FIPDes
Food Innovation & Product Design

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Development of a High-Protein Vegan Mango Yogurt for Note-by-Note Cooking

MODULE CODE: TFCS9025

MODULE TITLE: Advanced Molecular Gastronomy

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FOOD PRODUCT:HIGH-PROTEIN VEGAN MANGO YOGURT

Table of Content

Introduction

This project aimed to develop a high-protein, dairy-free mango yogurt using note-by-note cooking techniques, avoiding fresh mango, to achieve a sustainable, visually appealing, and flavorful product with at least 20g of protein per serving.

This four-week project aimed to iteratively refine the formulation, resulting in a dairy-free mango milkshake with enhanced sensory qualities. This report outlines the development process, final recipe, sensory evaluation, and conclusions.

Development Process

The project unfolded over four weeks, with each week targeting specific improvements:

Week 1: Comparing Mango Powder and Flavoring

- Objective: Assess mango powder versus mango flavoring for flavor delivery.
- Method: Prepared Batch 573 (mango powder) and Batch 745 (mango flavoring).
- Findings: Both batches were too fluid, needing a thicker texture. Batch 573 offered a subtle aroma but a distinct mango taste, while Batch 745 had a strong aroma but weak flavor. Mango powder was preferred for taste.

Week 2: Enhancing Flavor and Texture

- Objective: Improve texture and flavor balance.
- Method: Added guar gum and xanthan gum for thickness; adjusted mango flavoring.
- Findings: Texture improved to a creamier consistency, but excessive mango flavoring introduced a bitter aftertaste.

Week 3: Exploring Protein Alternatives

- Objective: Replace whey and casein with cricket protein for a dairy-free version.
- Method: Incorporated cricket protein with adjusted mango powder and flavoring.
- Findings: Cricket protein added a chocolate-like off-flavor and black particles, compromising flavor and appearance. A switch to pea protein was planned.

Week 4: Finalizing with Pea Protein and Spherification

- Objective: Use pea protein and add mango pearls for texture and visual appeal.
- Method: Substituted pea protein, use 30 grams more of mango powder to create mango pearls via spherification, and added blue/green colorants for a pastoral theme.
- Findings: Achieved a successful dairy-free mango milkshake with improved texture and aesthetics.The final product contains approximately 20g of protein per serving (from 20g pea protein powder), meeting the high-protein objective.

Final Recipe and method:

Materials and Method (Ingredients, Equipment and Method)

Recipe:

Mango Powder (38g), Mango Flavoring (1.5g), Coconut Milk Powder (20g), Inulin powder (1.25g), Xanthan Gum (1g), Guar Gum (1.5g), Pea Protein Powder (20g), Water (500g), Icing Sugar (40g), Yellow Colorant (1g), Coconut Butter (5g, unsalted), Lactic Acid (2g), Blue Colorant (0.075g), Green Colorant(2g), Sodium Alginate (2g), Calcium Chloride (5g), Water (500g),

Equipment: Electric blender (Serial Number: O6900182102)

Method:

1. **Prepare the yogurt base:**
    a) Mix 500g room-temperature water with melted 5g coconut butter.
    b) Blend in 20g pea protein powder and 20g coconut milk powder until smooth.
    c) Add 4.5g mango powder, 1.5g mango flavoring, and blend.
    d) Dissolve 1 gram of lactic acid in 10 mL of water, then add to the mixture and blend thoroughly to ensure even acidity.
    e) Mix 1.5g guar gum with 20g water to form a slurry, then add 1.25g inulin powder and 1g xanthan gum, blending well.
    f) Stir in 40g icing sugar.
    g) Chill for 30 minutes, stir before serving.
2. **Prepare the Mango Solution**:
    a) Dissolve 20-30 grams of mango powder in 200 ml of warm water (about 40-50°C; avoid boiling water) by stirring until fully dissolved, creating a mango-flavored liquid.
    b) Add 1 gram of yellow colorant.
    c) Let the solution cool to room temperature, then add 2 grams of sodium alginate. Blend or whisk thoroughly until fully dissolved (about 2-3 minutes).
    d) Let the mixture sit for 30 minutes to allow air bubbles to dissipate, leaving a clear solution.
3. **Prepare the Calcium Chloride Bath**: Dissolve 5 grams of calcium chloride in 500 ml of water, stirring until completely mixed. Pour into a small container and set aside.
4. **Create the Pearls**:
    a) Fill a spoon with the mango solution.
    b) Slowly drip the solution into the calcium chloride bath, one drop at a time, with a slight pause between drops.
    c) As the drops hit the bath, they'll form a gel membrane and turn into small pearls.
    d) Allow the pearl to sit in the calcium chloride bath for 1-2 minutes to fully set the outer layer.
    e) Gently scoop out the pearl with a spoon and rinse them in clean water to remove any residual calcium chloride taste.

