

Introduction

Shigella toxin-producing *Escherichia coli* (STEC) has been implicated in beef-related foodborne illness outbreaks. Environmental factors influence bacterial attachment on beef and understanding of bacterial attachment may inform future interventions at the abattoir.

Objective

This study measured STEC attachment under simulated meat processing conditions on adipose and lean beef tissues.

Methods

Beef brisket was purchased from a local grocer, and 50 cm² adipose and lean tissue samples were obtained and stored overnight (18 h; 4°C). The following day, half of the samples were heated to a surface temperature of 30°C while the remaining samples were maintained at 4°C prior to inoculation with 150 µL STEC cocktail (O26, O45, O103, O111, O121, O145, and O157:H7; ca. 7 log CFU/mL) onto the meat surface. Samples were stored at 4°C 30 min after inoculation and enumerated at times 0, 3, 5, and 20 min and 1, 3, 8, 12, 24 and 48 h by spread plating loosely attached cells (buffer) and firmly attached cells (homogenized sample) on MacConkey Agar. At every sampling point, each meat sample was shaken for 90 s in a stomacher bag with 0.1% peptone water (PW), transferred into a second stomacher bag with fresh PW, and homogenized.

Experimental Findings

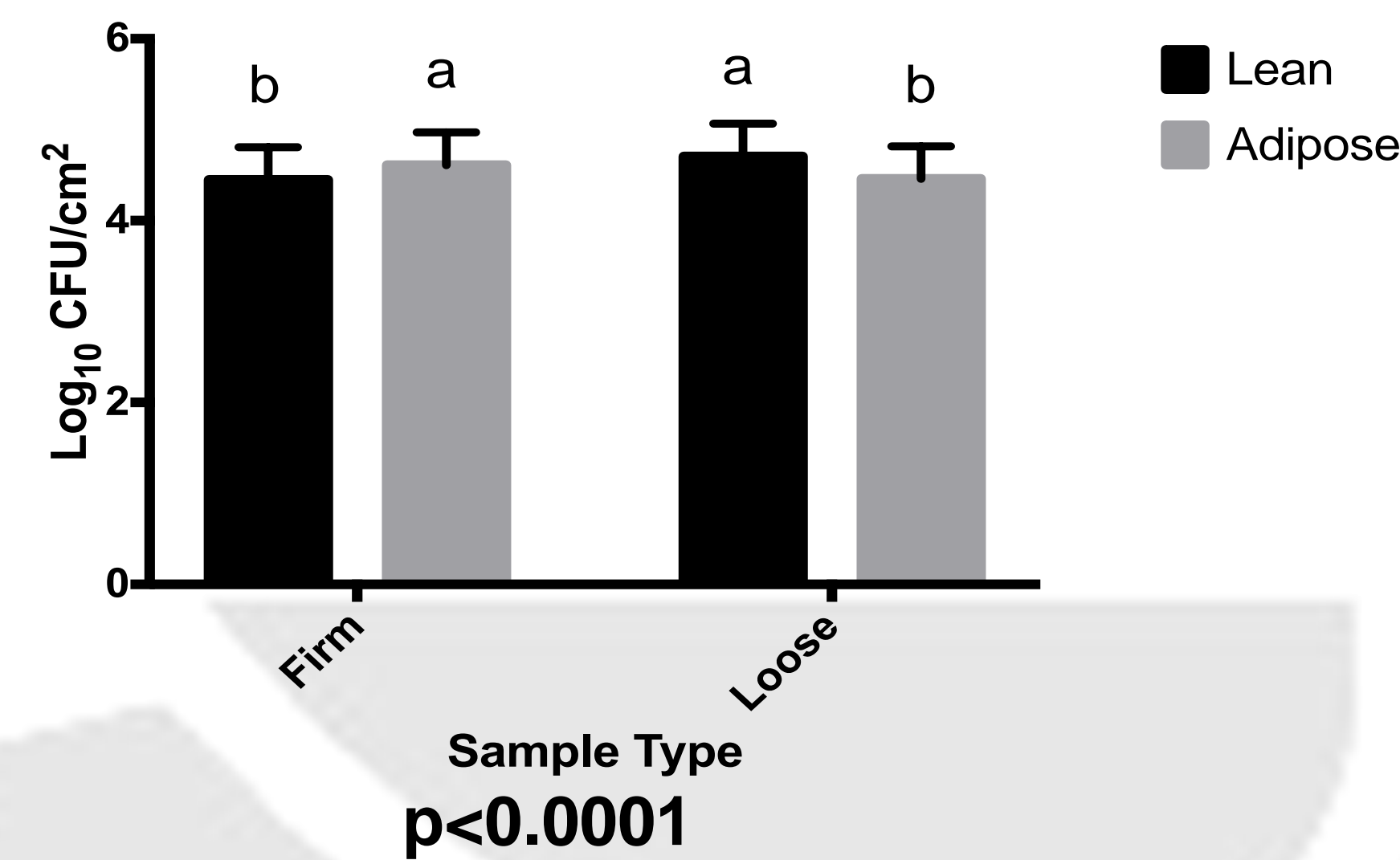


Figure 1: Comparison of Sample Type and Log CFU/cm² STEC cells grown in TSB

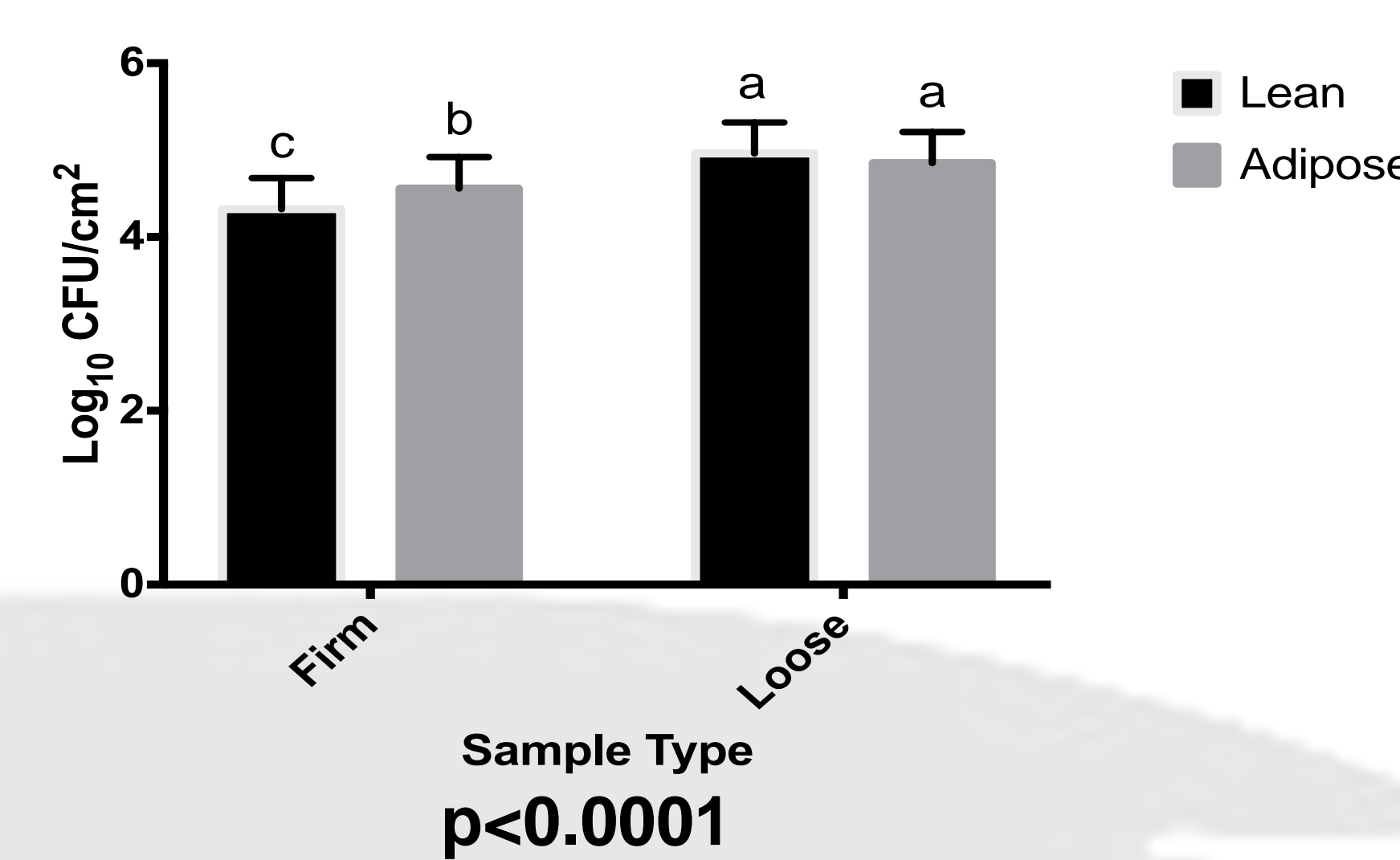


Figure 2: Comparison of Sample Type and Log CFU/cm² STEC cells within the first 20 minutes

