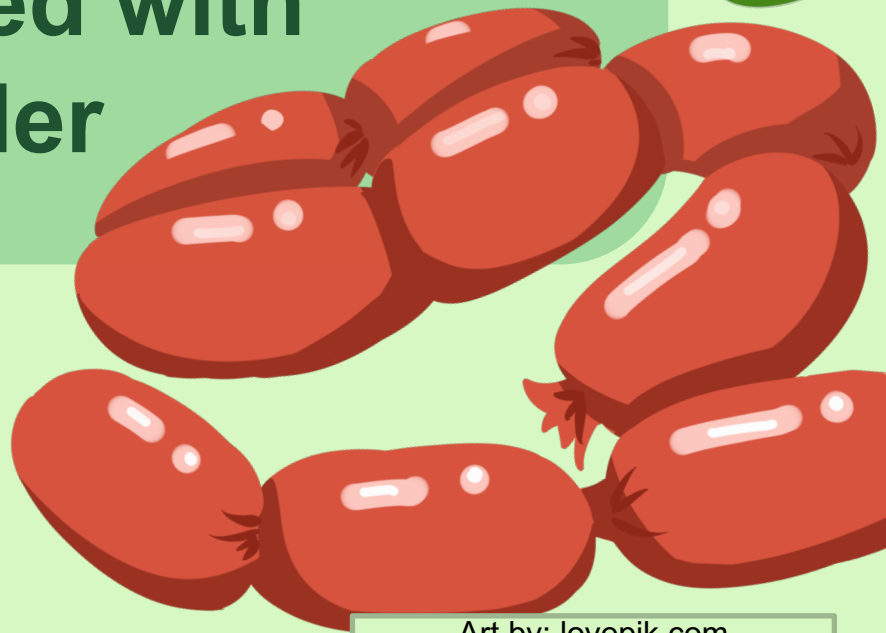


Total Phenolics, Antioxidant Activity, and Sensory Evaluation of Sausages Incorporated with Calamansi Peel Powder

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Calamansi (*Citrus microcarpa*)

- Local citrus fruit in Guam that is a member of the *Rutaceae* family

Appearance:

- Small in diameter, approximately 3 cm
- Green or yellow, depending on the maturity level
- Citrus peels are excellent sources of polyphenols (phenolic acids, flavanones, flavanol, and flavones) which protect tissues from oxidative processes [1].
- Citrus flavonoids exhibit health benefits, such as antioxidative, anticancer, anti-inflammatory, and cardiovascular protective activities [2].



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Sausages

- Sausage is a meat product made up of a mixture of grounded meat stuffed into a natural casing.
- Sausage contains a high lipid content and is prone to oxidation. Since lipid oxidation negatively affects the sensory and nutritional quality of sausage, synthetic antioxidants are often added to the meat mixture to prevent the oxidation.
- However, synthetic antioxidants may have some negative effects on human health, such as causing DNA damage [3].



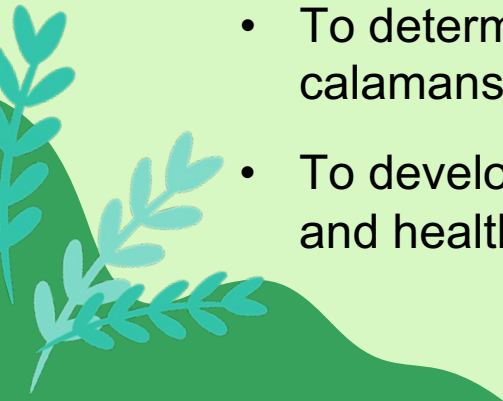
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Hypothesis

Since calamansi peels are a good source of phenolic acids and flavonoid compounds, adding them to sausages can increase the sausages' total phenolic content and antioxidant activity.

Objectives

- To determine the total phenolic content of sausages incorporated with calamansi peel powder
- To determine the antioxidant activity of sausages with the added calamansi peel powder
- To develop a sausage recipe with appropriate sensory attributes and health benefits for consumers



Preparation of Sausages Incorporated with Calamansi Peel Powder

Pork Sausage Recipe:

- Lean Meat (61%)
- Fat (30%)
- Water (6%)
- Salt (1.8%)
- Black Pepper (0.7%)
- Garlic Powder (0.5%)
- Onion Powder (0.5%)
- Green Calamansi Peel Powder (0%, 2.5%, and 5%)



