

Evaluating the effect of flavonoids in tomato exocarp on *Salmonella enterica*



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Introduction

Salmonella enterica is a leading cause of foodborne illnesses stemming from fresh produce with historical multi-state outbreaks being linked to tomato, *Solanum lycopersicum*. The exocarp of tomato is known to produce high levels of flavonoids, a specialized metabolite with health benefits for human consumption. Previous research suggests that flavonoids may also have antimicrobial effects in addition to their nutritional benefits. Flavonoid production can vary between tomato cultivars; however, their flavonoid profiles and efficacy on *Salmonella* association *in vitro* has yet to be fully investigated.

Objective

To investigate the flavonoid levels and profiles in the exocarp of different tomato cultivars and potential antimicrobial effects of flavonoids on *Salmonella* Newport and Montevideo.

Plant Material

Cultivar Name	Color
‘Heinz-1706’	Red
‘Midnight Roma’	Purple/ orange
‘Dixie Red’	Red
‘Indigo Cherry’	Red/Purple
‘Indigo Rose’	Purple
‘Black Icicle’	Chocolate
‘Charger’	Red

Plants were grown under high-tunnel conditions at the WYE Research and Education Center in Queenstown, MD. Fruits were harvested and processed by removing peels and lyophilizing to dryness and stored at -20° C.

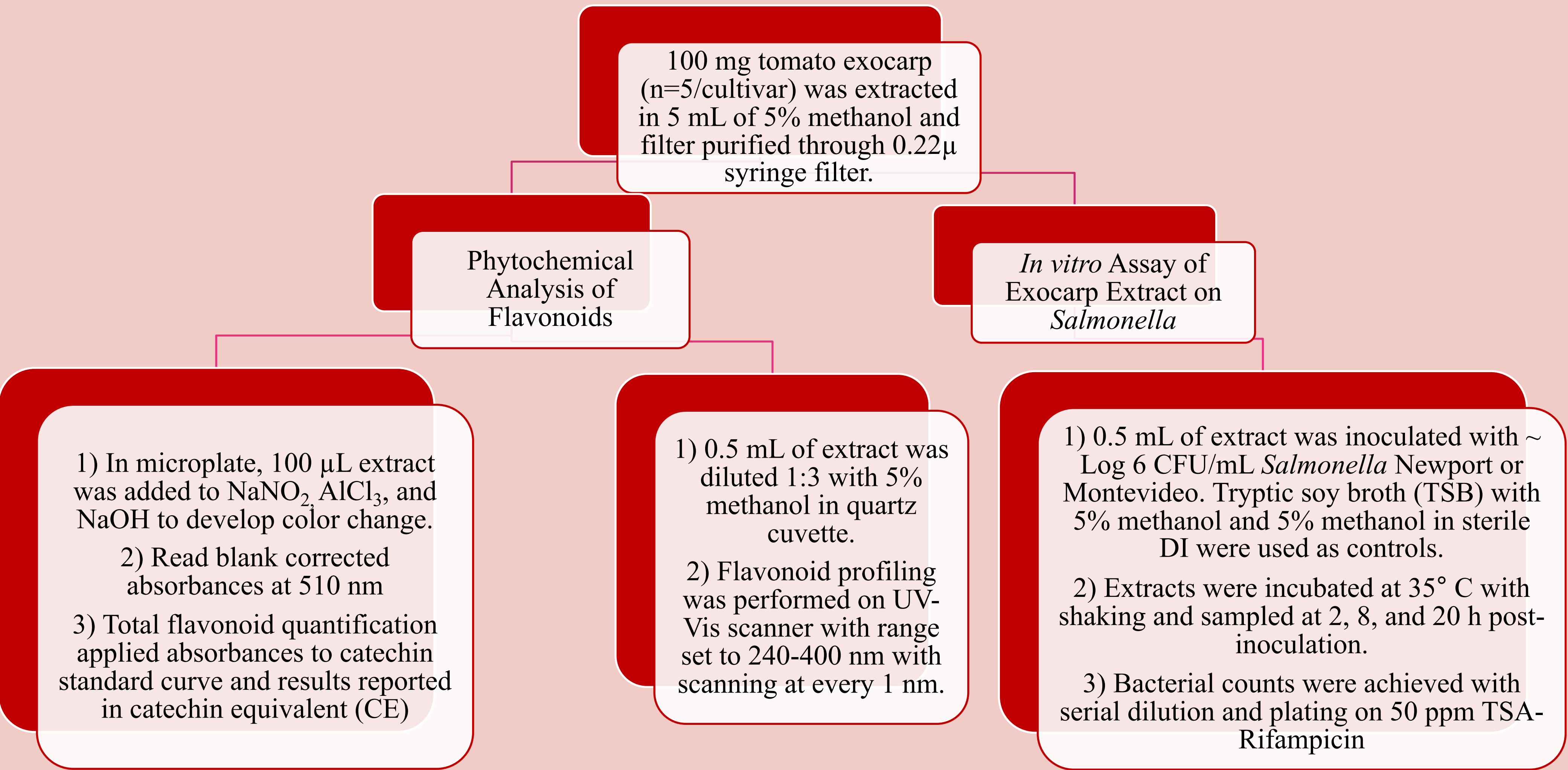


‘Midnight Roma’