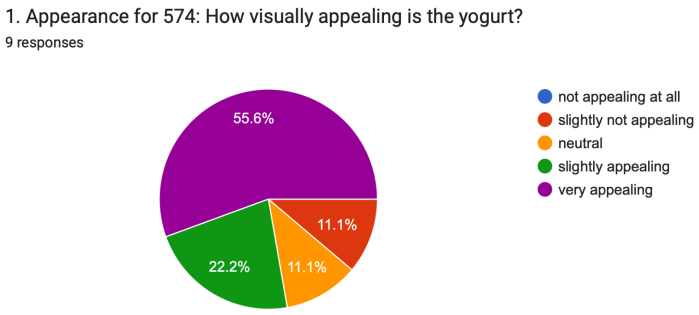
5. **Create the Pastoral Presentation:**
    a) Dye 100g of the yogurt with blue colorant to create a blue shade, then pour it into a plate to represent the "sky."
    b) Dye another 100g of the yogurt with green colorant to create a green shade, then pour it into the plate below the blue yogurt to represent the "grassland."
    c) Add the mango pearls on top of the blue yogurt to represent the "sun."
    d) Add 10g of undyed yogurt onto the blue yogurt to create "clouds."
    e) Drip a few drops of undyed yogurt onto the green yogurt to represent "sheep" on the grassland.

Figure 1: Final product

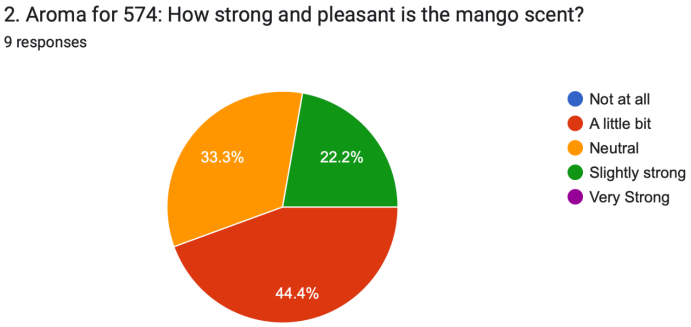
Sensory Evaluation

A panel of 9 respondents evaluated the product across key attributes:

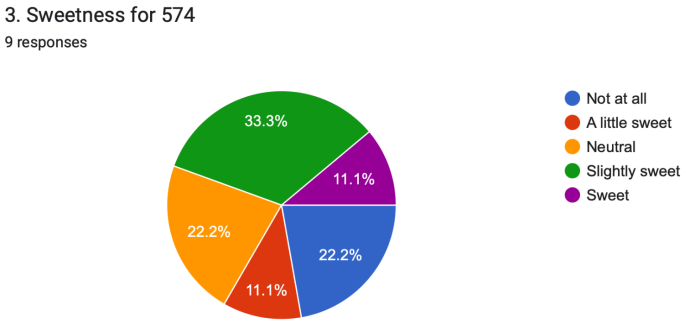
Results and discussion



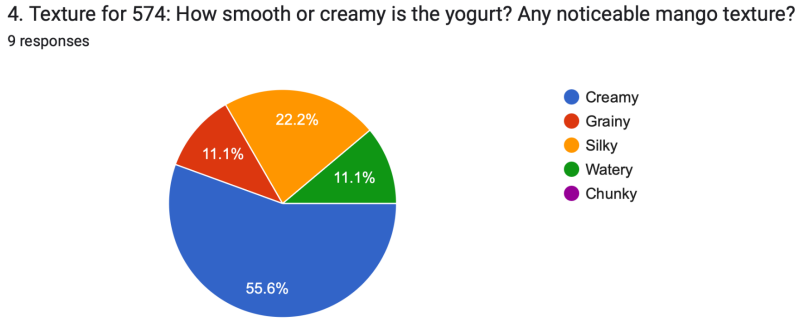
Appearance: Most respondents (55.6% "very appealing," 22.2% "slightly appealing") found the yogurt visually appealing, though 11.1% rated it "neutral" and 11.1% "slightly not appealing," suggesting minor inconsistencies in presentation.



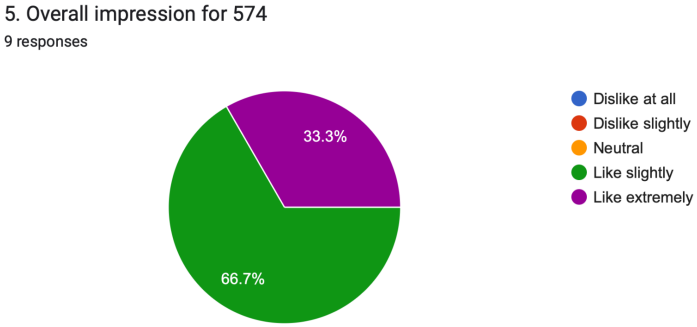
Aroma: The mango scent was weak, with 44.4% rating it "a little bit" pleasant, 33.3% "neutral," and 22.2% "slightly strong." No "very strong" ratings indicate a need for a more pronounced mango aroma.



Sweetness: Sweetness was moderate, with 33.3% rating it "slightly sweet," 22.2% "neutral," 22.2% "not at all," and 11.1% "a little sweet." Only 11.1% found it "sweet," suggesting it may not meet expectations for a mango yogurt.



