JAPSI (Journal of Agriprecision and Social Impact)
Volume 1 Issue 3 November 2024
e-ISSN: 3032-7849; p-ISSN: 3046-5397, Page 323-342
DOI: 10.62793/japsi.v1i3.33
Available online at: https://journal.kdp.co.id/index.php/japsi

Effect of Adding Natural Extracts on pH Value, Yield, and Organoleptic Properties of Honey Candy

Anif Mukaromah Wati
Animal Science Study Program, Study Program Outside the Main Campus of Universitas Brawijaya (PSDKU), Kediri, Indonesia

Premy Puspitawati Rahayu
Faculty of animal science , Universitas Brawijaya, Malang, Indonesia

Dimas Irawan Prasetyo
Animal Science Study Program, Study Program Outside the Main Campus of Universitas Brawijaya (PSDKU), Kediri, Indonesia

Novie Ayu Kuncoro Esti
Animal Science Study Program, Study Program Outside the Main Campus of Universitas Brawijaya (PSDKU), Kediri, Indonesia

Address: Jl. Pringgodani, Mrican, Kec. Mojoroto, Kota Kediri, Jawa Timur 64111
Corresponding author: premypuspita@ub.ac.id

Abstract. *This study investigates the effects of adding various natural extracts: carrot, red ginger, mango, and tamarind on the physical and sensory properties of honey candy. Specifically, the research examines the pH value, yield, and organoleptic qualities (taste, aroma, texture, and color) of honey candy enhanced with these extracts. A laboratory experiment with a completely randomized design (CRD) was conducted, and each treatment was replicated four times. Results showed highly significant differences in the all treatments. The highest pH was recorded with red ginger extract (5.41), while the lowest was with tamarind extract (4.02). Carrot extract yielded the highest production efficiency (61.5%), followed closely by tamarind (58%), whereas red ginger and mango showed lower yields. Organoleptic testing revealed that tamarind extract was most preferred in terms of taste and color, while mango and red ginger improved texture. Red ginger, however, received lower scores for taste and aroma, likely due to its strong spicy profile. Overall, the addition of natural extracts significantly impacted the quality of honey candy, with tamarind and carrot extracts demonstrating the most favorable effects on yield and sensory attributes, making them promising choices for enhancing functional candy products.*

Keywords: *Honey candy, Natural extracts, Organoleptic properties, pH, Yield*

Received: September 15, 2024; Accepted: October 25, 2024; Published: November 9, 2024
*Corresponding author premypuspita@ub.ac.id

INTRODUCTION

Honey is one of the natural products that has been widely used since ancient times due to its high nutritional content and health benefits. Honey contains various active components such as sugars, organic acids, vitamins, minerals, enzymes, and phenolic compounds, making it highly valuable in food and health products (Edo et al., 2023). One of the uses of honey that has developed in the modern food industry is as a base ingredient for candy production, which not only serves as a sweet snack but also offers health benefits (Babbar et al., 2023).

Honey, rich in health benefits, is not only used in its natural form but has also evolved into processed products like honey candy (Bhattarai & Kusma, 2022), which combines the nutritional benefits of honey with a delicious taste and more practical form (Edo et al., 2023). Honey candy is a type of processed product made by mixing honey with other ingredients that can change the texture of honey from liquid or viscous to solid (Ganie et al., 2022). In addition to providing natural sweetness, honey also offers functional advantages due to its rich content of antioxidants and antibacterial properties(Šedí-k et al., 2023). In recent years, honey candy has gained special attention among health-conscious consumers who prefer products made from natural ingredients (Sahlan et al., 2019).

The food industry is now shifting towards products that are not only delicious but also beneficial for health. Therefore, adding natural extracts to honey candy has the potential to enhance the commercial value of this product. The addition of natural extracts in the formulation of honey candy is believed to improve the physical and organoleptic qualities of the candy. Natural extracts such as herbal extracts, fruits, or other plants are often chosen due to their high bioactive content. These extracts can function as natural preservatives, flavor enhancers, and also provide additional health benefits (Stupar et al., 2024).

In this study, the addition of natural extracts to honey candy will be tested for its effect on three main aspects: pH value, yield, and organoleptic characteristics. This research is important to explore the potential for developing healthier and higher-quality functional food products, as well as providing natural alternatives to synthetic additives. However, in the process of making candy, especially honey candy, there are several challenges that affect the final product quality. The pH value, yield, and organoleptic

characteristics of honey candy are greatly influenced by the composition of the ingredients and the manufacturing process. To produce honey candy of good quality, stability of pH value, high yield, and organoleptic characteristics that are liked by consumers become the main targets.

Although various studies have proven the benefits of honey and natural extracts in food products, research specifically exploring the effect of adding natural extracts on physical qualities such as pH value, yield, and organoleptic characteristics in honey candy remains limited (Susanti et al., 2023). Moreover, few studies have deeply examined how combinations of different natural extracts can optimize the quality of honey candy without sacrificing its stability and health value. Therefore, this study aims to fill this gap by evaluating the specific effects of several types of natural extracts on the overall quality of honey candy, providing innovative solutions for the development of healthier and higher-quality functional food products.