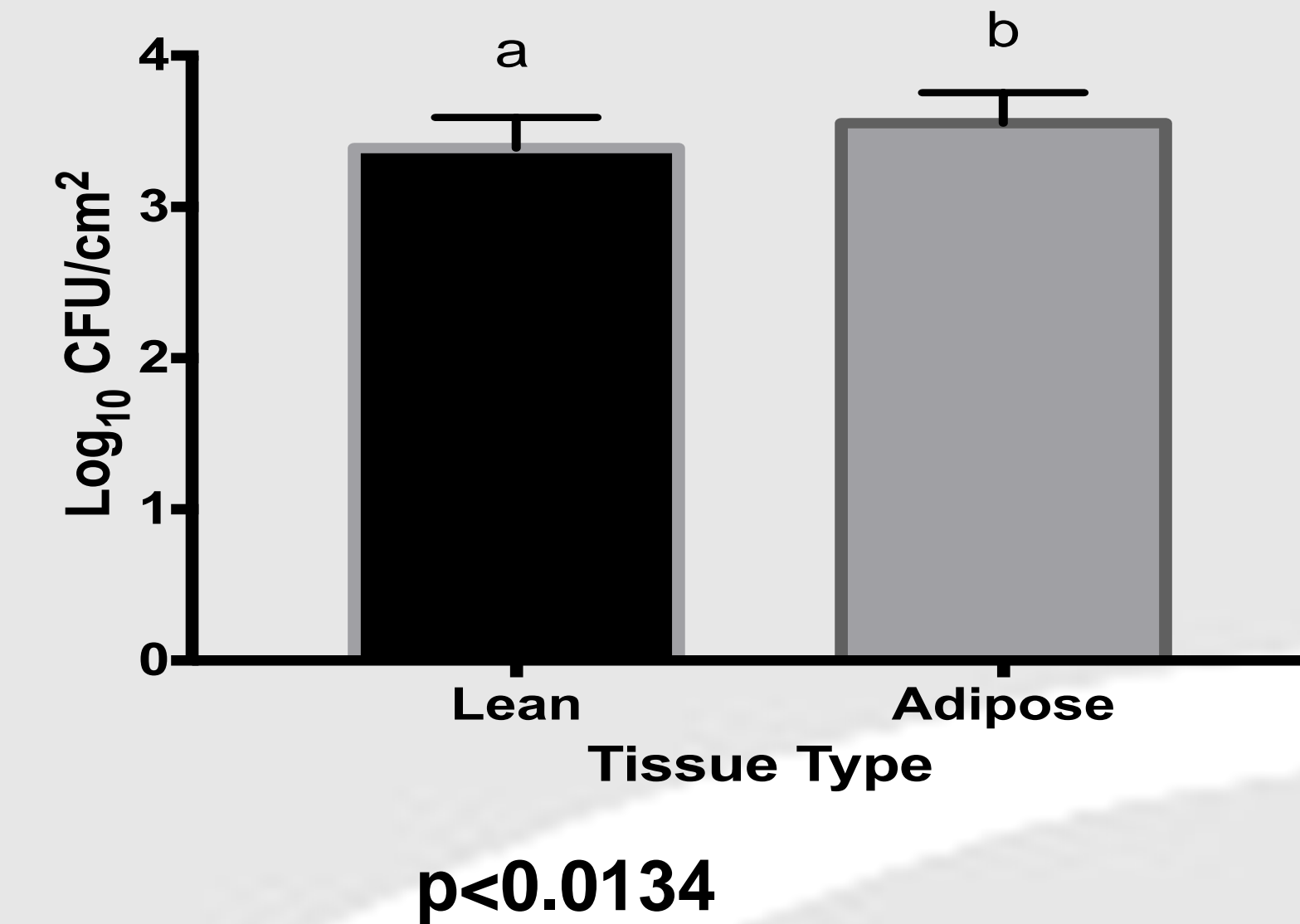


Figure 3: Comparison of Tissue Type and Log CFU/cm² STEC cells originating from M9 minimal salt medium

