

Consumer Acceptance and Sensory Analysis of Fortified Beef Meatballs with Fibre-Rich Waste Functional Ingredient: A Case Study on Apple (*Malus domestica*) Pomace Incorporation.

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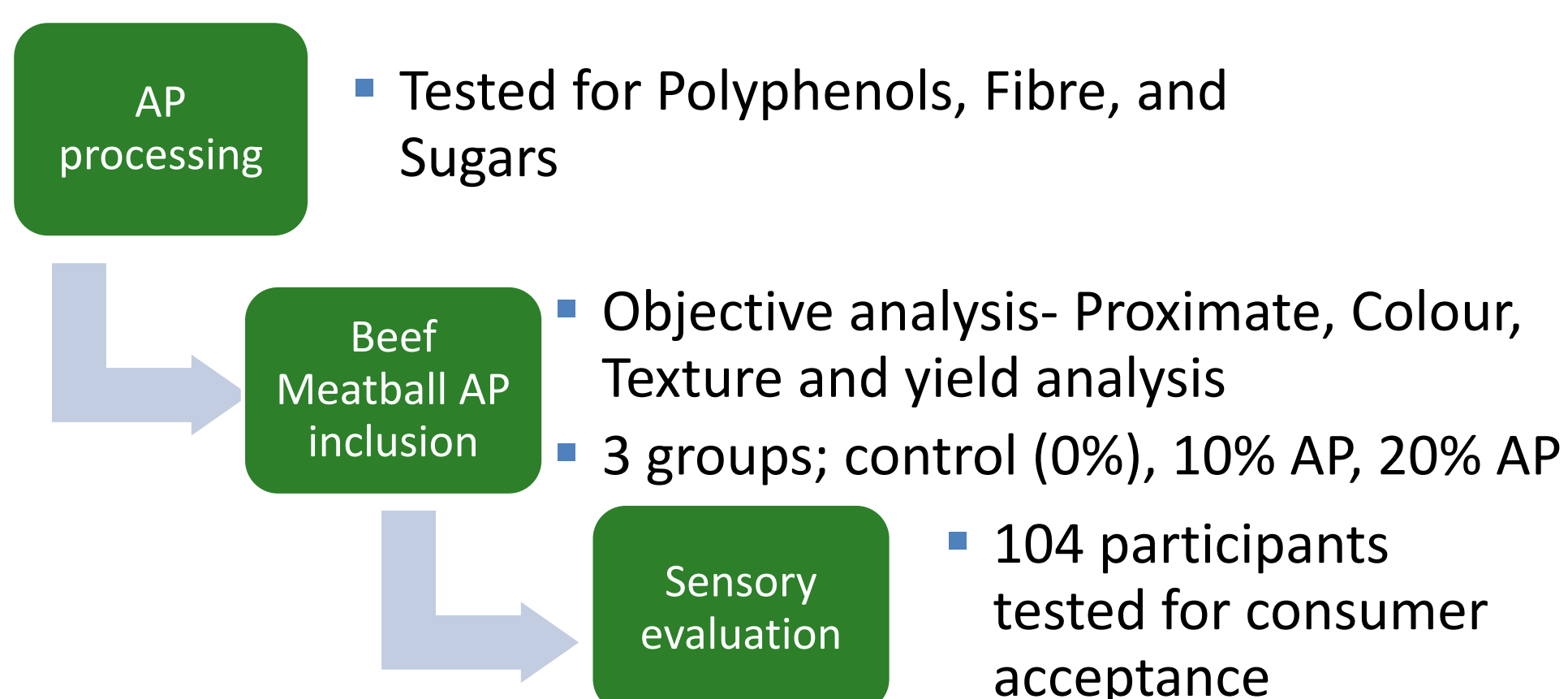
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INTRODUCTION & AIM