This study aims to explore how the addition of natural extracts can affect the physical and organoleptic characteristics of honey candy. The study is expected to provide new insights into the development of healthy candy products made from natural ingredients. With increasing consumer awareness of the importance of healthy eating patterns, this research has the potential to offer innovative solutions for the functional food industry.

Moreover, the results of this research can benefit candy manufacturers in improving the quality and competitiveness of their products. By understanding how the addition of natural extracts affects pH, yield, and organoleptic characteristics, manufacturers can devise better formulation strategies to produce honey candy with higher nutritional value and better taste. Additionally, this research also contributes to the advancement of knowledge regarding the interaction between honey and natural extracts in food applications.

LITERATURE REVIEW

The use of honey as a base ingredient for candy has grown due to its nutritional content and health benefits, such as high antioxidant and antibacterial properties (Edo et al., 2023). Honey candy serves as a healthy alternative for snacks, providing a sweet taste along with health benefits (Babbar et al., 2023). Health-conscious consumers are increasingly attracted to this honey candy product because it uses natural ingredients.

Additionally, the addition of natural extracts in honey candy can enhance its physical and organoleptic qualities, including pH, yield, and sensory characteristics such as taste, aroma, and texture (Stupar et al., 2024). Products enriched with natural extracts also have a higher commercial value, as they can offer additional health benefits compared to conventional candies.

Each extract brings specific bioactive components that contribute to the product's characteristics. For example, red ginger extract contains gingerol, which provides a spicy taste and distinctive aroma, while carrot extract is rich in beta-carotene, which adds an attractive color to the candy (Yulianto et al., 2023). Previous research has shown that tamarind provides the best results in terms of taste and color preference, while carrot yields the highest production efficiency (Sahlan et al., 2019). The combination of these extracts offers a more complex variety of flavors and health benefits, attracting consumer interest and meeting the market demand for healthy and natural products.

The pH level of honey candy is also influenced by the extracts used, which in turn affects the product's stability and flavor. Red ginger and carrot extracts tend to maintain the pH at a higher level, while tamarind extract, which is rich in organic acids, lowers the pH and provides a fresh acidic taste (Vikram et al., 2023). This pH difference impacts the texture stability and shelf life of honey candy (Wichchukit et al., 2023). y understanding the effects of each natural extract, producers can develop an optimal honey candy formulation favored by consumers and improve the product's quality in terms of nutrition and organoleptic appeal.

RESEARCH METHODS

1. Location and Time of Research: This research was conducted at PSDKU UB Kediri, during the research period from April to June 2024.
2. Materials and Tools: The tools needed are Teflon, wooden spatula, measuring glass, analytical scale, spoon, candy molds, pH meter, and organoleptic testing tools (panelists). The required materials include 50 grams of multiflora honey, 50 grams of granulated sugar, and 40 grams of water, as well as several natural extracts including: T1: addition of Carrot Extract, T2: addition of Red Ginger Extract, T3: addition of Mango Extract, T4: addition of Tamarind Extract. These extracts were purchased from local suppliers and selected based on their antioxidant characteristics and health effects.

3. Honey Candy Making Procedure:
    a. Prepare the ingredients and cooking tools
    b. Turn on the stove to low heat
    c. Pour water into the Teflon until it starts to bubble
    d. Add sugar, stir until the sugar melts
    e. Add honey, stir until the mixture thickens
    f. Once the water content decreases, the mixture can be removed
    g. Pour the mixture into the molds
    h. Wait until it hardens
4. Research Method: This research uses a laboratory experiment method with a completely randomized design (CRD). The treatments involve adding several types of natural extracts to the honey candy formulation to observe their effects on pH, yield, and organoleptic testing. Each treatment was repeated four times to ensure data consistency.
5. Observation Parameters:

a. pH Testing: pH measurements were taken on each honey candy sample after the drying process was completed. A digital pH meter with standard calibration was used for pH measurement. Each sample's pH was tested four times to obtain the average pH value.

b. Yield: Weigh and record the initial weight of the sample mixture. After the molding process, the cooled and hardened samples are removed from the molds. Weigh and record the final weight of the samples to determine the yield.

$$\text{Yield \%} = \frac{\text{(initial weight)}}{\text{(final weight)}} \times 100$$

c. Organoleptic Test: The organoleptic test was conducted to assess the sensory quality of honey candy, including taste, aroma, texture, and color. The organoleptic test was carried out by a panel of 20 semi-trained panelists. The panelists were asked to rate each sensory parameter on a scale of 1–5 (1 for dislike, 5 for highly like). The results of the organoleptic test will be analyzed using statistical methods.

6. Data Analysis: The data obtained from pH, yield, and organoleptic testing were statistically analyzed using analysis of variance (ANOVA) to observe the effect of adding natural extracts on each parameter. If significant differences were found,

further analysis using Duncan's test was conducted to determine differences between treatments. Data processing was carried out using SPSS software version 25.

