

Evaluation of electrostatic spray application of antimicrobials in sequential treatment combinations on product safety and instrumental color qualities of beef *Biceps femoris* muscles

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Introduction

• Beef product safety is a serious concern for the meat industry as microbial pathogens can be introduced to muscle surfaces at various sources during processing.

• Public awareness of foodborne illness has increased, and in recent surveys food poisoning from meat was cited as the fifth biggest concern of U.S. consumers.

• Foodborne pathogens result in over 5,000 deaths a year, one-third of which can be attributed to pathogens found in meat and poultry.

• Since eradication of pathogens is challenging, the meat industry is continuously looking for new techniques to minimize pathogenic bacteria in final meat products.

Objective

To evaluate the effectiveness of antimicrobial sequential treatment combinations on microbiological and instrumental color characteristics of beef *Biceps femoris* muscles treated at the sub-primal level.

Materials and Methods

Bacterial preparation and inoculation

Escherichia coli (ATCC#11775) 0.1 mL

Salmonella Typhimurium (ATCC#176NR) 0.1 mL

Brain Heart Infusion
(40 ml)

Incubated at 37°C 18hr

Centrifugated 3500 × g for 20 min at 37°C

Re-suspended in Buffered Peptone

Bacterial cocktail (EC log 10⁷ CFU, 3600 ml) 4°C

Beef *Biceps femoris* (n = 11) were inoculated with the bacterial cocktail and placed in a 4°C cooler for 12 to 14 h

Antimicrobial Treatment and Analysis

Inoculated beef *Biceps femoris* muscles were sprayed with the electrostatic spraying system (3ml/sec/60psi) (n = 11)

