

Effect of Mustard Powder on the Survival of *Salmonella* ser. Typhimurium in Packaged Shredded Cheese



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Objective

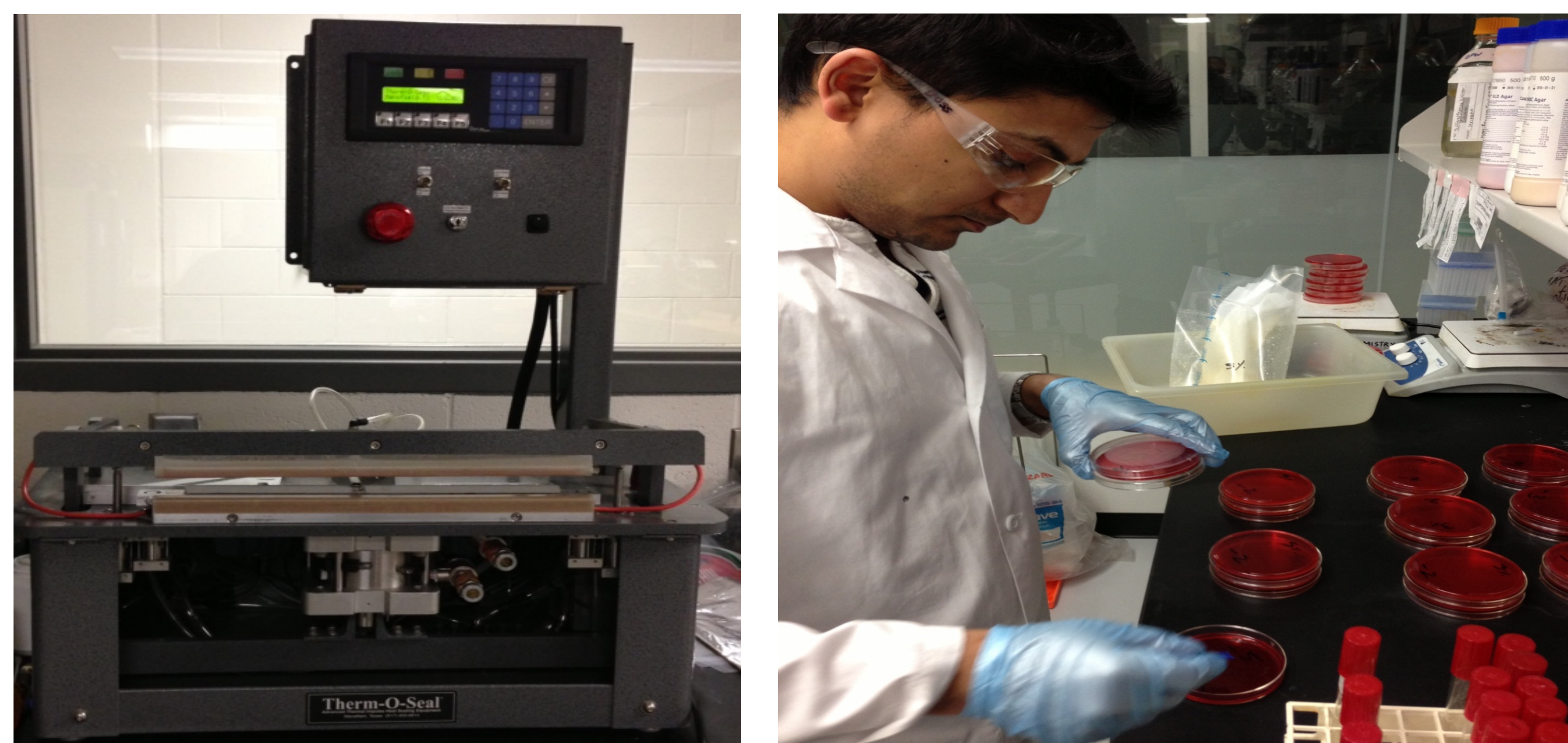
- To evaluate the effect of mustard powder on the survival of *Salmonella* ser. Typhimurium in shredded cheese.