Method: Sausages with Calamansi Peel Powder Recipe

1



Weigh each ingredient

2



Mix ground lean meat and fat

3



Add the spices to the meat mixture

4



Add water

5



Add the calamansi peel powder (0%, 2.5%, 5%)

6



Mix sausage mixtures and place into natural casing

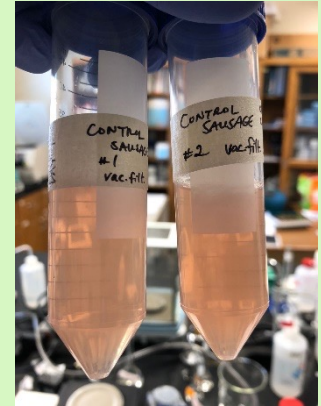
Methods and Experiments

Preparation of Extracts

- The sausage mixture was blended with water until homogenized.
- Mixtures were centrifuged. The supernatant was collected, vacuumed filtered, and used as the extract for analysis.



Blended Extract

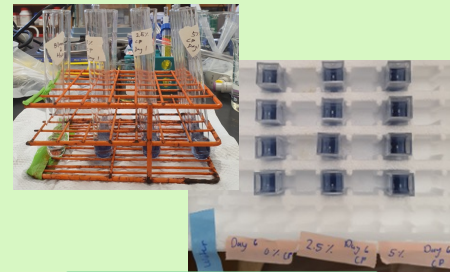


Filtered Extract

Methods and Experiments Cont.

Total Phenolics

- Extracts were mixed with the Folin-Ciocalteu (FC) reagent and the absorbance was measured at 765 nm.
- Total phenolic content was calculated as gallic acid equivalents (mg/100g) based on a standard curve.



Total Phenolics
Test Samples

Antioxidant Activity

- Antioxidant activity was measured using the 2,2-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging assay.
- Extracts were mixed with DPPH solution and the absorbance was read at 515 nm.
- $$\text{Inhibition (\%)} = (A_{\text{DPPH}} - A_{\text{DPPH+Extract}}) * 100 / A_{\text{DPPH}}$$



Antioxidant Activity
Test Samples

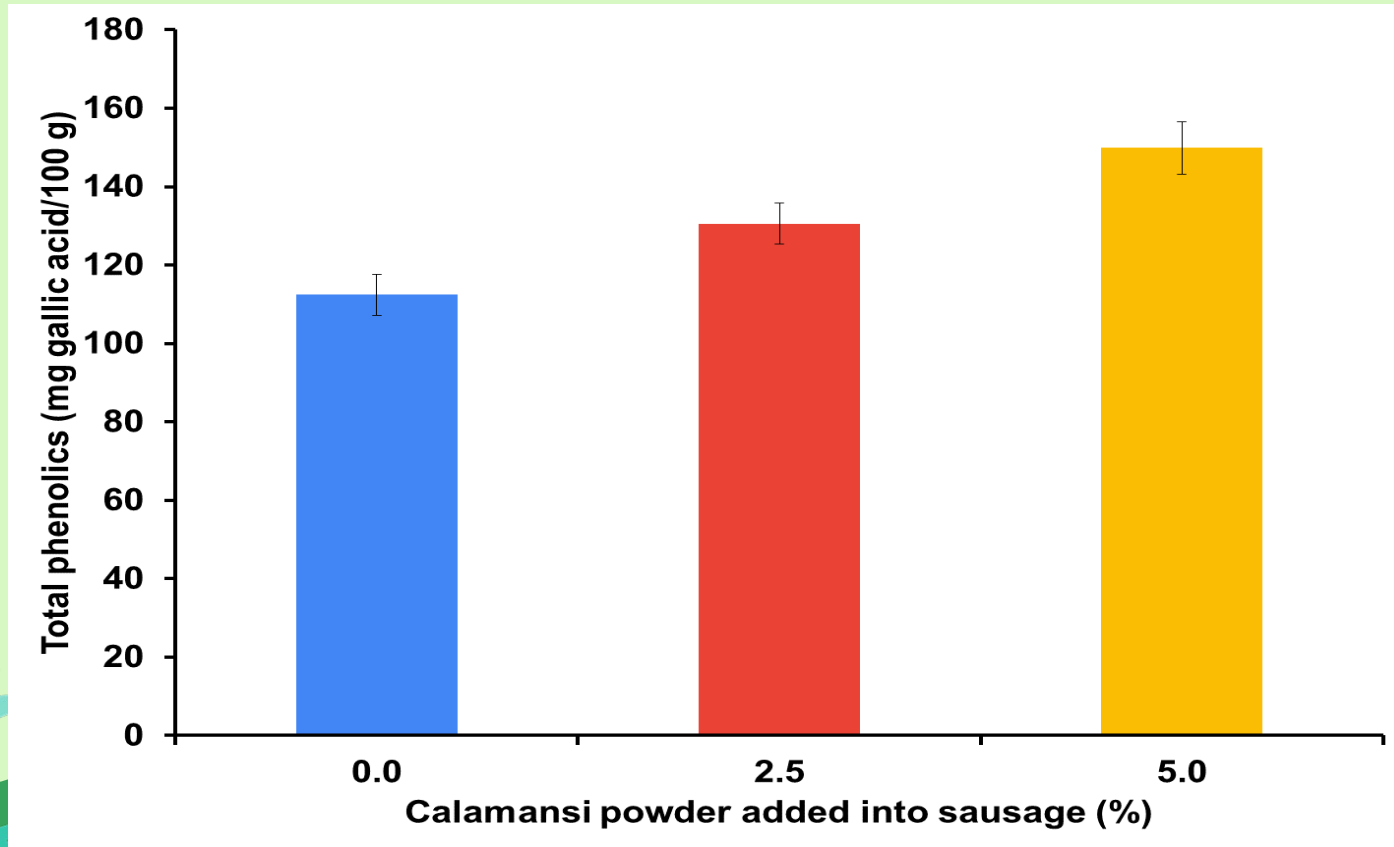
Methods and Experiments Cont.