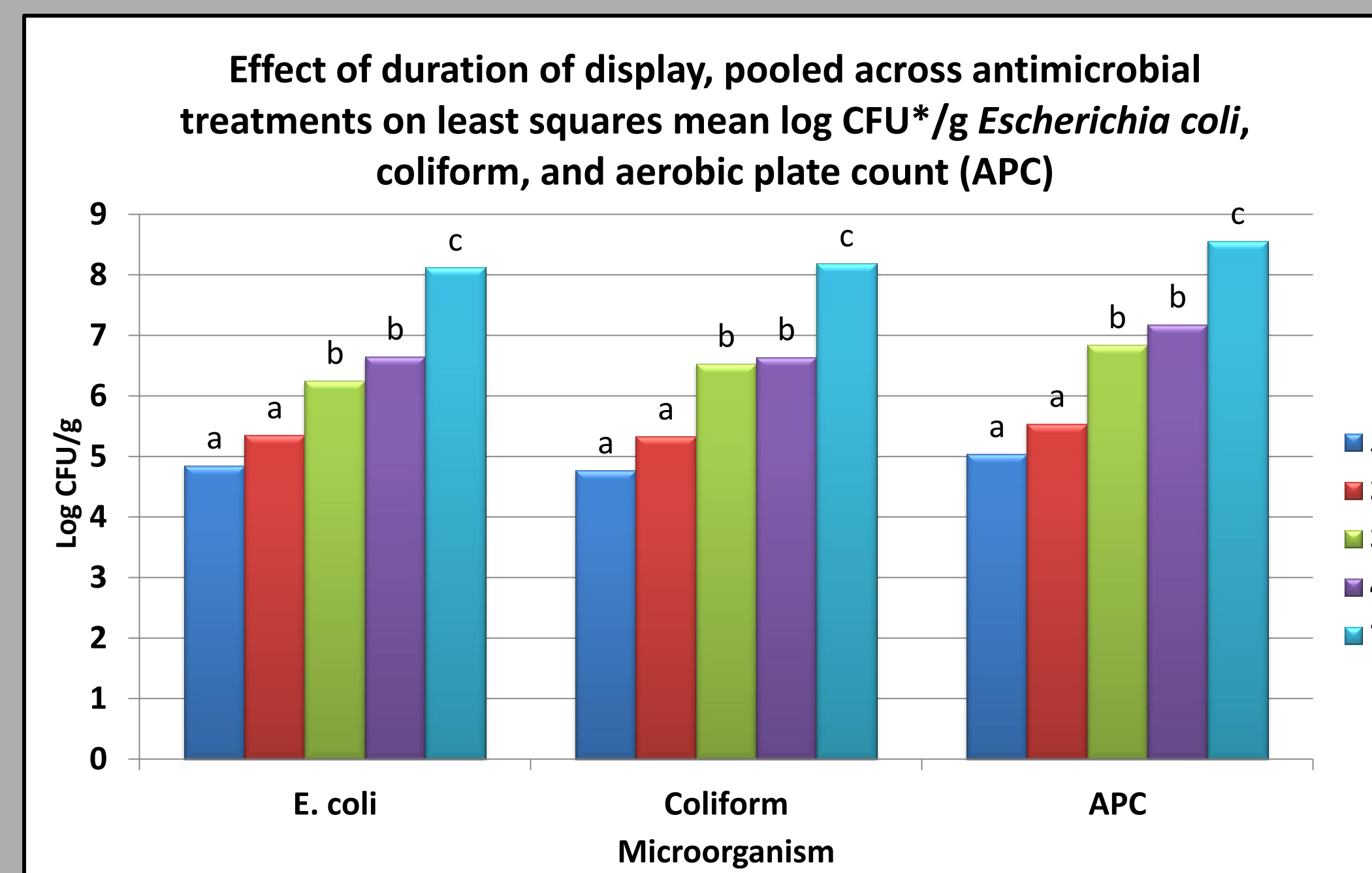