Introduction

- Cheese is a ready-to-eat (RTE) food product and there have been several cheese-related foodborne outbreaks in the United States.
- Since 2007, a total of 403 dairy related illnesses, epidemiologically linked to *Salmonella* have been reported in the United States.
- Glucosinolates, found in Brassicale vegetables, when hydrolyzed enzymatically, produce Allyl Isothiocyanate (AITC) which is a strong volatile antibacterial and antimycotic agent.
- Mustard, a source of glucosinolate, when added to cheese as an ingredient may enhance microbial safety and quality of cheese.

Table 1: Reports of *Salmonella* outbreaks in the United States associated with consumption of dairy products (since 2007 to present).

Year	State	Etiology	No of Illness	Hospitalizations	Source
2008	NJ	S. Java	70	0	Pasteurized cheddar cheese
2007	Multi-State	S. Montevideo	20	9	Pasteurized shredded cheese
2004	CA	S. Newport	100	5	Pasteurized milk
2002	WY	S. Typhimurium	116	4	Pasteurized 2% milk; served at school
2001	CT	S. Newport	4	1	Pasteurized milk
2000	PA/NJ	S. Typhimurium	93	6	Pasteurized milk



Material and Methods

Sample Preparation and Inoculation of Cheese Samples

- Shredded mozzarella cheese (Cady Cheese, Wilson, WI) was aseptically mixed with mustard powder (Zenobia LLC, Bronx, NY) at the concentration of 0, 2.9, 4.8, 9.1 and 16.7% (w/w).
- 50g of each treatment sample was placed into sterile polyethylene packages (17x15.5 cm) (Flair Flexible Corp., Appleton, WI).
- Packages were gas flushed (70% Nitrogen and 30% Carbon dioxide) and sealed (14-TT-VAC-1/4, Mansfield, TX).
- Salmonella* ser. Typhimurium at the concentration of 6.2 log CFU per gram of cheese was inoculated using syringe and septum (PPL-193456, Illinois Instrument, Johnsonburgs, IL).
- A three strain cocktail of *Salmonella* ser. Typhimurium (ATCC 14028, 25241 and 13311) was used in the study
- Packaged cheese samples were stored under refrigerated condition at 4°C.

Enumeration for *Salmonella* Ser. Typhimurium

- Cheese samples were sampled periodically during storage for enumeration of *Salmonella* populations (days 0, 1, 2, 3, 5, 8, 11 and 15)
- For enumeration, packaged cheese sample was stomached (Seward Stomacher 400, UK) in Stomacher bags (BA6041/57R Seward, UK) with 100 ml of sterile 0.1% buffer peptone-water (BPW) for 30 seconds.
- Decimal dilutions of the stomached preparation was plated on Xylose lysine deoxycholate (XLD) agar and the plates were incubated at 37°C for 24 hours before colonies were counted.

Statistical Analysis

- All packaging tests was replicated three times. Significant differences between treatment means was analyzed using Analysis of Variance (ANOVA) using the Minitab Statistical Software.