Texture: A majority (55.6%) rated the texture "creamy," and 22.2% "silky," but 11.1% found it "grainy" and 11.1% "watery," indicating some inconsistency. No "chunky" ratings suggest a lack of noticeable mango pieces.



Overall Impression: All respondents liked the product (66.7% "like slightly," 33.3% "like extremely"), showing strong overall acceptance despite aroma and sweetness shortcomings.

Discussion

The fluidity in Week 1 was resolved by incorporating guar gum and xanthan gum in Week 2, while cricket protein's off-flavor in Week 3 was addressed by switching to pea protein in Week 4.

However, this dairy-free, high-protein yogurt alternative achieved strong visual (55.6% "very appealing") and textural (55.6% "creamy") appeal using note-by-note cooking (Barham et al., 2010). Weak aroma (44.4% "a little pleasant") may stem from insufficient mango flavoring (1.5g) or masking by coconut milk powder, while low sweetness (11.1% "sweet") suggests a need for adjustment. Increasing mango flavoring to 2g could enhance aroma, and raising icing sugar to 45g (a 12.5% increase) may boost sweetness to a target of 30-40% "sweet" responses, pending texture stability tests. The small sensory panel (n=9) limits generalizability; future studies should involve 30-50 participants across diverse demographics.

All ingredients comply with EU Regulation (EC) No 1333/2008 for category 01.7. Additives (E415, E412, E270, E401, E509) are used at *quantum satis*, and colorants (E100, E133 at 150 mg/kg, E141) meet permitted limits. Food components meet safety standards under Regulation (EC) No 178/2002.

Conclusion

This project successfully developed a dairy-free, high-protein mango yogurt using molecular gastronomy techniques, achieving strong visual and textural appeal with 100% positive feedback (66.7% "like slightly," 33.3% "like extremely"). The use of pea protein and spherification proved effective, offering a foundation for further refinement, though challenges in aroma (44.4% "a little pleasant") and sweetness (11.1% "sweet") suggest increasing flavoring and sugar content in future iterations.

This mango yogurt inspires "Food for the Future" by showcasing how molecular gastronomy can create sustainable, plant-based foods with pea protein. Note-by-note cooking enables precise control over texture (via spherification) and aesthetics (via colorants), though aroma enhancement remains a future focus. By using note-by-note cooking, it encourages chefs to explore resource-efficient, dairy-free techniques for innovative cuisine (This, 2013). Furthermore, it demonstrates how simple compounds can be transformed into a high-protein, sustainable yogurt alternative, addressing global demands for future nutrition.

References

- This, H. (2013) *Molecular Gastronomy: Exploring the Science of Flavor*. New York: Columbia University Press.
- Barham, P. et al. (2010) 'Molecular gastronomy: a new emerging discipline', *Chemical Reviews*, 110(4), pp.2313–2365. doi: 10.1021/cr900105w.
- European Commission (2008) 'Regulation (EC) No 1333/2008 on food additives', *Official Journal of the European Union*, L 354, pp.16–33. Available at:

https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:32008R1333.
- European Commission (2024) *EU Food Additives Database*. Available at: https://food.ec.europa.eu/food-safety/food-improvement-agents/additives/database_en (Accessed: 29 April 2025).

Appendix 1

The brands and functionalities of each ingredient are listed below.

Ingredient	Brand	Functionality	Compliance Details
Mango Powder (38g)		Provides primary mango flavor and natural fruit taste to the yogurt base.	Food component, complies with Regulation (EC) No 178/2002.
Mango Flavoring (1.5g)		Enhances mango aroma for a stronger sensory impact.	Flavoring, complies with Regulation (EC) No 1334/2008 (GMP)
Coconut Milk Powder (20g)		Acts as a dairy-free base, adding creaminess and a subtle coconut flavor.	Food component, complies with Regulation (EC) No 178/2002.
Inulin powder (1.25g)		Adds fiber, improves texture, and acts as a prebiotic for gut health.	Food component, complies with Regulation (EC) No 178/2002.

Xanthan Gum (1g)		Stabilizes and thickens the mixture, ensuring a smooth, uniform texture.	E415, quantum satis in category 01.7, compliant (Regulation (EC) No 1333/2008).
Guar Gum (1.5g)		Enhances thickness and creaminess, preventing separation.	E412, quantum satis in category 01.7, compliant (Regulation (EC) No 1333/2008).
Pea Protein Powder (20g)		Supplies high protein content (20g per serving), replacing dairy protein.	Food component, complies with Regulation (EC) No 178/2002.
Icing Sugar (40g)	N/A	Sweetens the yogurt, balancing the tartness and enhancing flavor.	Food component, complies with Regulation (EC) No 178/2002.
Coconut Butter (5g, unsalted)		Adds richness and improves mouthfeel, reducing grittiness.	Food component, complies with Regulation (EC) No 178/2002.