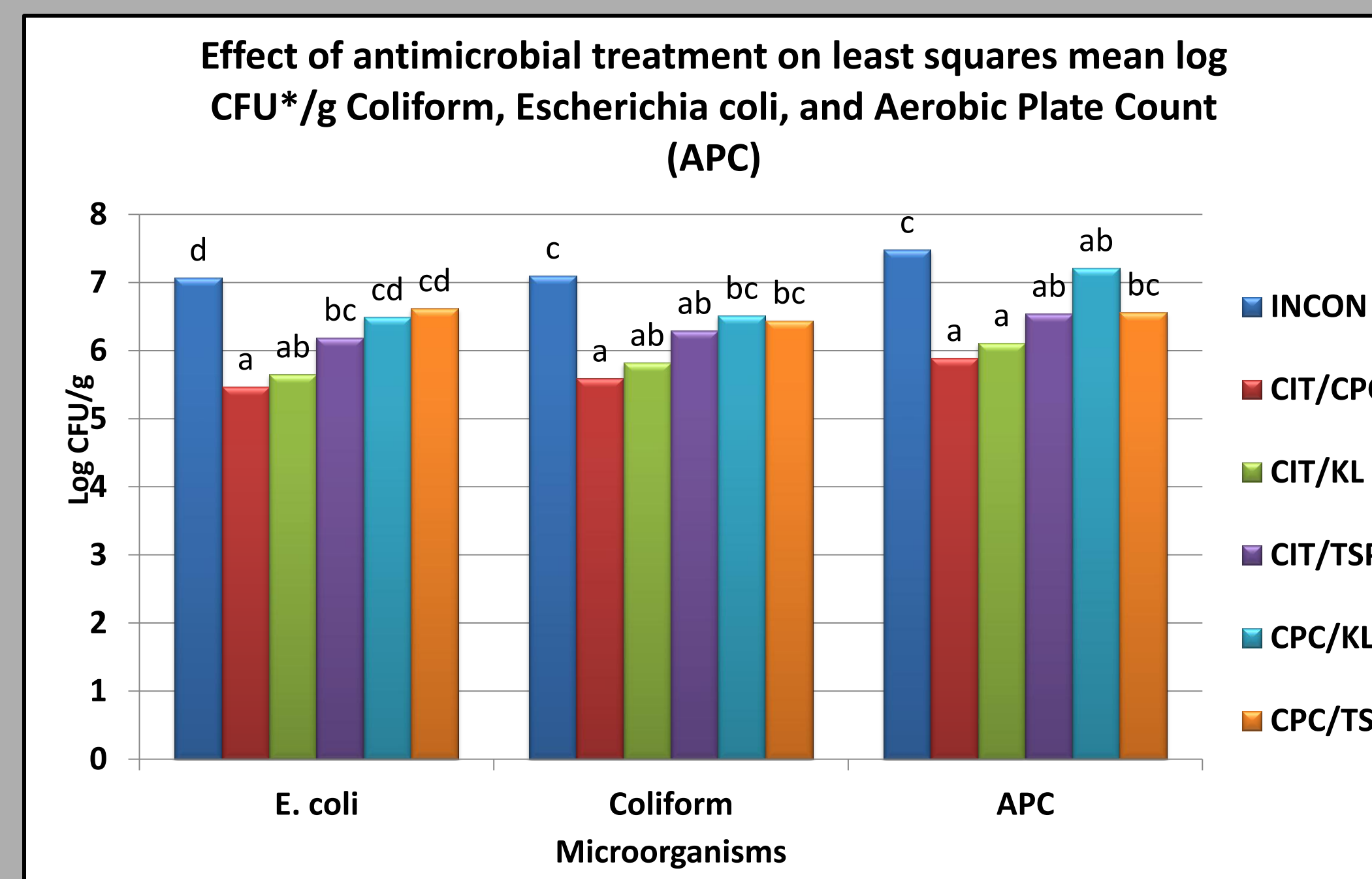
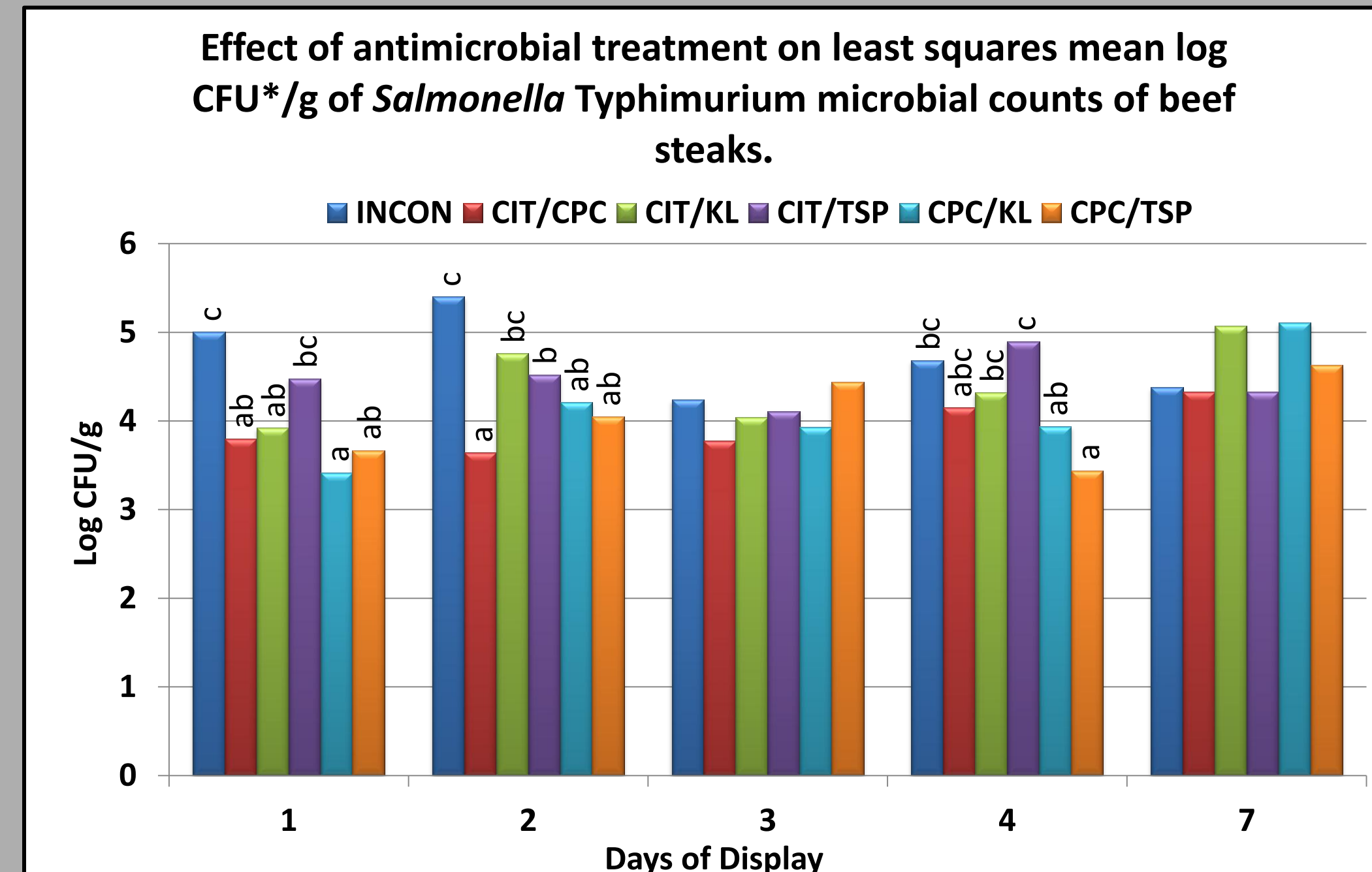
Uninoculated untreated beef *Biceps femoris* muscle (n=1)