Results

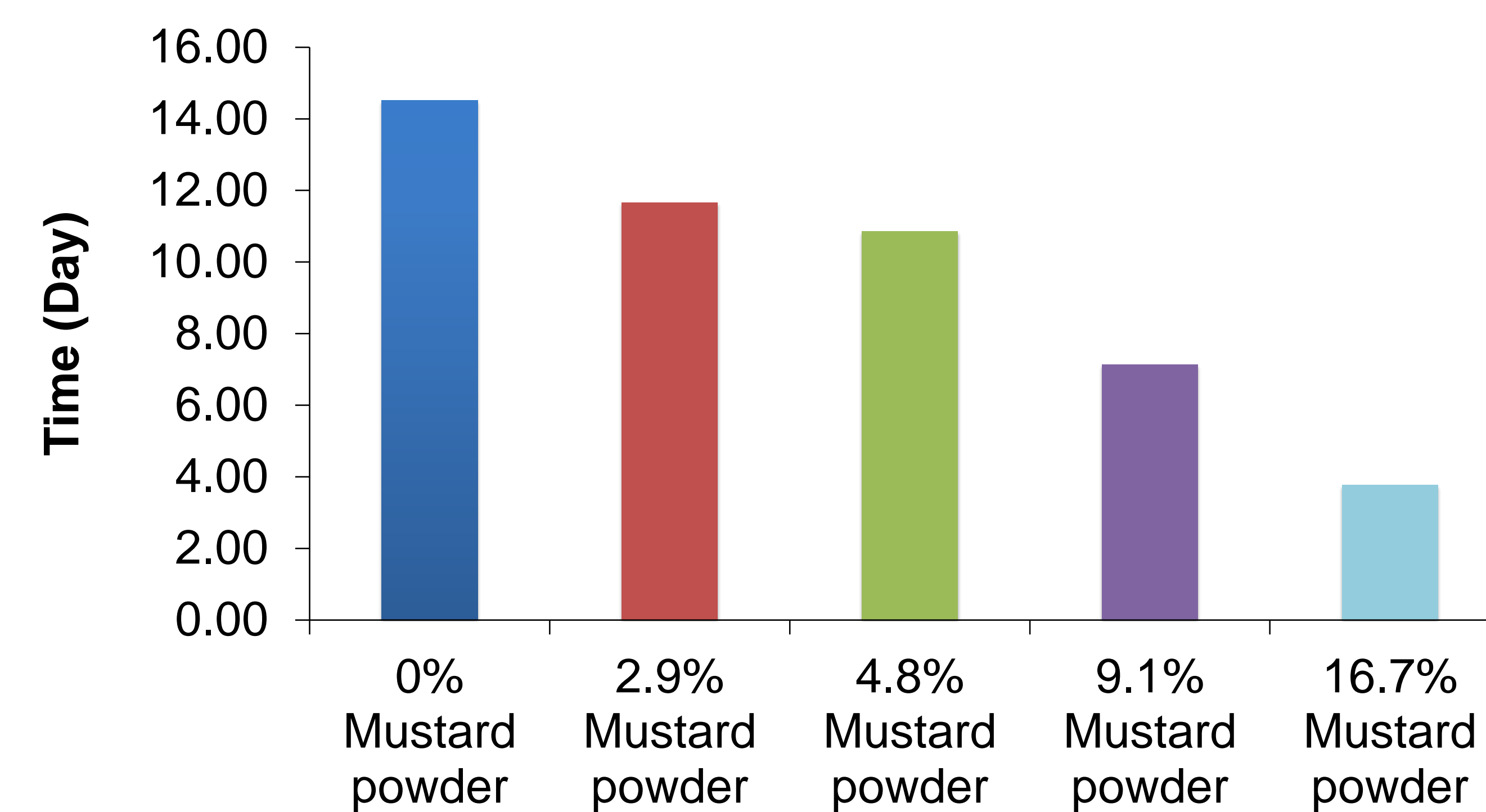


Figure 1 D-values (Decimal reduction time) for *Salmonella* ser. Typhimurium in cheese with varying level of mustard powder, stored at 4°C.

