Relative Resistance of the Red, Dry, and Rough (RDAR) and Smooth and White (SAW) Morphotypes expressed by *Salmonella* to a steam blanching treatment

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Abstract:

The acquired ability of *Salmonella* to express varying morphotypes when placed in nutrient-limited conditions is hypothesized to predict increased resistance to food processing interventions. Two of the morphotypes expressed by *Salmonella* are Red, Dry and Rough (RDAR) and Smooth and White (SAW). Increased resistance is predicted for the RDAR morphotype due to the expression of thin aggregative fimbriae (tafi) coupled with production of cellulose and other potentially protective extracellular polysaccharides. SAW strains are hypothesized to be less resistant due to their lack of tafi and cellulose production. Strains of Salmonella, previously classified as RDAR (n=3) and SAW (n=3), were separately inoculated on the shell surface of hazelnuts and steam blanched (88°C, 1 minute) to determine resistance patterns between the two morphotypes. The steam treatment resulted in insignificant reduction (<1.0 log CFU/g) of all *Salmonella* strains; therefore, differences in the relative resistance of the two morphotypes were unable to be determined. Additional, steam treatments with longer hold times will be tested to further explore the potential difference between morphotypes.

Objectives:

- Characterize *Salmonella* isolates from in-shell hazelnuts by morphotype on Congo Red Agar
- Evaluate the relative thermal resistance of *Salmonella* strains of differing morphotype (RDAR vs. SAW) on a low moisture product (in-shell hazelnuts).

Methodology:

Strain characterization and selection:

RDAR: Red, dry, and rough
Salmonella Typhimurium 1900
Salmonella Typhimurium 1908
Salmonella Saintpaul 1915

SAW: Smooth and white
Salmonella Thompson 1901
Salmonella Thompson 1904
Salmonella Thompson 1905

Inoculate → Congo Red Agar → Incubate 28C, 5 days → Congo Red Agar → Characterize

Inoculum and sample preparation:

Inoculate → TSA → Incubate 37C, 24 hrs → Bacterial Lawns → Harvest → Inoculum → Inoculate (12.5 ul spot) → In-shell Hazelnut (Basal Scar) → Dry Package → Sample (50 g: 10 g inoculated + 40 g uninoculated)
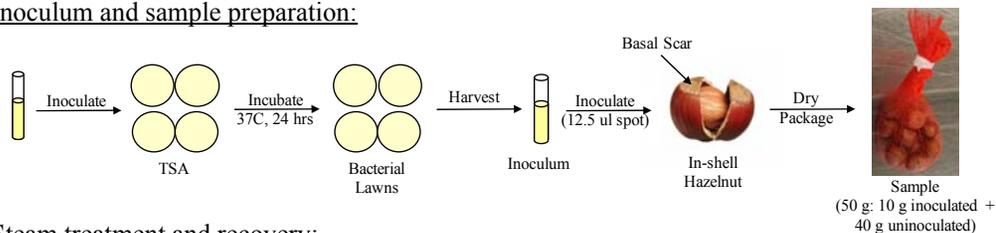
Steam treatment and recovery:

FRONT VIEW
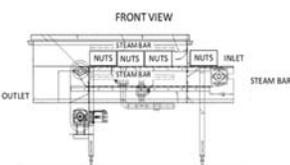
Steam Treatment: 88C, 1 min

OUTLET / STEAM BAR / INLET

Pilot-Scale Steam Blancher

TOP VIEW

Dilute → 0.1% Peptone Water (50 ml) → Dilute Spread Plate → TSA / HE → Incubate 37C, 24 hrs → TSA / HE → Enumerate → Data Analysis
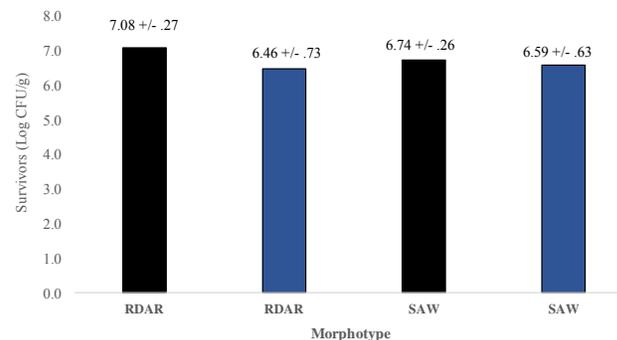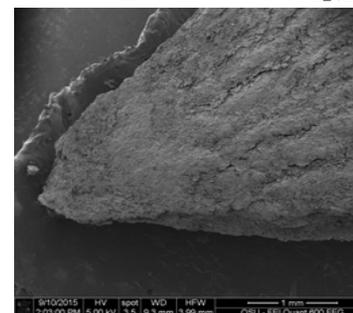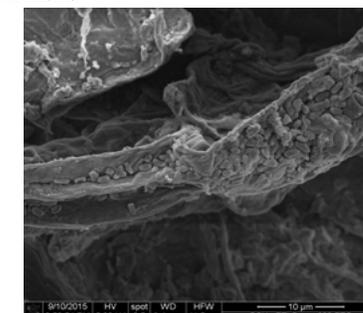
Results:

Figure 1. Impact of steam blanching treatment (88°C, 1 min) on *Salmonella* strains of varying morphotypes inoculated onto in-shell hazelnuts.
RDAR= Red, Dry, and Rough; SAW= Smooth and White.
Values reported are the mean ± standard deviation
$n \geq 2$ for initial cell densities
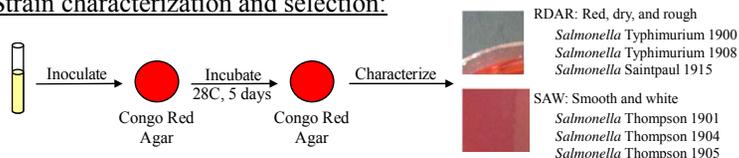$n \geq 6$ for surviving cell densities.

RDAR: 7.08 +/- .27
RDAR: 6.46 +/- .73
SAW: 6.74 +/- .26
SAW: 6.59 +/- .63

Basal scar surface of an in-shell hazelnut

Inoculated basal scar surface of an in-shell hazelnut

Conclusion:

With the selected thermal parameters, the lethality was insufficient to determine potential differences between the morphotypes.

Future Plans:

For future experiments, longer hold times need to be implemented to determine if the RDAR morphotype is more resistant to steam treatments on inoculated in-shell hazelnuts than the SAW morphotype.