Sensory Evaluation

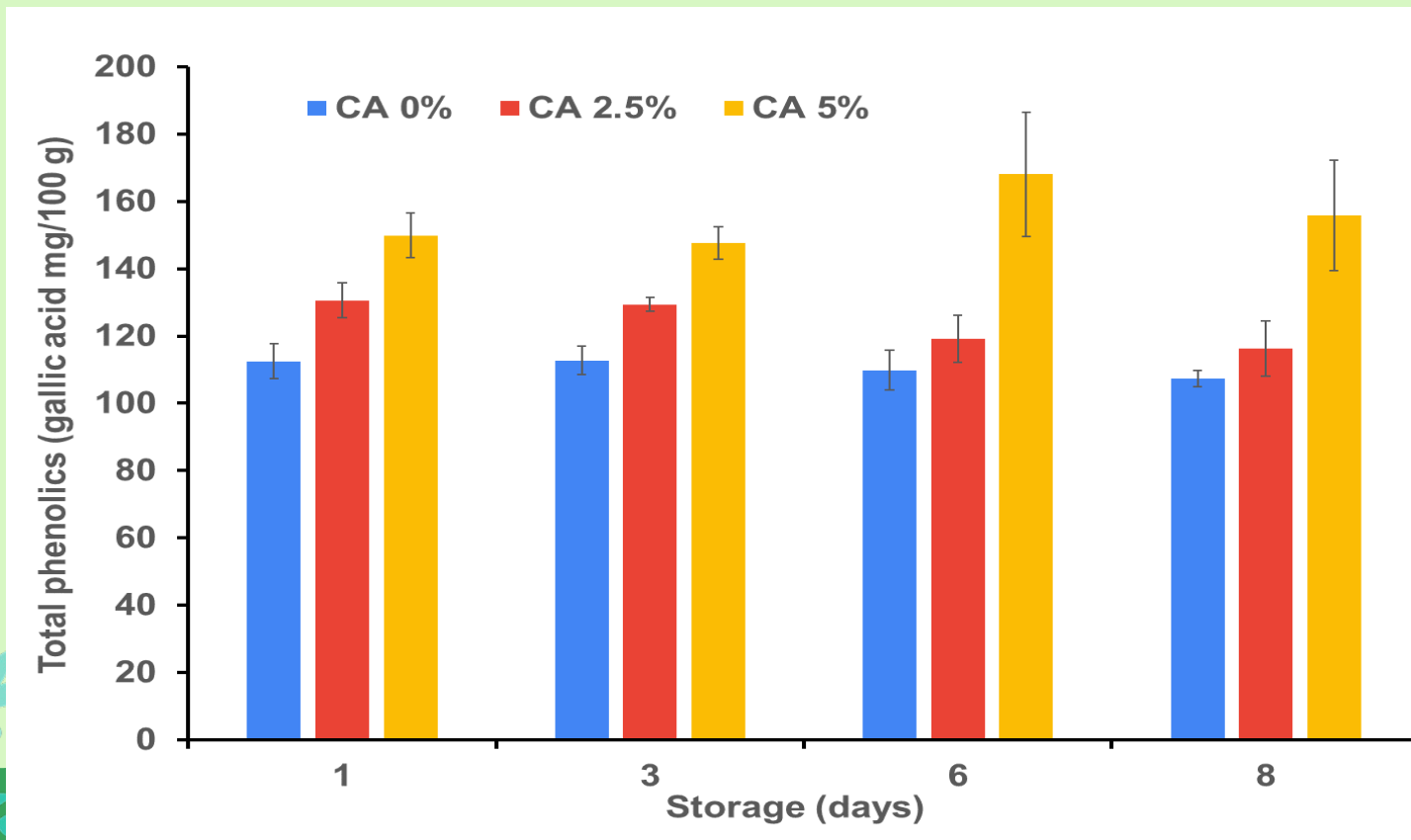
- Through blind testing, ten panelists evaluated the sausage quality by the consumer acceptance test.
- A hedonic scale was used to evaluate the quality attributes of sausages.