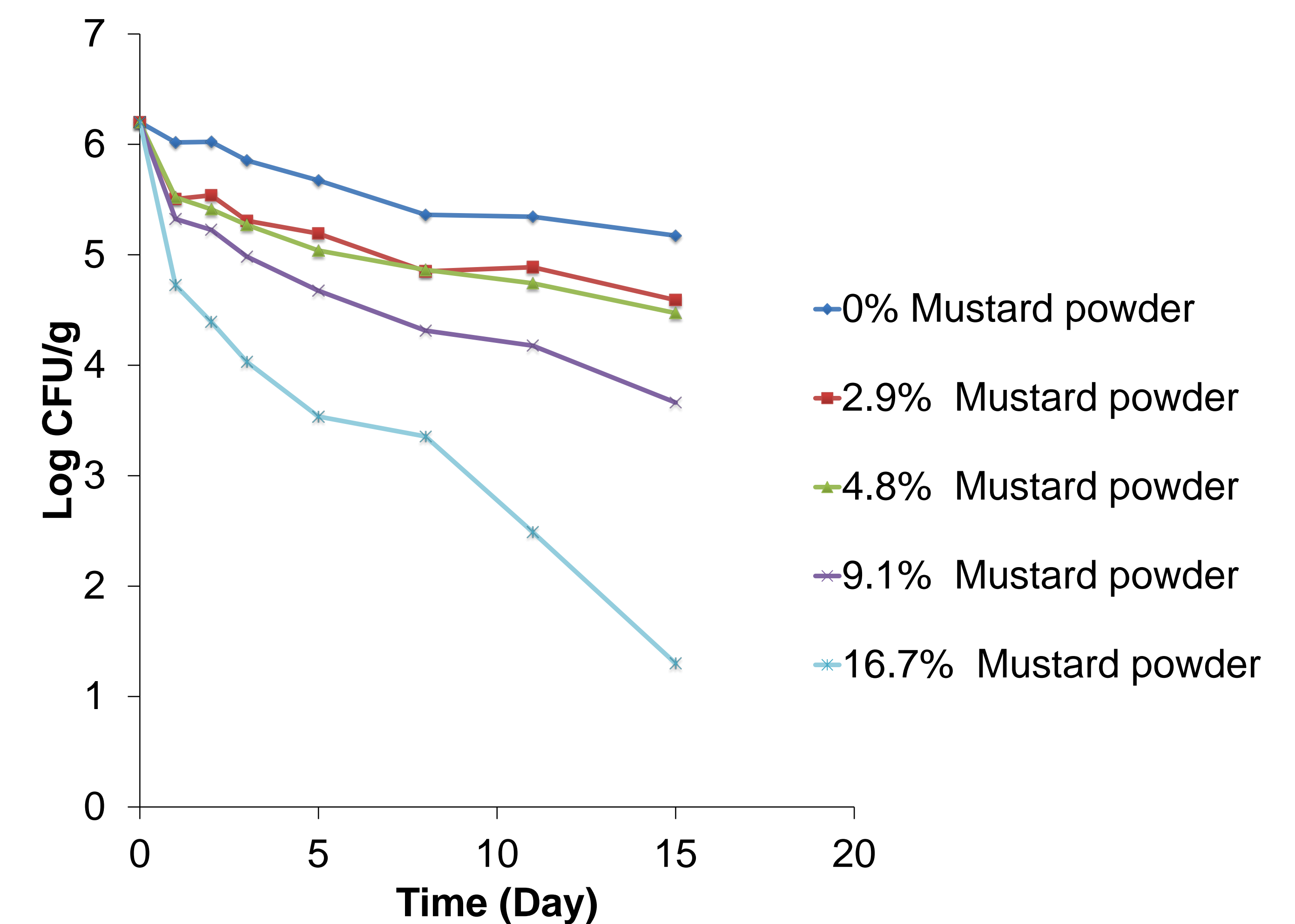


Figure 2 Effect of varying concentration of mustard powder on the survival of *Salmonella* ser. Typhimurium

Discussion

- Cheese treatment with mustard powder had a significant destructive effect on *Salmonella* ($p \leq 0.05$)
- Concentration of mustard powder in cheese had a significant effect. Increasing the concentration of mustard powder resulted in a faster rates of bacterial death (Figure 1).
- Mustard powder may be used to inhibit *Salmonella* Ser. Typhimurium in cheese.

Ongoing Research

- To evaluate the sensory acceptability of cheese, formulated with varying concentration of mustard powder.
- To determine the AITC concentration profile in packaged cheese formulated with mustard powder as a function of time.
- To evaluate the antimycotic property of mustard powder in cheese.

References

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