New York is the second-largest apple producer in the US, generating a significant amount of apple pomace (AP) from cideries as a byproduct. This byproduct is often treated as waste and disposed of in landfills producing greenhouse gases. AP is the skin, stem, core, and seeds that are left over after the juicing process. AP is rich in dietary fibre and bioactive polyphenols, which the Western diet with high meat consumption is deficient in. Increasing dietary fibre along with other interventions can help address obesity-induced metabolic syndrome like type 2 diabetes. Polyphenols as antioxidants in the body scavenge free radicals, these free radicals can cause damage in the cells promoting inflammation and cancer. This study processed apples to make pomace, analysed the freeze-dried pomace, incorporated the fibre and polyphenol-rich AP into meatballs to reduce meat consumption and increase fibre content. The final stage was to measure consumer acceptance of this hybrid product.

The aim of this study is to demonstrate that AP once lyophilized can be stored and rehydrated as a functional high fibre and polyphenol ingredient in meatballs, while testing the consumer acceptance.

METHOD



RESULTS & DISCUSSION

The 40% dietary fibre measurement for the freeze-dried AP provides evidence that it can be used as an effective fibre rich supplement. The high fibre and the diverse polyphenol results agree with previous research. However, it must be noted that there is variation in the results for polyphenols in the literature as the content changes with the varieties of apples used and what part of the season the apples were harvested.

Table 1: Chemical analysis of Triple variety Apple Pomace (AP)

Parameters measured	Measurement
Fibre	(%)
Total Dietary Fibre ¹	40
	<i>Weight based concentration</i>
Polyphenolic compounds	(mg/100g)
Caffeic acid ²	0.26
Polymeric tannins ²	601.50
Protocatechuic acid ²	3.00
Syringic acid ²	4.35
Coumaric acid ²	6.75
Ethyl gallate ²	5.10
Ferulic acid ²	5.25
Total flavanols ³	67.34
Tannin ⁴	306.00

The superscript numbers beside the parameters measured indicate which method was used to ascertain these results. 1 indicates the AOAC 991.43 Mod, 2 refers to an enzymatic assay, 3 is titration, 4 is High pressure liquid chromatography, 5 Quercitrin Equivalence, 6 Folin – Ciocalteu Assay Gallic Acid eq.

RESULTS & DISCUSSION

Table 2: Proximate analysis of meatballs with apple pomace (AP) addition

Parameter measured	Control	10% AP	20% AP
Dry Matter (%)	45.0±0.37	45.4±0.37	42.0±0.37
Crude Protein (%)	27.4±0.26	24.0±0.26	20.0±0.26
Crude Fat (%)	15.85±11.7	15.17±11.7	16.54±11.7
Ash (%)	2.52±15.5	2.24±15.5	2.09±15.5
pH	6.2±0.05	6.1±0.05	6.0±0.05

Table 2 gives evidence for the decrease in protein that was expected. What was not expected was the increase in fat, as the apple pomace that was used did not have additional lipids. The slight fluctuations in pH are expected due to the organic acids in the pomace. The beef having the buffering capacity to deal with this makes the meat ideal to include a functional ingredient like apple pomace. Table 1 and Figure 1 were vital results to demonstrate that the inclusion of a fibre and polyphenol rich ingredient like AP in a meat product could be accepted. This increase in fibre for beef meatballs is an opportunity for people who consume predominantly meat products to have extra fibre. This is important as only 5% of Americans are meeting their daily recommendation of fibre. Lack of fibre is a public health concern for developed countries as it has been linked to problems with digestive health and chronic disease.