Lactic Acid (2g)		Mimics yogurt's tanginess, adjusting pH for an authentic taste.	E270, quantum satis in category 01.7, compliant (Regulation (EC) No 1333/2008).
Yellow Colorant (1g)		Gives a vibrant mango-like hue to the yogurt base.	E100 (Curcumin), quantum satis in category 01.7, compliant (Regulation (EC) No 1333/2008).
Blue Colorant (0.075g)		Dyes yogurt to represent the "sky" in the pastoral presentation.	E133 (Brilliant Blue FCF, "Bleu Ciel"), 150 mg/kg in category 01.7, compliant at 75mg (Regulation (EC) No 1333/2008).
Green Colorant(2g)		Dyes yogurt to represent the "grassland" in the pastoral theme.	E141 (Copper Chlorophyllin), quantum satis in category 01.7, compliant (Regulation (EC) No 1333/2008).

Sodium Alginate (2g)		Forms a gel membrane for spherification, creating mango pearls.	E401, quantum satis in category 01.7, compliant (Regulation (EC) No 1333/2008).
Calcium Chloride (5g)		Reacts with sodium alginate to set the mango pearls in the spherification process.	E509, quantum satis in category 01.7, compliant (Regulation (EC) No 1333/2008).

Appendix 2 - Logbook

WEEK NO.:1 **DATE:18/03/2025**

Weekly Aims and Objectives

Aim: to make a high-protein mango yogurt without any fresh mango

Objective: to verify if which batch works better, the one with mango powder or the one with mango flavoring

Materials and Method (Ingredients, Equipment and Method)

Ingredients:

- 573 (with mango powder only)
    - Mango Powder: 3 grams
    - Lactic Acid: 0.5 gram
    - Cellulose: 1.25 grams
    - Xanthan Gum: 1.25 grams
    - Whey Protein Powder: 20 grams
    - Water: 500 grams
    - Icing sugar: 35 grams
    - Yellow colorant: 2.5 grams

- 745 (with mango flavoring only)
    - Mango Flavoring: 1 gram
    - Lactic Acid: 0.5 gram
    - Cellulose: 1.25 grams
    - Xanthan Gum: 1.25 grams
    - Whey Protein Powder: 20 grams
    - Water: 500 grams
    - Icing sugar: 35 grams
    - Yellow colorant: 2.5 grams

Equipment: Electric blender (Serial Number: O6900182102)

Methods:

Steps for 573:

1. Prepare the Water Base: Pour 500 grams of water into a large mixing bowl or beaker. Ensure the water is at room temperature to help better dissolve the other components.

2. Dissolving Whey Protein: Slowly add 15 grams of whey protein powder to the water, whisking continuously to avoid clumping. It's important to ensure the whey protein is fully dissolved to maintain a smooth texture.

3. Adding Flavors and Acids:

    1. Introduce 3 grams of mango powder to the mixture and continue stirring until it is fully integrated and there are no visible particles.

    2. Add 0.5 gram of lactic acid, mixing thoroughly until completely dissolved. This acid will mimic the tartness found in traditional yogurt.

4. Incorporate Thickeners:

    1) Gradually sprinkle 1.25 grams of cellulose into the mixture, continuing to stir to prevent any lumps. Cellulose will add body to the yogurt.

    2) Add 1.25 grams of xanthan gum while mixing vigorously. Xanthan gum acts as a thickening agent and will help stabilize the texture of the yogurt.

5. Thorough Mixing: Use an electric mixer to blend the mixture for a few minutes, ensuring all components, especially the thickeners, are uniformly distributed without any lumps.

6. Adjusting Flavor and Consistency:

    1) Taste the mixture to assess the flavor balance. Adjust with additional mango powder or a sweetener like stevia if needed.

    2) Check the acidity with a pH meter if available, aiming for a pH similar to that of natural yogurt (around pH 4.5).

7. Chilling the Yogurt: Pour the mixture into a clean container and refrigerate for at least 30 minutes. This step allows the flavors to meld and the texture to firm up, achieving a yogurt-like consistency.

8. Final Preparation: Once chilled, stir the yogurt well before serving to ensure that any separation is corrected and the texture is creamy and uniform.

Steps for 745:

1. Prepare the Water Base: Pour 500 grams of water into a large mixing bowl or beaker. Ensure the water is at room temperature to help better dissolve the other components.

2. Dissolving Whey Protein: Slowly add 15 grams of whey protein powder to the water, whisking continuously to avoid clumping. It's important to ensure the whey protein is fully dissolved to maintain a smooth texture.

3. Adding Flavors and Acids: Introduce 1 gram of mango flavoring to the mixture and continue stirring until it is fully integrated and there are no visible particles. Add 0.5 gram of lactic acid, mixing thoroughly until completely dissolved. This acid will mimic the tartness found in traditional yogurt.

4. Incorporate Thickeners:

    3) Gradually sprinkle 1.25 grams of cellulose into the mixture, continuing to stir to prevent any lumps. Cellulose will add body to the yogurt.

    4) Add 1.25 grams of xanthan gum while mixing vigorously. Xanthan gum acts as a thickening agent and will help stabilize the texture of the yogurt.

5. Thorough Mixing: Use an electric mixer to blend the mixture for a few minutes, ensuring all components, especially the thickeners, are uniformly distributed without any lumps.

6. Adjusting Flavor and Consistency:

    3) Taste the mixture to assess the flavor balance. Adjust with additional mango powder or a sweetener like stevia if needed.

