QUESTIONS