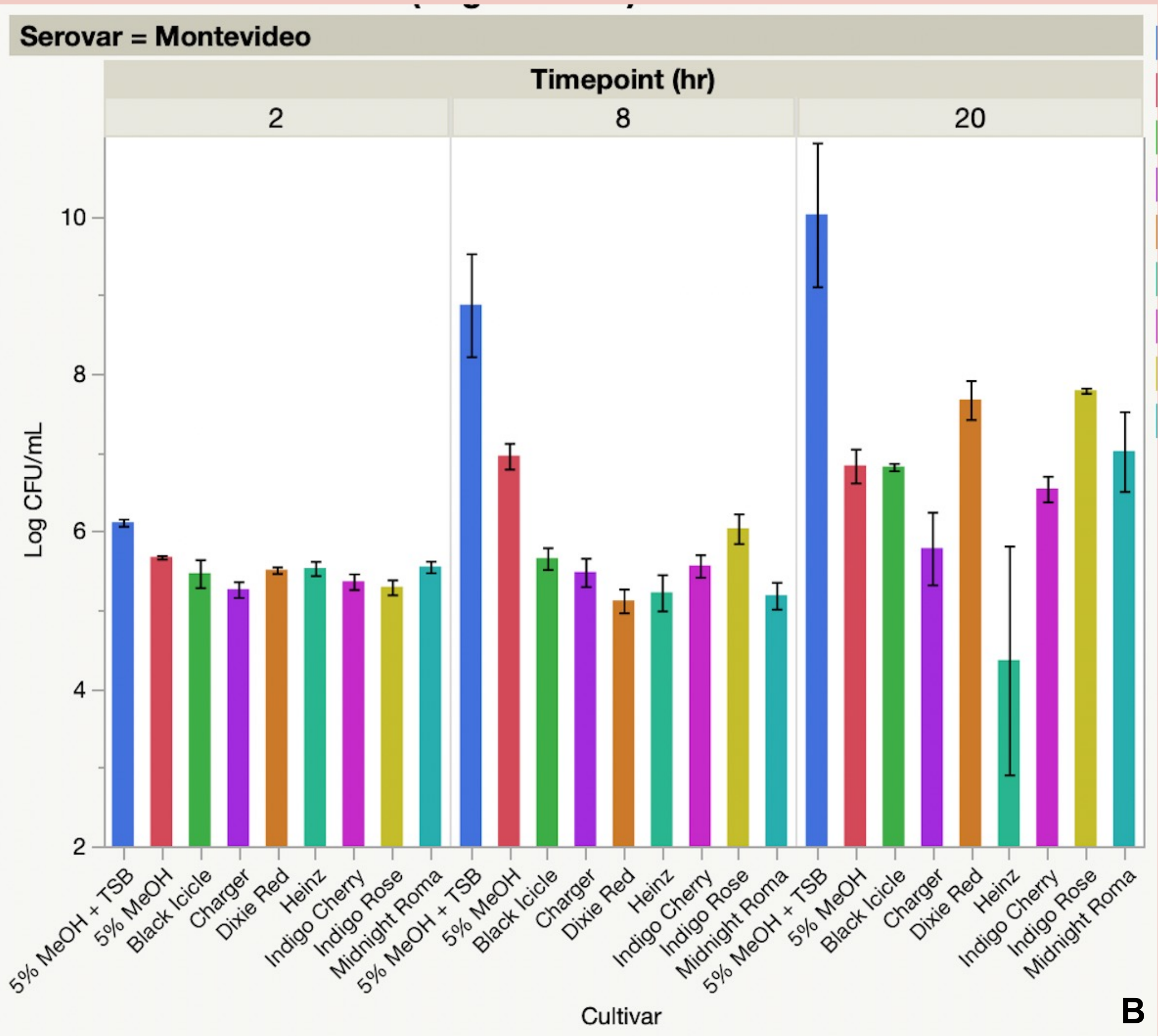