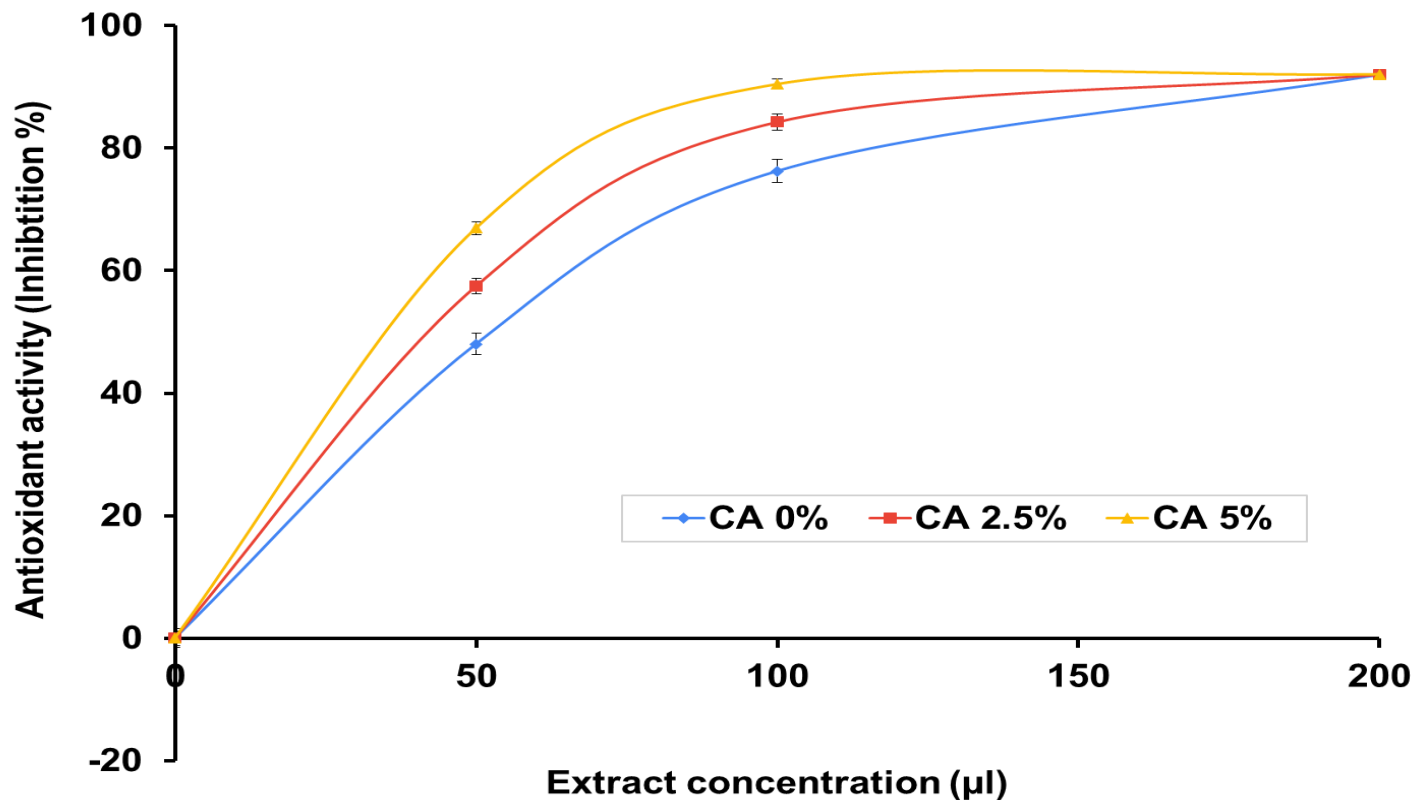
Total Phenolic Content of Sausages Incorporated with Calamansi Peel Powder for Day 1