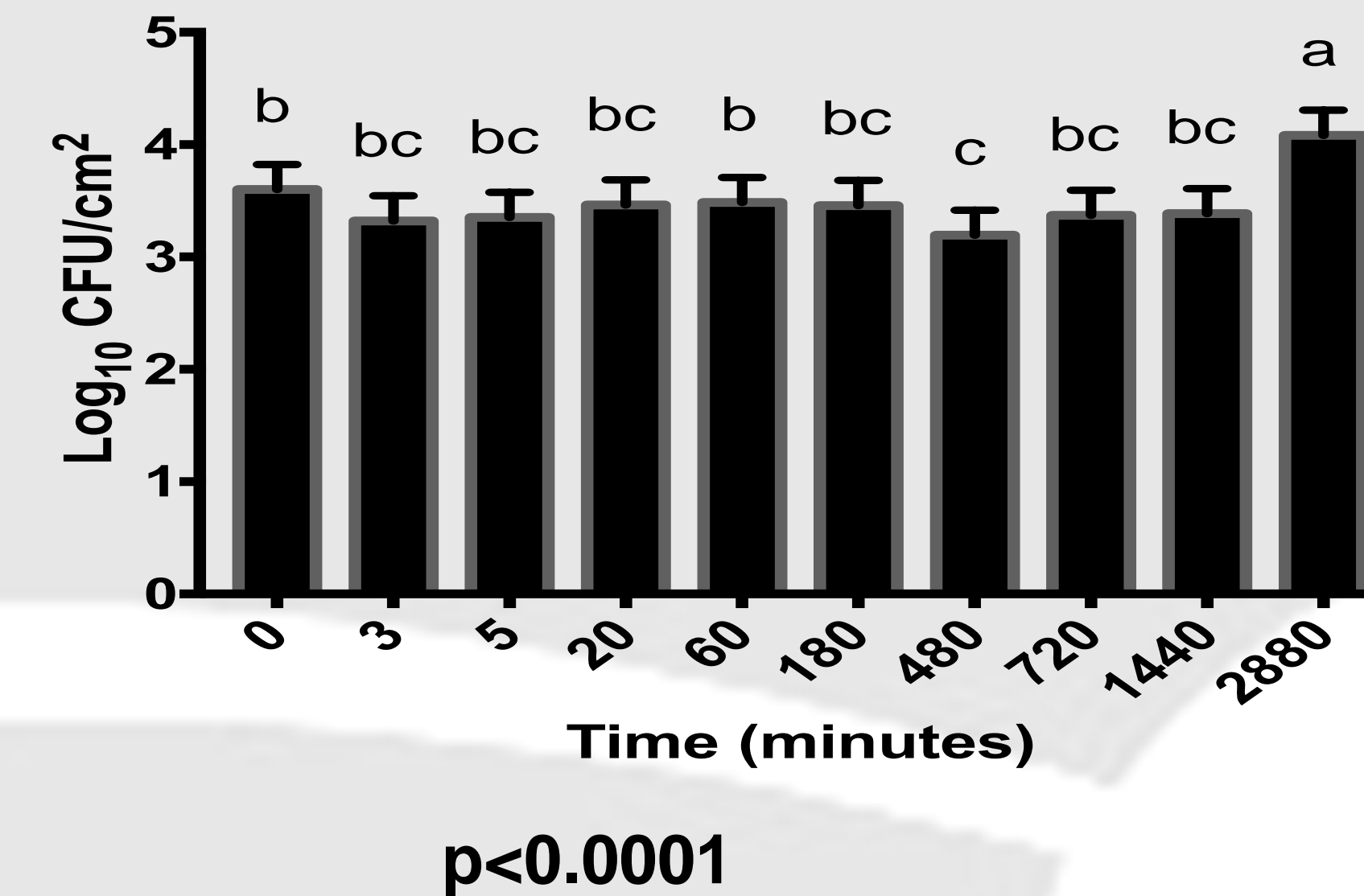


Figure 4: Abundance of STEC cells originating from M9 minimal salt medium over 48 h

Table 1: Comparison of Populations of STEC cells grown in TSB over 48 h (2880 min), at 4°C

Time (minutes)	Beef Tissue Type	
	Loose (log ₁₀ CFU/cm ²)	Firm (log ₁₀ CFU/cm ²)
0	4.90 ^a	4.38 ^{e,f,d}
3	4.94 ^a	4.63 ^{b,c}
5	4.89 ^a	4.38 ^{e,f,d}
20	4.89 ^a	4.37 ^{e,f,d}
60	4.57 ^{b,c,d}	4.47 ^{e,c,d}
180	4.43 ^{e,f,c,d}	4.57 ^{b,c,d}
480	4.37 ^{e,f,d}	4.56 ^{c,d}
720	4.25 ^f	4.54 ^{e,c,d}
1440	4.25 ^f	4.63 ^{b,c}
2880	4.33 ^{e,f}	4.79 ^{a,b}