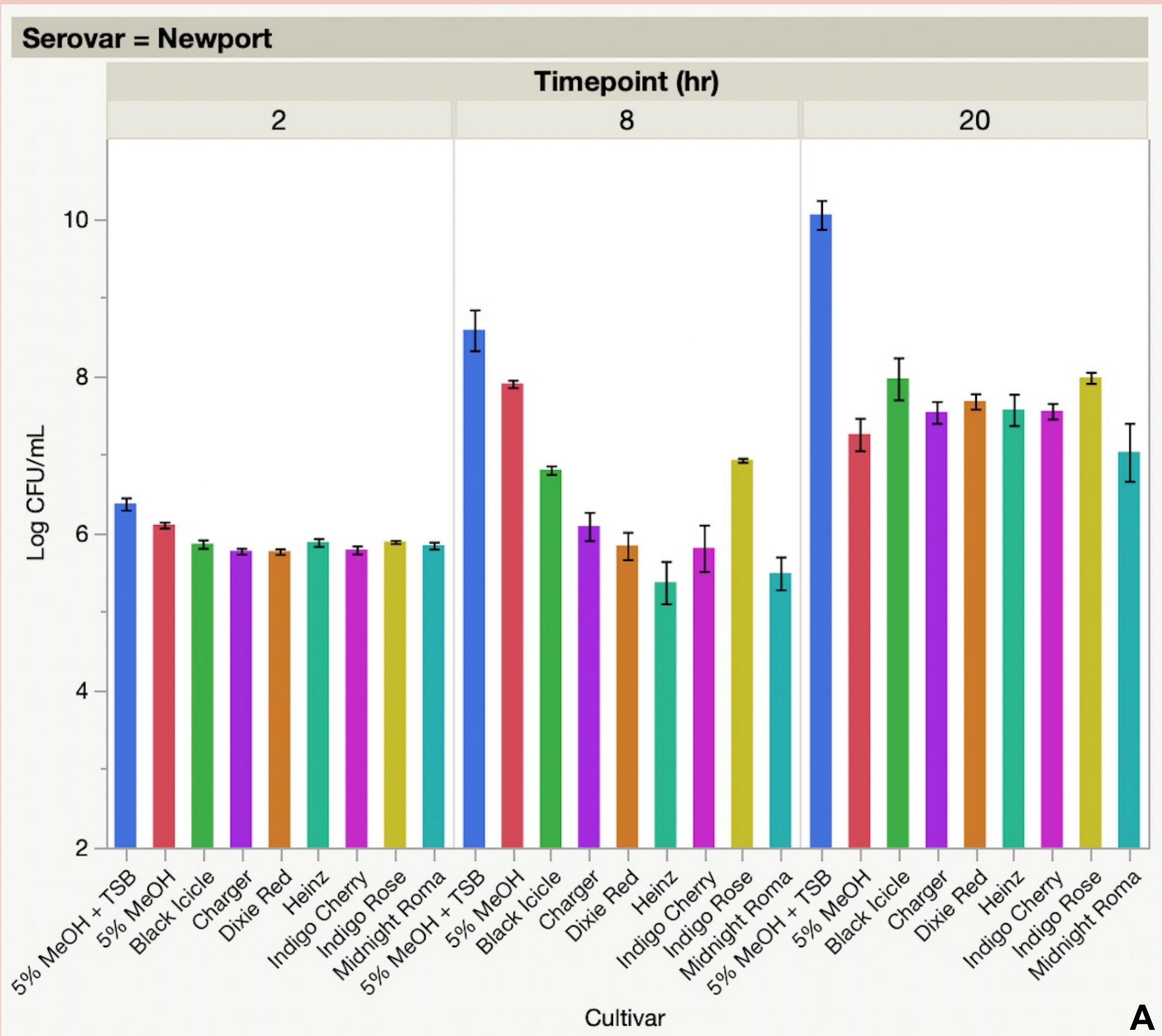