7. Chilling the Yogurt: Pour the mixture into a clean container and refrigerate for at least 30 minutes. This step allows the flavors to meld and the texture to firm up, achieving a yogurt-like consistency.

8. Final Preparation: Once chilled, stir the yogurt well before serving to ensure that any separation is corrected and the texture is creamy and uniform.

Results and discussion

Figure 2: Batch 745

Figure 3: Batch 573

Both Batch 573 (mango powder) and Batch 745 (mango flavoring) were highly fluidic, thanks to 500 grams of water and thickeners (1.25 grams each of cellulose and xanthan gum). Flavor profiles differed significantly.

Batch 573, with 3 grams of mango powder, had a faint mango aroma but delivered a noticeable mango taste when consumed. Batch 745, with 1 gram of mango flavoring, offered a strong mango scent but lacked flavor on the palate. The sweetness from 35 grams of icing sugar was present but could be stronger in both to enhance the mango notes.

Batch 573 better meets the goal of a high-protein mango yogurt due to its taste delivery, despite a weaker aroma. Batch 745 excels in scent but disappoints in flavor. Increasing sweetness (e.g., to 40 grams of icing sugar) and tweaking mango amounts—more powder for 573 or a hybrid approach for 745—could improve both.

Conclusions

This week's experiments with Batch 573 (mango powder) and Batch 745 (mango flavoring) provided valuable insights into achieving a high-protein mango yogurt without fresh mango. Batch 573, despite its faint aroma, delivered a satisfactory mango taste, outperforming Batch 745, which offered a strong scent but minimal flavor on the palate. Both batches remained highly fluidic, indicating a need for enhanced thickening, and the sweetness from 35 grams of icing sugar, while adequate, could be intensified for a richer profile. These findings suggest that combining mango powder and flavoring could balance aroma and taste, a strategy to be implemented next week.

Next week's plan involves testing three variations: a dairy-free version with coconut milk powder version. It will incorporate both mango powder (3 grams) and flavoring (1 gram), 40 grams of icing sugar for increased sweetness, and 5 grams of butter to improve mouthfeel and reduce grittiness. To address the

persistent fluidity, 1.5 grams of guar gum will be added as a thickener, cooperating with 1 gram of xanthan gum, chosen for its ability to create a creamy, yogurt-like consistency without requiring heat, unlike agar agar. These iterations aim to refine texture, enhance flavor cohesion, and explore base ingredient impacts, building on this week's lessons to optimize the final product. Moreover, yellow colorant will be replaced by orange colorant.

Recipe for the following week:

Mango Powder: 3g
Mango Flavoring: 2g
Coconut Milk Powder: 20g
Cellulose: 1.5g
Xanthan Gum: 3g
Guar Gum: 4.5g
Whey Protein Powder: 20g
Casein Protein Powder: 10g
Icing Sugar: 40g
Yellow Colorant: 2g
Coconut Butter (unsalted): 10g
Lactic Acid: 1g

Recommendations for the following week.

Next week's plan involves testing three variations: a dairy-free version with coconut milk powder version. It will incorporate both mango powder (3 grams) and flavoring (1 gram), 40 grams of icing sugar for increased sweetness, and 5 grams of butter to improve mouthfeel and reduce grittiness. To address the persistent fluidity, 1.5 grams of guar gum will be added as a thickener, cooperating with 1 gram of xanthan gum, chosen for its ability to create a creamy, yogurt-like consistency without requiring heat, unlike agar agar. These iterations aim to refine texture, enhance flavor cohesion, and explore base ingredient impacts, building on this week's lessons to optimize the final product. Moreover, yellow colorant will be replaced by orange colorant.

The recommendation is to:

1. Improve Texture: Increase thickening with 1.25g cellulose, 1g xanthan gum, and 1.5g guar gum, targeting a creamy, spoonable consistency, adjusting guar gum to 1g if overly thick.
2. Boost Sweetness and Mouthfeel: Use 40g icing sugar for a richer profile and add 5g coocnut butter for dairy-free to reduce grittiness, assessing mouthfeel.
3. Adjust Acidity and Appearance: Include 1g lactic acid to mimic yogurt's pH (~4.5), omitting it in the yogurt powder version due to inherent acidity, and use 2g yellow colorant per batch (6g total) for a vibrant mango-like hue.

WEEK NO.: 2 **DATE:24/03/2025**

Weekly Aims and Objectives

Aim: to make a high-protein mango yogurt without any fresh mango

Objective:

Enhance Flavor Cohesion: Incorporate 3g mango powder and 1g mango flavoring per batch to achieve a harmonious balance of taste and aroma, refining the 3:1 ratio based on taste-test feedback.

1. Improve Texture: Increase thickening with 1.25g cellulose, 1g xanthan gum, and 1.5g guar gum, targeting a creamy, spoonable consistency, adjusting guar gum to 1g if overly thick.
2. Boost Sweetness and Mouthfeel: Use 40g icing sugar for a richer profile and add 5g butter for dairy-free to reduce grittiness, assessing mouthfeel.
3. Adjust Acidity and Appearance: Include 0.5g lactic acid to mimic yogurt's pH (~4.5), omitting it in the yogurt powder version due to inherent acidity, and use 2g yellow colorant per batch (6g total) for a vibrant mango-like hue.