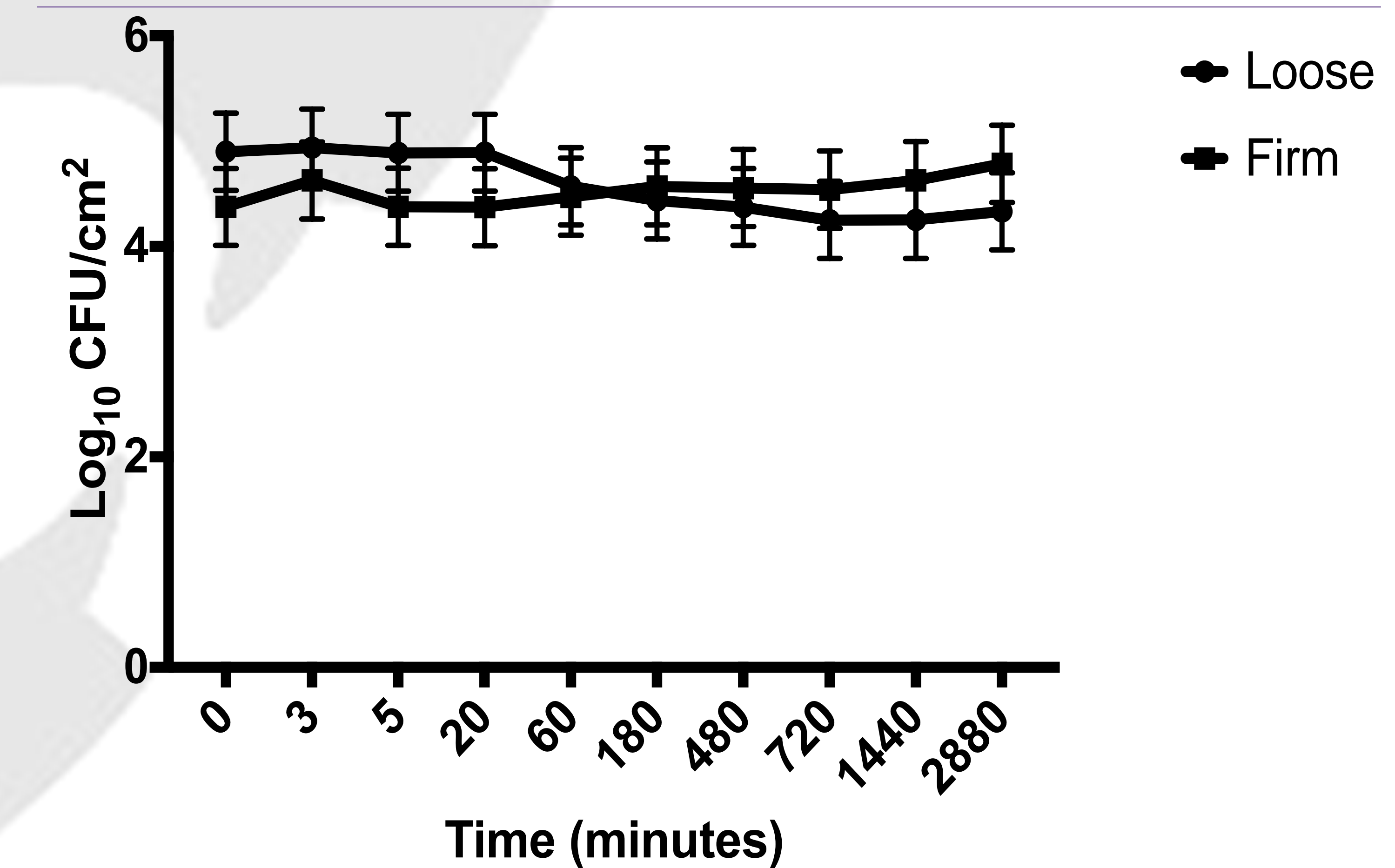


Figure 5: Comparison of loose and firm populations of STEC cells grown in TSB over 48 h, at 4°C

Results

Loosely attached cells predominate within the first 20 min of the TSB-originating cells. Tissue type and temperature were not significant within the TSB or M9 data sets, within this experiment. Within the TSB model, the effect of the combination of sample type and tissue type was statistically significant, with a difference of 0.26 log CFU/cm².

Note: superscripts symbolize varying statistical significance

Conclusions

These data demonstrate that the firmly attached STEC population steadily increases on lean and adipose beef tissues over time. Future research should investigate if an increase in firmly attached STEC cells is correlated to reduced intervention efficacy on post-chill carcasses and subprimal cuts, as commonly observed.

Support

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