Steaks were cut from each subsection (n=36 subsections)
Steaks were cut to 2.5cm thickness (n=108)

Steaks were overwrapped with polyvinyl chloride film.
(O₂ Transmission rate = 14,000 cc/mm²/24h/1atm)

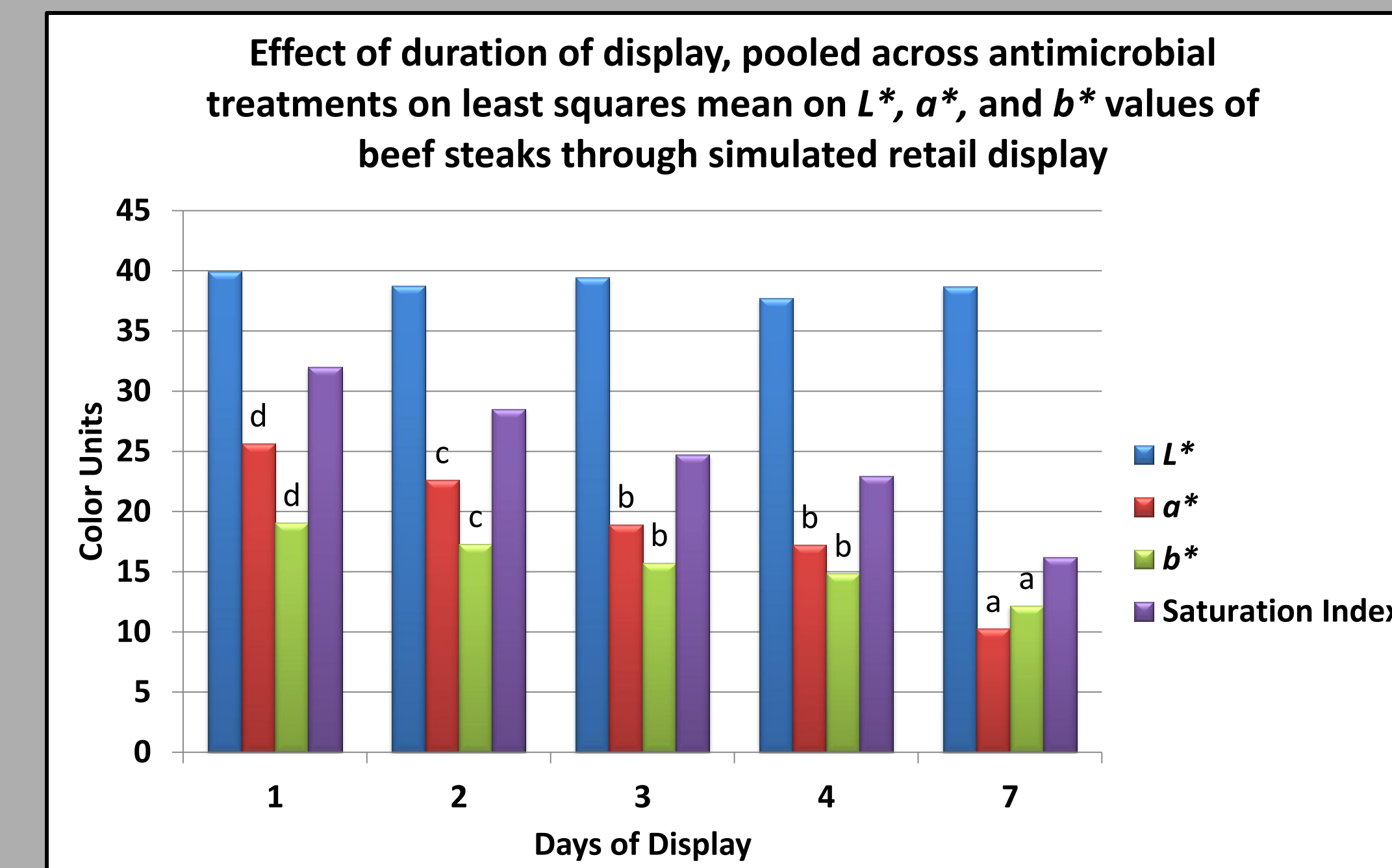
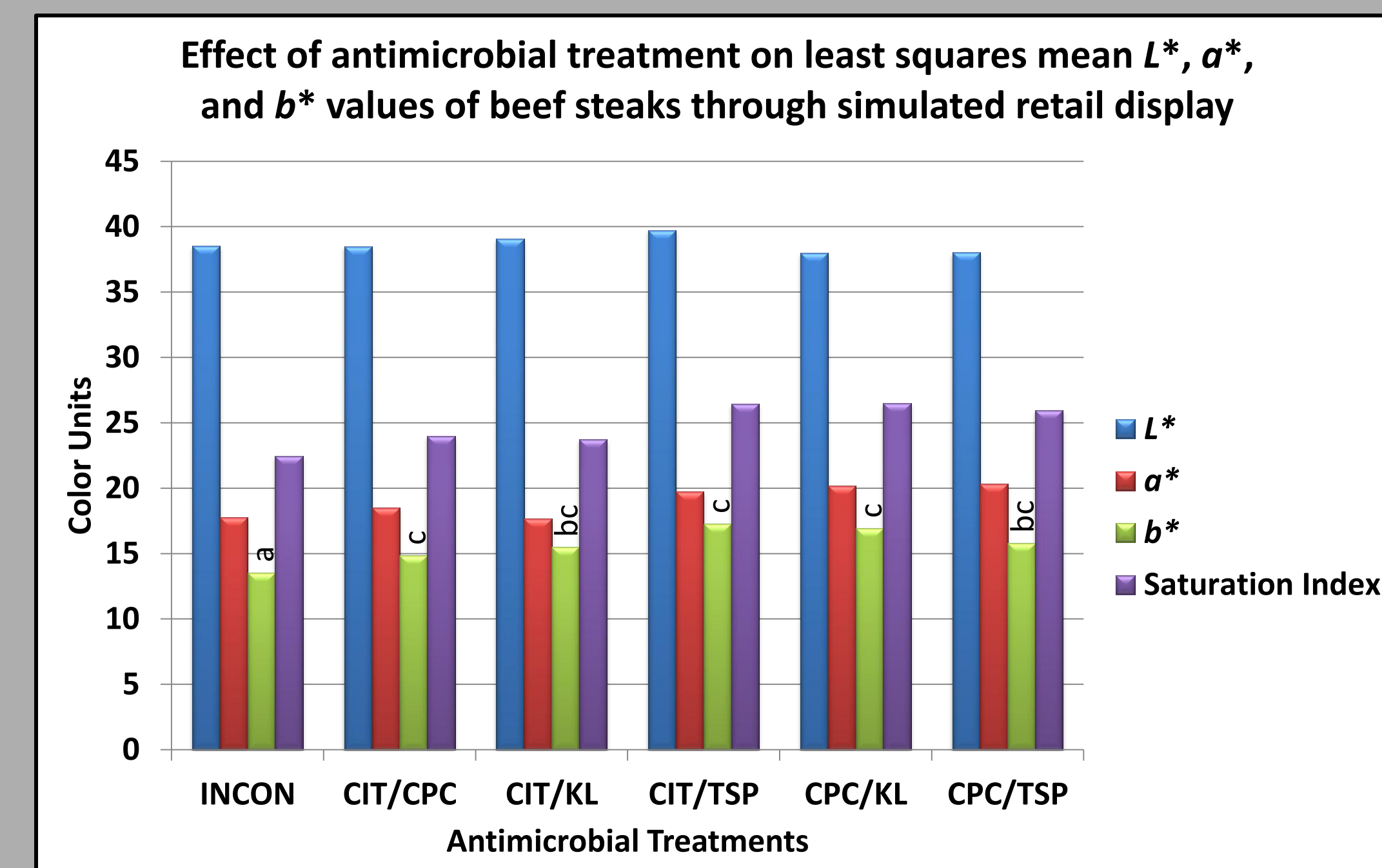