Materials and Method (Ingredients, Equipment and Method)

Recipe: Dairy-Free with Coconut Milk Powder

Ingredients: Mango Powder (3g), Mango Flavoring (2g), Coconut Milk Powder (20g), Cellulose (1.25g), Xanthan Gum (1g), Guar Gum (1.5g), Whey Protein Powder (20g), Water (500g), Icing Sugar (40g), Orange Colorant (2g), Coconut Butter (5g, unsalted), Lactic Acid (1 gram), Casein Protein(10g)

Equipment: Electric blender (Serial Number: O6900182102)

Method:

1. Mix 500g room-temperature water with melted 5g coconut butter.
2. Blend in 20g whey protein, 20g casein protein and 20g coconut milk powder until smooth.
3. Add 3g mango powder, 1g mango flavoring, and blend.
4. Dissolve 0.5 grams of lactic acid in 10 mL of water, then add to the mixture and blend thoroughly to ensure even acidity.
5. Mix 1.5g guar gum with 20g water to form a slurry, then add 1.25g cellulose and 1g xanthan gum, blending well.
6. Stir in 40g icing sugar and 2g orange colorant.
7. Chill for 30 minutes, stir before serving.

Results and discussion

Figure 4: Final Product

This week, the textural quality exhibited marked improvement following the incorporation of xanthan gum and guar gum. The acidity and sweetness were maintained at moderate levels; however, the concentration of mango flavoring was excessive, resulting in an undesirably bitter aftertaste.

Conclusions

The incorporation of guar gum and xanthan gum has markedly enhanced the texture of the formulation this week. However, the excessive use of mango flavoring resulted in a slightly bitter aftertaste. To improve the flavor profile, the plan for next week is to increase the amount of mango powder from 3g to 8g and adjust the mango flavoring to 1.5g. Additionally, in an effort to develop a dairy-free protein milkshake, 25g of cricket protein will replace the traditional whey and casein proteins.

Recommendations for the following week.

Mango Powder (8g), Mango Flavoring (1.5g), Coconut Milk Powder (20g), Cellulose (1.25g), Xanthan Gum (1g), Guar Gum (1.5g), Cricket Protein Powder (25g), Water (500g), Icing Sugar (40g), Yellow Colorant (2g), Coconut Butter (5g, unsalted), Lactic Acid (1g)

WEEK NO.: 3 **DATE:31/03/2025**

Weekly Aims and Objectives

Aim: to make a high-protein mango yogurt without any fresh mango

Objective:

To improve the flavor profile, the plan for next week is to increase the amount of mango powder from 3g to 4.5g and adjust the mango flavoring to 1.5g. Additionally, in an effort to develop a dairy-free protein milkshake, 25g of cricket protein will replace the traditional whey and casein proteins.

Materials and Method (Ingredients, Equipment and Method)

Recipe:

Mango Powder (8g), Mango Flavoring (1.5g), Coconut Milk Powder (20g), Cellulose (1.25g), Xanthan Gum (1g), Guar Gum (1.5g), Cricket Protein Powder (25g), Water (500g), Icing Sugar (40g), Yellow Colorant (2g), Coconut Butter (5g, unsalted), Lactic Acid (1g)

Equipment: Electric blender (Serial Number: O6900182102)

Method:

1. Mix 500g room-temperature water with melted 5g coconut butter.
2. Blend in 25g cricket protein powder and 20g coconut milk powder until smooth.
3. Add 4.5g mango powder, 1.5g mango flavoring, and blend.
4. Dissolve 1 gram of lactic acid in 10 mL of water, then add to the mixture and blend thoroughly to ensure even acidity.
5. Mix 1.5g guar gum with 20g water to form a slurry, then add 1.25g cellulose and 1g xanthan gum, blending well.
6. Stir in 40g icing sugar and 1g yellow colorant.
7. Chill for 30 minutes, stir before serving.

Results and discussion

Figure 5: Mango yogurt using cricket protein

The initial version of product, a dairy-free mango milkshake with 25g of cricket protein, did not meet expectations. As seen in Figure 1, the cricket protein added black particles, making the appearance unappealing despite 2g of yellow colorant. It also gave a chocolate-like flavor that clashed with the 4.5g of mango powder and 1.5g of mango flavoring, disrupting the intended taste. .

Conclusions

The development of product 574, a vegan mango yogurt, revealed that cricket protein powder was unsuitable due to its black particles and chocolate-like flavor, which clashed with the mango profile and harmed the appearance. To address this, the next phase will replace it with 25g of pea protein to achieve a better flavor and look. Additionally, 2g of sodium alginate, 5g of calcium chloride, 500g of water, and 30g of mango powder will be used to create mango pearls via spherification, adding a unique texture. Blue colorant (0.075g) and green colorant (2g) will also be incorporated to enhance the visual appeal, aligning with the pastoral theme of the product. These adjustments aim to improve both the sensory experience and market potential of the milkshake.