‘Heinz-1706’

Methodology



Results

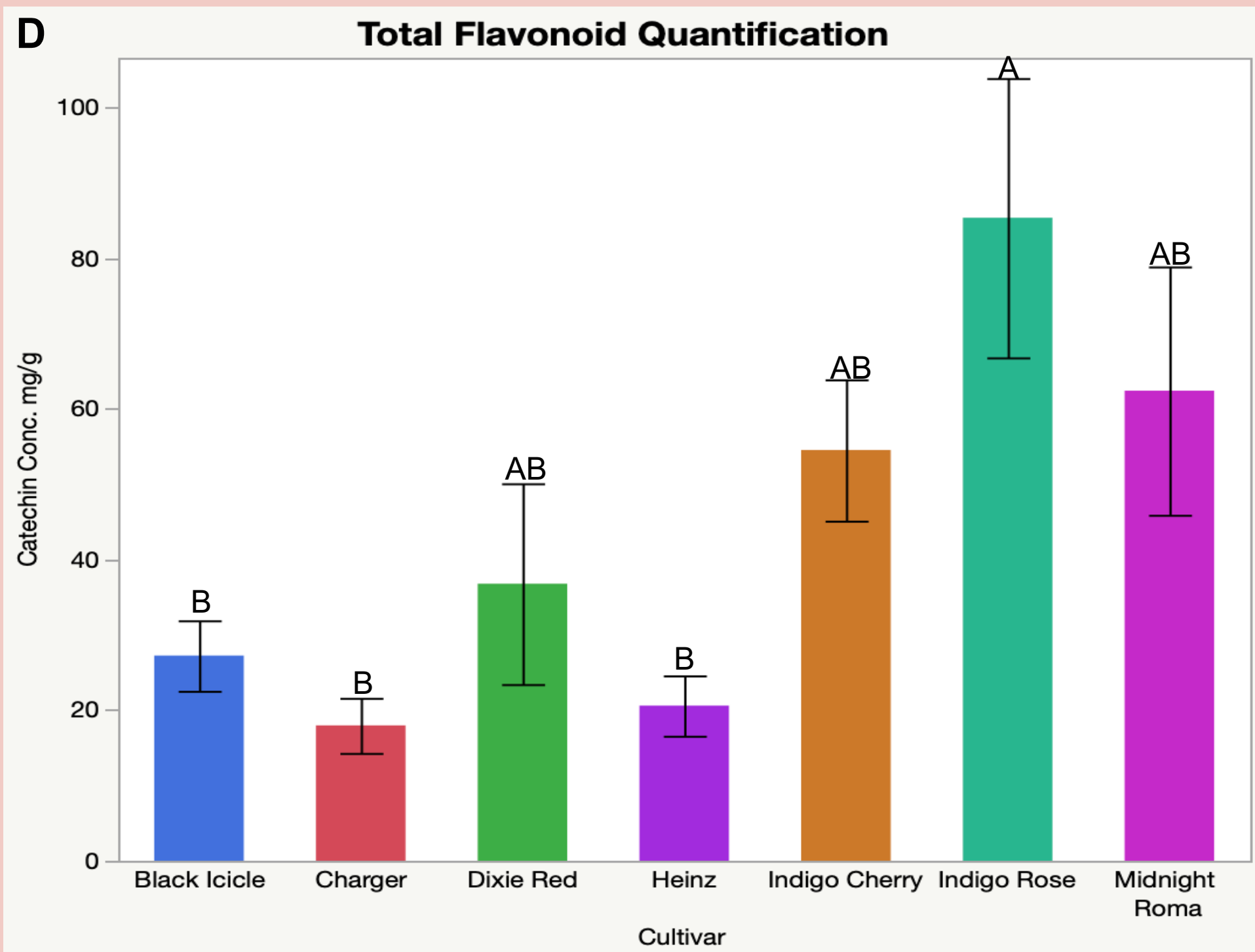


Effect Tests					
Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
Timepoint (hr)	2	2	89.846265	109.2881	<.0001*
Serovar	1	1	23.758658	57.7996	<.0001*
Cultivar	6	6	18.605740	7.5439	<.0001*
Serovar*Timepoint (hr)	2	2	3.762642	4.5768	0.0116*
Cultivar*Timepoint (hr)	12	12	18.236284	3.6971	<.0001*
Cultivar*Serovar*Timepoint (hr)	12	12	15.466265	3.1355	0.0005*
Cultivar*Serovar	6	6	5.917881	2.3995	0.0300*

A) *Salmonella* Newport retrieval in tomato exocarp extracts over 20-hour period. B) *Salmonella* Montevideo retrieval in tomato exocarp extracts over 20-hour period.