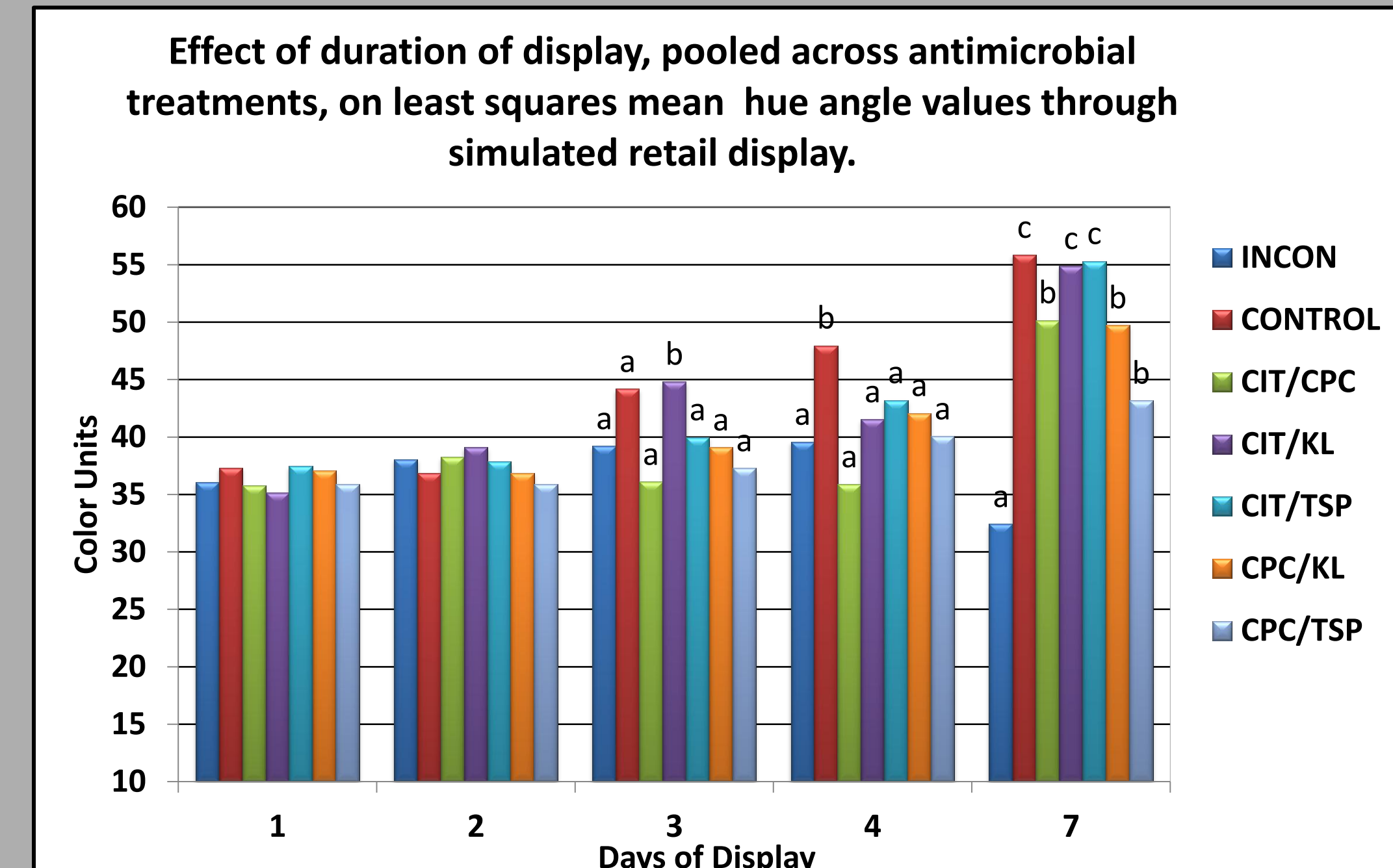
Stored in simulated retail display at 4°C
1630 lux of deluxe warm white fluorescent lighting