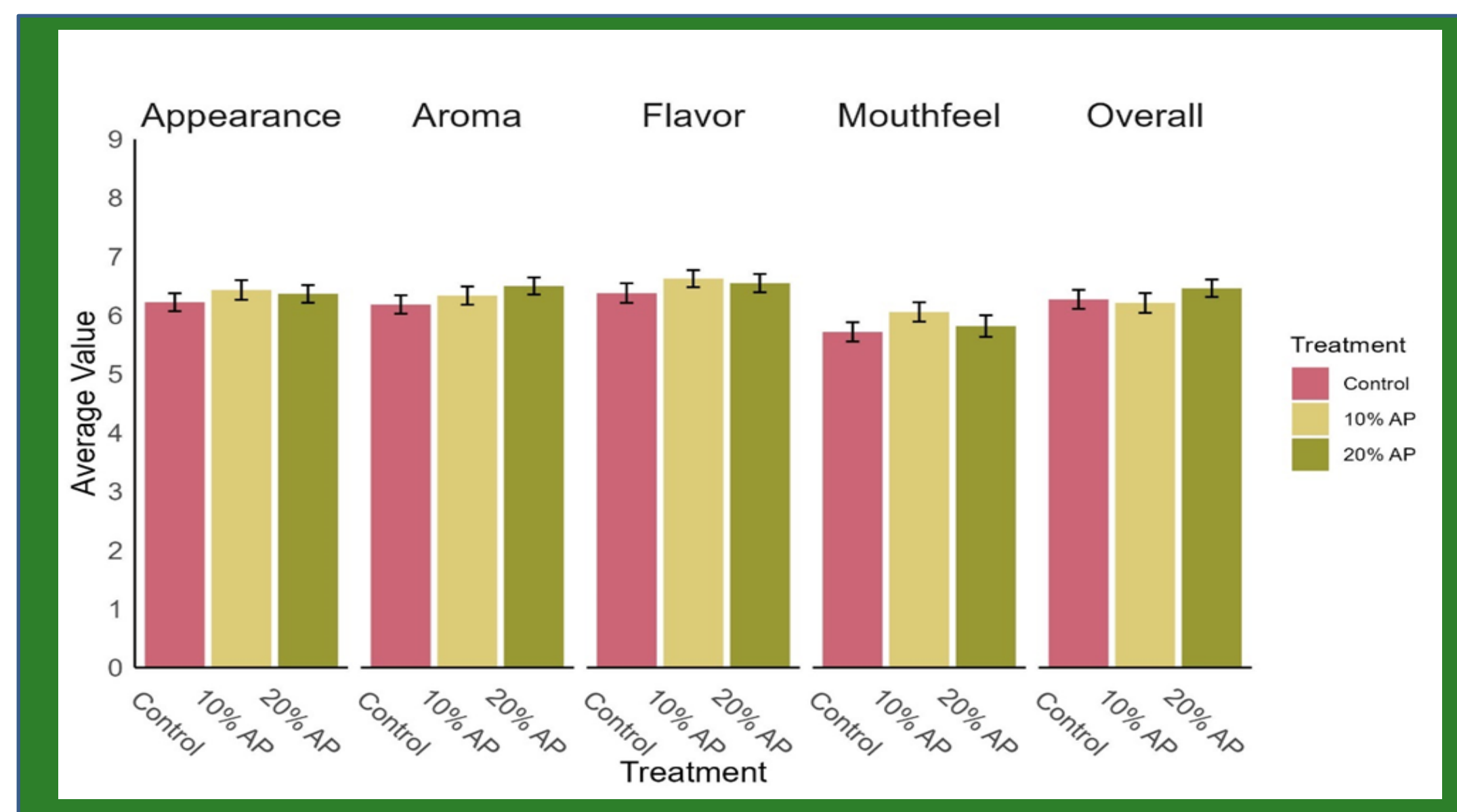


Figure 1: Ratings of likeness of different sensory properties of the three treatment groups on a 9-point hedonic scale. No significant differences.

CONCLUSION

- The utilization of AP as a food ingredient relieves a sustainability burden for the apple processing industry.
- AP can be processed to become a healthy, viable food ingredient if it is freeze-dried for storage and rehydrated for inclusion.
- There is a possibility for consumer acceptance of the 10% AP as in a 104-participant study, the 10% AP was ranked higher than any other group most often and there were no significant differences

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