Recommendations for the following week.

Mango Powder (8g), Mango Flavoring (1.5g), Coconut Milk Powder (20g), Cellulose (1.25g), Xanthan Gum (1g), Guar Gum (1.5g), Pea Protein Powder (20g), Water (500g), Icing Sugar (40g), Yellow Colorant (1g), Coconut Butter (5g, unsalted), Lactic Acid (2g), **Blue Colorant (0.075g), Green Colorant(2g)**, **Sodium alginate (2g), calcium chloride (5g)**, water (500g), **mango powder(30g)**

WEEK NO.: 4 **DATE:07/04/2025**

Weekly Aims and Objectives

Aim: to make a high-protein mango yogurt without any fresh mango

Objective:

To improve the flavor profile, in an effort to develop a dairy-free protein milkshake, 25g of pea protein will replace the cricket protein. Also, to make the appearance and improve the creativity of the product, blue and green colorant will be introduced, as well as mango egg-yolk will be added.

Materials and Method (Ingredients, Equipment and Method)

Recipe:

Mango Powder (8g), Mango Flavoring (1.5g), Coconut Milk Powder (20g), Cellulose (1.25g), Xanthan Gum (1g), Guar Gum (1.5g), Pea Protein Powder (20g), Water (500g), Icing Sugar (40g), Yellow Colorant (1g), Coconut Butter (5g, unsalted), Lactic Acid (2g), **Blue Colorant (0.075g), Green Colorant(2g)**, **Sodium alginate (2g), calcium chloride (5g)**, water (500g), **mango powder(30g)**

Equipment: Electric blender (Serial Number: O6900182102)

Method:

Prepare the yogurt base:

1. Mix 500g room-temperature water with melted 5g coconut butter.
2. Blend in 20g pea protein powder and 20g coconut milk powder until smooth.
3. Add 4.5g mango powder, 1.5g mango flavoring, and blend.
4. Dissolve 1 grams of lactic acid in 10 mL of water, then add to the mixture and blend thoroughly to ensure even acidity.
5. Mix 1.5g guar gum with 20g water to form a slurry, then add 1.25g cellulose and 1g xanthan gum, blending well.
6. Stir in 40g icing sugar and 1g yellow colorant.
7. Chill for 30 minutes, stir before serving.

Prepare the Mango Solution:

- Dissolve 20-30 grams of mango powder in 200 ml of warm water (about 40-50°C; avoid boiling water) by stirring until fully dissolved, creating a mango-flavored liquid.
- Add 1 gram of yellow colorant.

- Let the solution cool to room temperature, then add 2 gram of sodium alginate. Blend or whisk thoroughly until fully dissolved (about 2-3 minutes).
- Let the mixture sit for 30 minutes to allow air bubbles to dissipate, leaving a clear solution.

Prepare the Calcium Chloride Bath: Dissolve 5 grams of calcium chloride in 500 ml of water, stirring until completely mixed. Pour into a small container and set aside.

Create the Pearls:

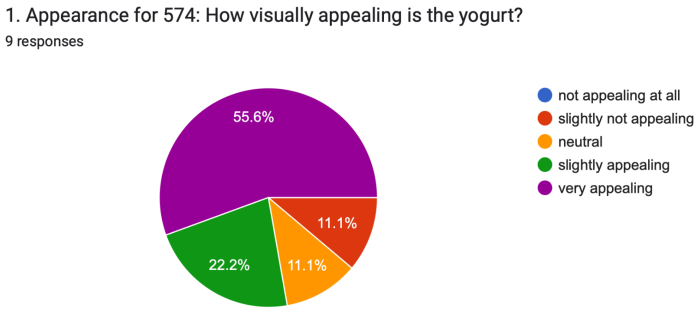
- Fill a spoon with the mango solution.
- Slowly drip the solution into the calcium chloride bath, one drop at a time, with a slight pause between drops.
- As the drops hit the bath, they'll form a gel membrane and turn into small pearls.
- Allow the pearl to sit in the calcium chloride bath for 1-2 minutes to fully set the outer layer.
- Gently scoop out the pearl with a spoon and rinse them in clean water to remove any residual calcium chloride taste.

Create the Pastoral Presentation:

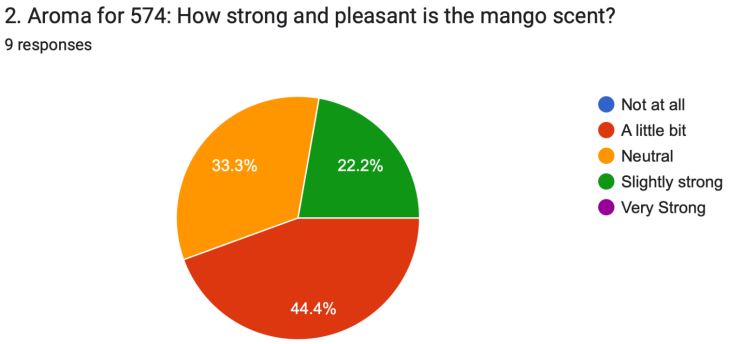
- Dye 100g of the yogurt with blue colorant to create a blue shade, then pour it into a plate to represent the "sky."
- Dye another 100g of the yogurt with green colorant to create a green shade, then pour it into the plate below the blue yogurt to represent the "grassland."
- Add the mango pearls on top of the blue yogurt to represent the "sun."
- Add 10g of undyed yogurt onto the blue yogurt to create "clouds."
- Drip a few drops of undyed yogurt onto the green yogurt to represent "sheep" on the grassland.