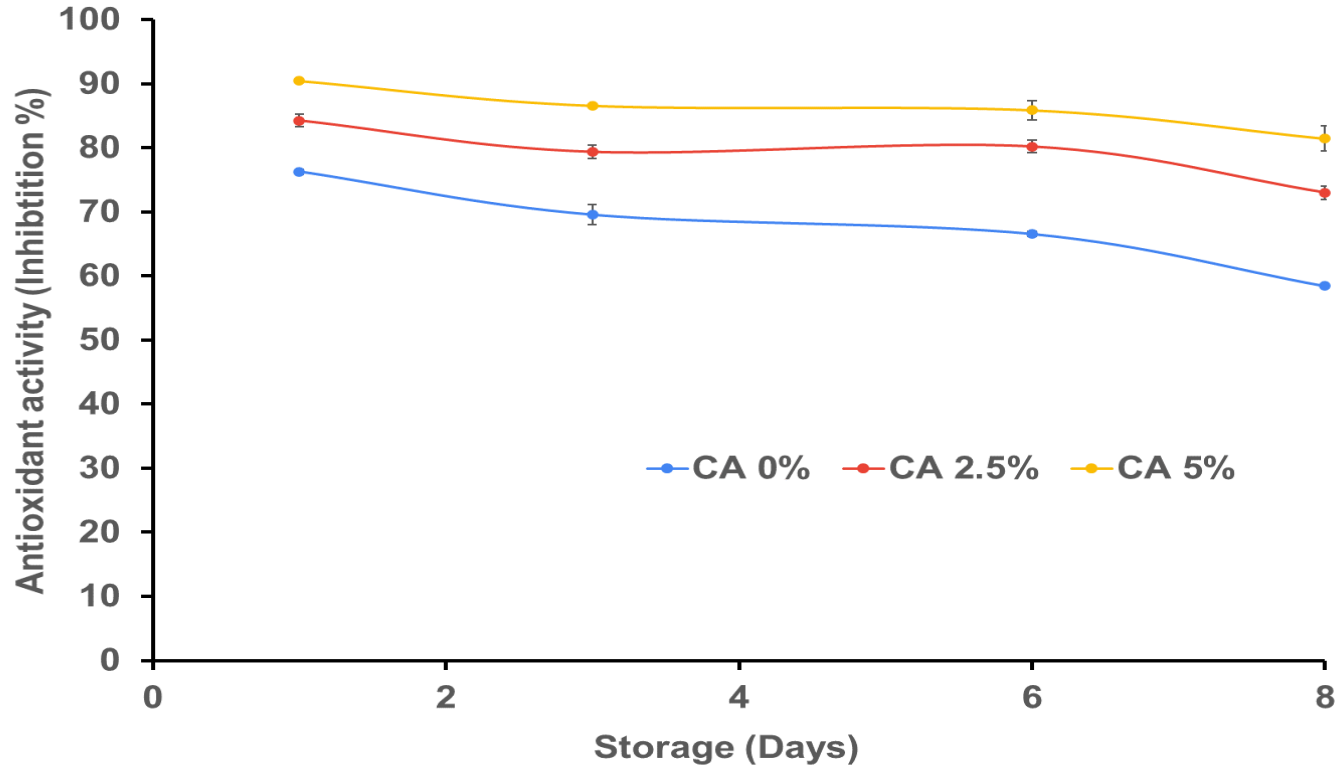
Total Phenolic Content of Sausages Incorporated with Calamansi Peel Powder Throughout a Storage Period