Results

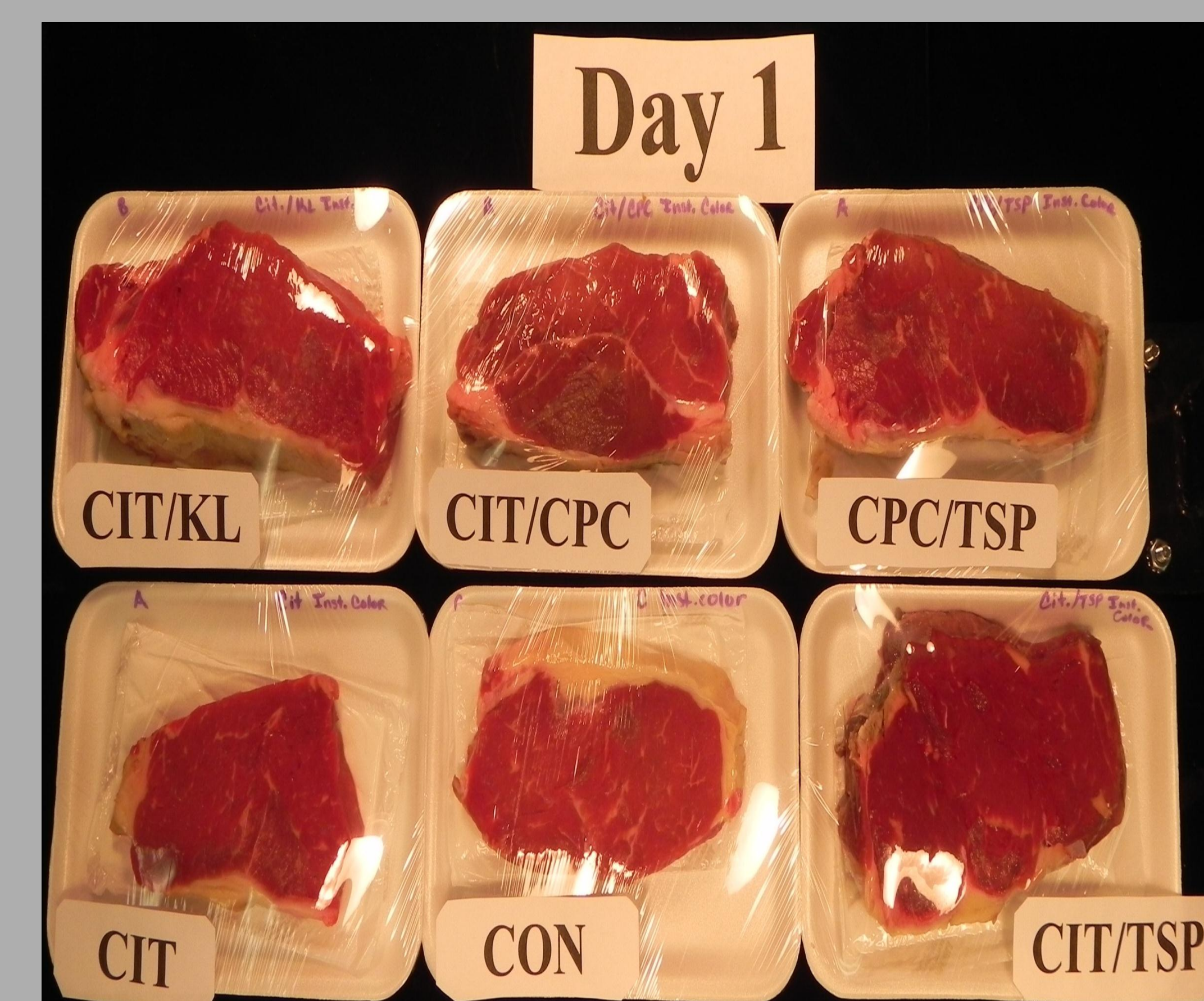


Electrostatic Antimicrobial Treatments

- INCON = untreated inoculated control
- CONTROL = untreated uninoculated control
- CIT/CPC = 20% hydrochloric / citric acid mixture followed by 0.4% cetylpyridinium chloride
- CIT/KL = 20% hydrochloric / citric acid mixture followed by 3% potassium lactate
- CIT/TSP = 20% hydrochloric / citric acid mixture followed by 10% trisodium phosphate
- CPC/KL = 0.4% cetylpyridinium chloride followed by 3% potassium lactate
- CPC/TSP = 0.4% cetylpyridinium chloride followed by 10% trisodium phosphate



*CFU- colony forming units
abcd Least squares means within day with different superscripts differ (P < 0.05)



Conclusion

Results suggest that treatment of *Biceps femoris* muscles at the sub-primal level with allotted treatment combinations may enhance shelf-life initially, but become similar to the control by day 7 of display. An added benefit is these treatments did not affect L*, a* and b*.

Instrumental color characteristics :

- Hunter MiniScan XE
- Illuminant A and 10 observer
- Properties for L*, a*, b*, hue angle and saturation index were evaluated on days 1, 2, 3, 4, and 7.
- Least squares means were generated for all variables and separated using the PDIFF option of SAS

Antimicrobial Analysis:

- Sampled on day 1, 2, 3, 4 and 7 as described by Pohlman et al., 2009.
- Spread plating in duplicates: Aerobic plate count (APC), *E. coli* (EC) / coliform (CO) counts on Petrifilm ®. ST was plated on *Salmonella* Shigella Agar.
- Bacterial values were transformed to log values and least squares means were generated for all variables and separated using the PDIFF option of SAS.