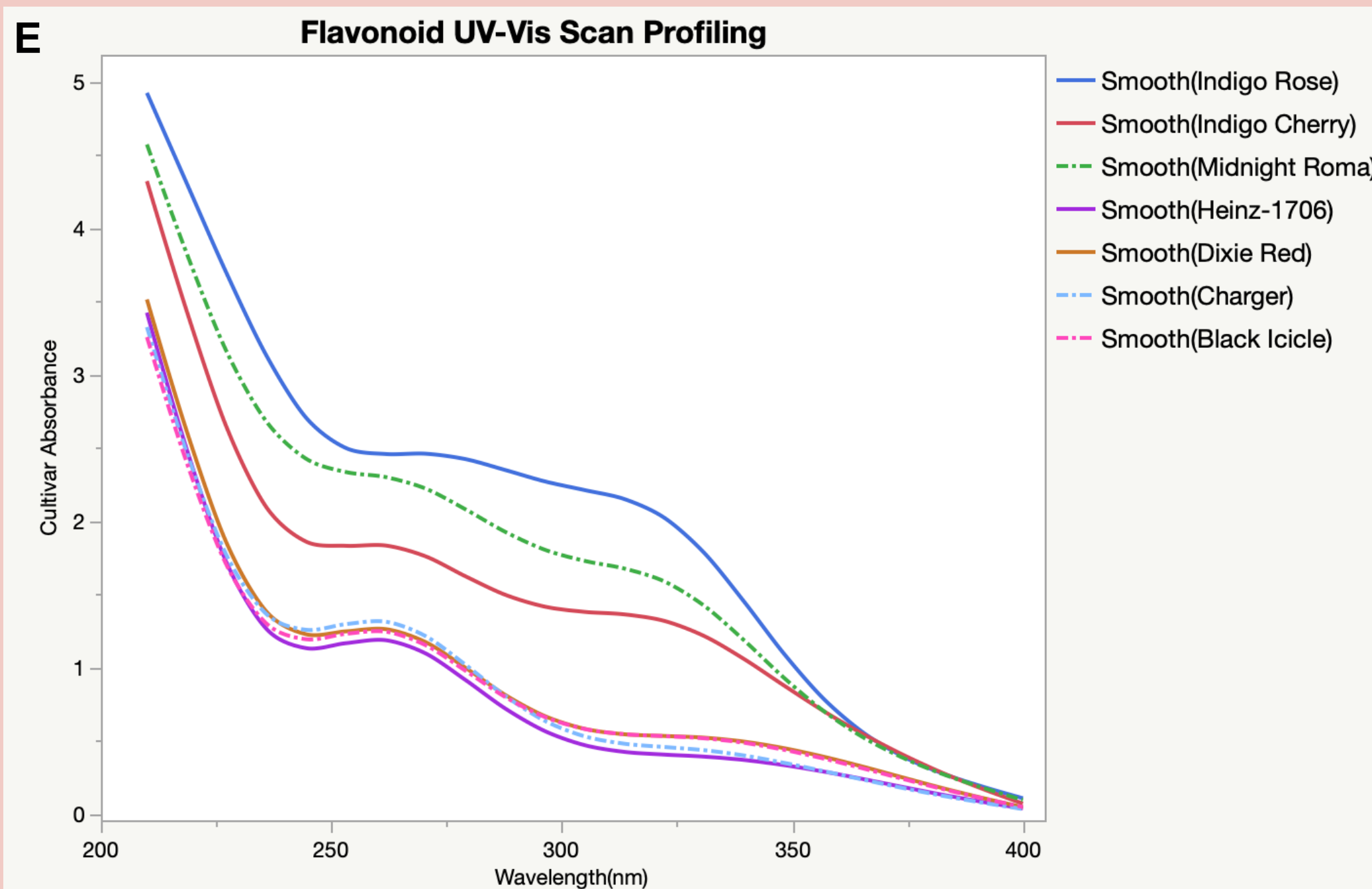
C) Data was fit to a linear model using Standard Least Squares method. Model showed that time, serovar, and cultivar have significant effect on *in vitro* extract analysis. Timepoint and serovar (p<0.0001) show the greatest influence on the differences being seen in *Salmonella* association in exocarp extracts.

Results



D) ‘Indigo Rose’ had higher total flavonoids (85.38 mg CE/g), than ‘Charger’ (17.98 mg CE/g, p<0.01), ‘Heinz-1706’ (20.61 mg CE/g, p<0.01) and ‘Black Icicle’ (27.25 mg CE/g, p<0.05).

E) UV-Vis scans display clustering between purple varieties and red/chocolate varieties with purple having higher flavonoid absorbance similar to total flavonoid quantification.



Conclusions

Purple tomato varieties such as ‘Indigo Rose’ and ‘Midnight Roma’ had highest amounts and levels of flavonoids compared to red/chocolate varieties.

Salmonella dynamics in fruit peel extracts varied by serovar, cultivar and time. ‘Heinz-1706’, ‘Midnight Roma’ and ‘Dixie Red’ had lowest levels of *Salmonella* Newport and Montevideo at 8-h post-inoculation. *Salmonella* Montevideo displayed higher sensitivity to exocarp extract compared to Newport.

Future Directions: Develop concentrated exocarp extract and profile flavonoids using HPLC-MS to identify antimicrobial flavonoid derived compounds.

Acknowledgements

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