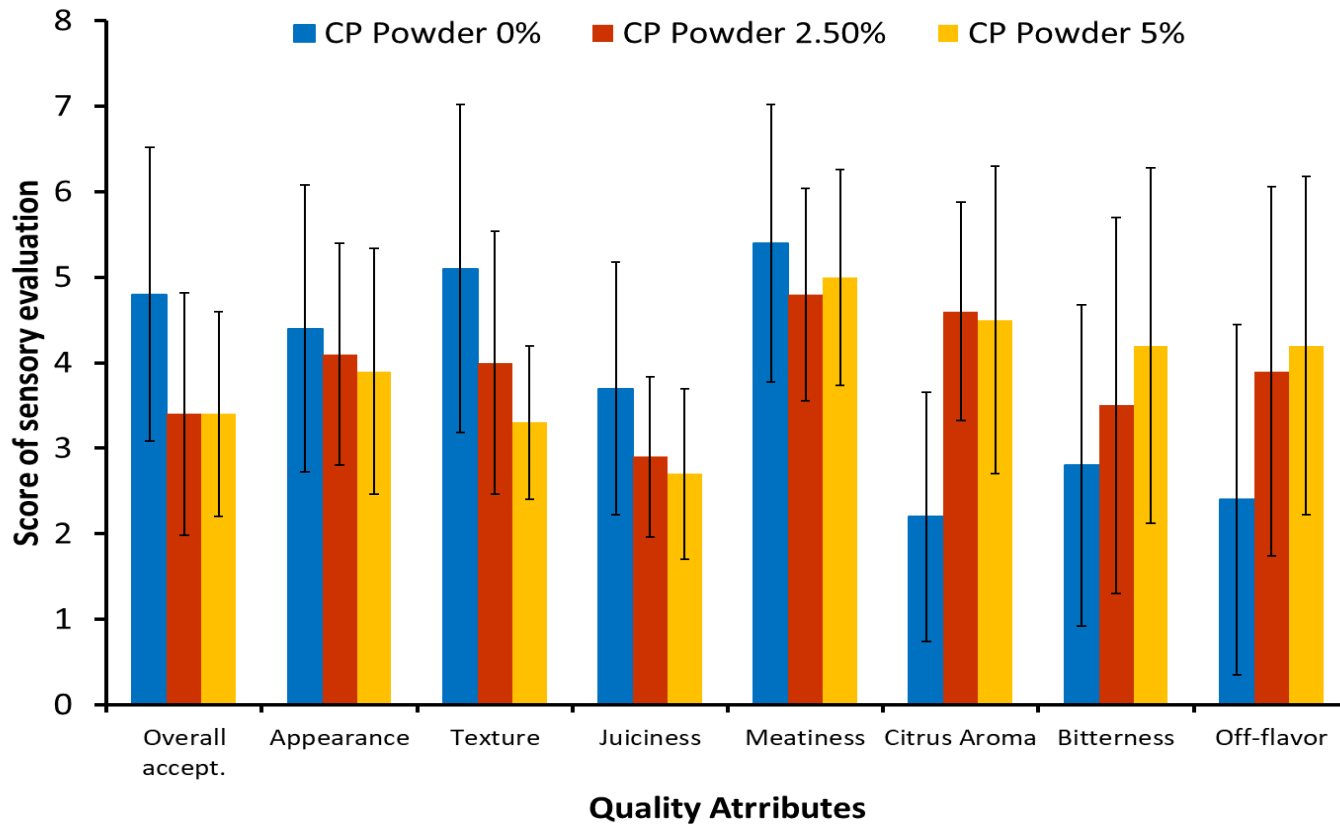
Antioxidant Activity of Sausages Incorporated with Calamansi Peel Powder for Day 1



Antioxidant Activity of 100 μ L Extract of Sausages Incorporated with Calamansi Peel Powder Throughout a Storage Period



Sensory Evaluation of Sausages Incorporated with Calamansi Peel Powder



Discussion

- Sausages incorporated with 2.5% and 5% calamansi peel powder have a higher total phenolic content compared to the sausage without calamansi peel powder.
- There was a slight decrease in total phenolic content value among the sausages incorporated with 0%, 2.5%, and 5% calamansi peel powder during storage for 8 days.
- Sausages incorporated with 2.5% and 5% calamansi peel powder have higher antioxidant activity compared to the sausage without calamansi peel powder.
- During the storage for 8 days, sausages incorporated with calamansi peel powder exhibited a gradual decrease in antioxidant activity.

Discussion Cont.

- Sausages without the calamansi peel powder exhibited a higher overall acceptance score than sausages incorporated with 2.5% and 5% calamansi peel powder and lower scores in citrus aroma, bitterness, and off-flavor.

Significance

- The results show that adding calamansi peel powder to sausages was able to increase the total phenolic content and antioxidant activity of sausages.
- The study shows that there is a possibility for calamansi peel powder to become a natural antioxidant for meat products.
- If the study was to be continued, the sausage recipe could be revised to include peels from mature/ripened calamansi.



References

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