Results and discussion

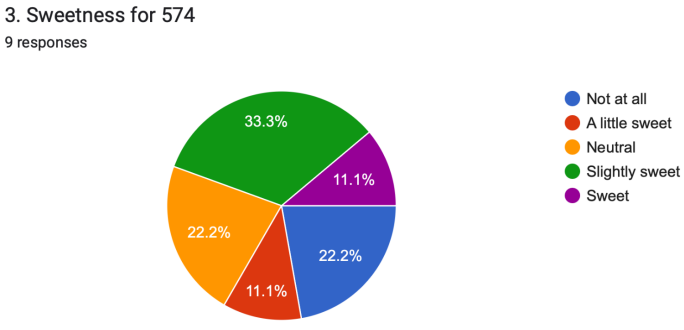
Figure 6: Final product



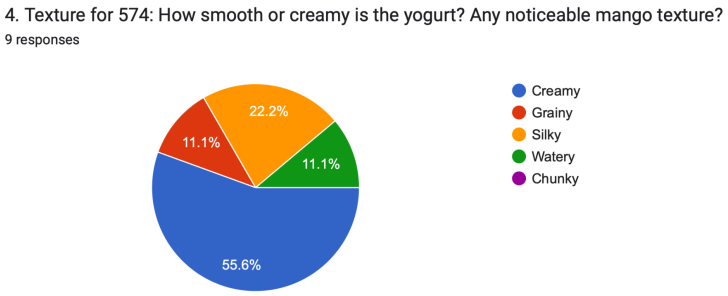
Appearance: Most respondents (55.6% "very appealing," 22.2% "slightly appealing") found the yogurt visually appealing, though 11.1% rated it "neutral" and 11.1% "slightly not appealing," suggesting minor inconsistencies in presentation.



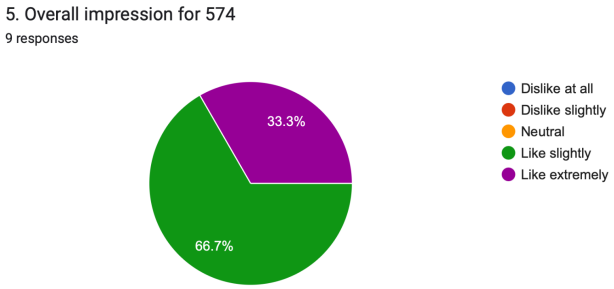
Aroma: The mango scent was weak, with 44.4% rating it "a little bit" pleasant, 33.3% "neutral," and 22.2% "slightly strong." No "very strong" ratings indicate a need for a more pronounced mango aroma.



Sweetness: Sweetness was moderate, with 33.3% rating it "slightly sweet," 22.2% "neutral," 22.2% "not at all," and 11.1% "a little sweet." Only 11.1% found it "sweet," suggesting it may not meet expectations for a mango yogurt.



Texture: A majority (55.6%) rated the texture "creamy," and 22.2% "silky," but 11.1% found it "grainy" and 11.1% "watery," indicating some inconsistency. No "chunky" ratings suggest a lack of noticeable mango pieces.



Overall Impression: All respondents liked the product (66.7% "like slightly," 33.3% "like extremely"), showing strong overall acceptance despite aroma and sweetness shortcomings.

Recommendations: Enhance the mango aroma and sweetness to better align with expectations, ensure texture consistency, and conduct further testing with a larger sample size to validate findings. Product 574 has strong potential but could benefit from these adjustments to improve its sensory profile.

Conclusions

The development of product 574, a dairy-free mango milkshake, successfully achieved its objective of creating a visually appealing and innovative product through molecular gastronomy techniques. The recipe, utilizing coconut milk powder, pea protein, and mango powder, effectively replaced cricket protein while delivering a creamy texture and meeting the target of 25g of protein per serving. The incorporation of yellow and green colorants enhanced the visual representation, with the mango protein symbolizing the sun, white yogurt representing clouds and sheep on the pasture, blue yogurt depicting the sky, and green yogurt illustrating the grassy field, as shown in Figure 1. The spherification process, using sodium alginate and calcium chloride, successfully created mango-flavored pearls, adding a unique textural element that complemented the pastoral theme.

The method ensured a balanced flavor with 8g of mango powder, 1.5g of mango flavoring, and 40g of icing sugar for sweetness, while 1g of lactic acid provided a subtle tanginess reminiscent of traditional yogurt. The process was streamlined and reproducible, with clear steps for blending, chilling, and spherification. In conclusion, product 574 effectively combines a dairy-free formulation with a creative pastoral design, offering a visually striking and flavorful milkshake. Further refinement in flavor intensity and pearl consistency could enhance its market appeal.