RESULTS AND DISCUSSION

Table 1. Effect of Different Natural Extracts Additions on pH, Yield, Taste, Texture, Aroma, and Color of Honey Candy

Treatment	pH	Yield	Taste	Texture	Aroma	Color
T1	5.08±0.01^{a}	61.5±1.66^{a}	5.13±0.00^{a}	2.25±0.01^{c}	4.33±0.01^{a}	3.05±0.00^{c}
T2	5.41±0.02^{a}	53±0,66^{b}	4.34±0.01^{b}	3.91±0.28^{a}	2.22±0.04^{b}	3.51±0.00^{b}
T3	4.48±0.01^{b}	51.25±0.91^{b}	5.17±0.00^{a}	4.08±0.01^{a}	4.21±0.00^{a}	3.51±0.00^{b}
T4	4.02±0.00^{c}	58±0.66^{ab}	5.21±0.00^{a}	3.32±0.00^{b}	4.13±0.00^{a}	4.06±0.01^{a}

^{a,ab,b,c}Mean values within a same column followed by the different letters are highly significantly different at ($p<0.01$)

T1: addition of Carrot Extract, T2: addition of Red Ginger Extract, T3: addition of Mango Extract, T4: addition of Tamarind Extract.

The Effect of Adding Natural Extracts on the pH Value of Honey Candy

Based on the table showing the average pH values of the four treatments, the measurement results indicate a highly significant difference ($p<0.01$) between the treatments, with pH ranges between 4.02 and 5.41. Treatment T2, which is honey candy with the addition of red ginger extract, produced the highest pH value, namely 5.41. This result indicates that red ginger extract can maintain a relatively high pH level in honey candy compared to the other treatments. However, treatment T1, which used carrot extract, had a pH value of 5.08, which was not significantly different from T2. Both treatments demonstrated the ability to maintain pH stability at a more alkaline level compared to the other treatments. On the other hand, treatment T3 (mango extract) resulted in a pH value of 4.48, which was lower than T1 and T2, while the lowest pH value was found in T4 (tamarind extract), with an average pH of 4.02. This shows that tamarind extract has the strongest influence in lowering the pH of honey candy, consistent with its natural acidic properties.

The addition of honey candy with red ginger and carrot had a relatively higher pH compared to the other treatments, indicating that carrot and red ginger extracts have a lesser effect on lowering the pH of honey candy. Ginger is known to contain bioactive components such as gingerol and shogaol (Yulianto et al., 2023), which provide a spicy taste and distinctive aroma (Pang et al., 2017), but these compounds tend not to be strong acids, thus not causing a significant drop in pH. Similarly, carrots, which are high in fiber and carotenoids, tend to be neutral or slightly alkaline (Liu et al., 2022; Singh et al., 2024),

so the final pH of honey candy with the addition of carrot extract remains in a relatively high pH range. Conversely, treatment T3, the addition of mango extract, resulted in a lower pH of 4.48. This indicates that mango extract, although not as strong as tamarind, has a higher acidity compared to carrot and red ginger. Mango contains organic acids such as citric acid and malic acid, which contribute to the lowering of pH (Lebaka et al., 2021). This acidity is derived from the bioactive components in mango, which is known to be one of the fruits with a relatively high acidity level.

Treatment T4, the addition of tamarind extract, produced the lowest pH among all treatments, at 4.02. This result is consistent with the characteristics of tamarind, which is known to have a high acid content, particularly tartaric acid and malic acid. The organic acids in tamarind contribute significantly to the decrease in pH in honey candy. Tamarind extract is often used in the food industry to provide a strong, refreshing sour taste, which naturally lowers the pH of food products to which it is added (Vikram et al., 2023). Thus, the significant decrease in pH in treatment T4 can be explained by the high concentration of acids present in tamarind extract.

From these results, it can be concluded that the type of natural extract added to honey candy has a significant effect on the final pH value of the product. Treatments with red ginger extract (T2) and carrot (T1) resulted in higher pH compared to mango extract (T3) and tamarind extract (T4). This shows that red ginger and carrot extracts tend to have a milder effect on reducing acidity compared to mango and tamarind extracts, which contain higher concentrations of organic acids.

This difference in pH values is also important in the context of product stability and consumer preference. Candies with higher pH, as in T1 and T2, tend to have better stability in terms of texture and resistance to enzymatic degradation processes influenced by pH. Conversely, candies with lower pH, as in T3 and T4, may have a higher risk of texture or flavor changes, but they provide a sour sensation that may be preferred by consumers seeking stronger acidic flavors in candies.

The influence of pH on the organoleptic quality and stability of honey candy is an important aspect in selecting natural extracts for candy formulation. Therefore, a good understanding of the effect of extracts on pH can help producers determine the appropriate type and amount of extract to produce candy with optimal physical and sensory properties.

The Effect of Adding Natural Extracts on the Yield of Honey Candy

This study aimed to evaluate the effect of adding various natural extracts on the yield of honey candy. The treatments tested included the addition of carrot extract (T1), red ginger extract (T2), mango extract (T3), and tamarind extract (T4). The highest yield was obtained in treatment T1 with the addition of carrot extract, which resulted in a value of 61.5%. This indicates that the addition of carrot extract significantly increased the production efficiency of honey candy compared to the other treatments. Treatment T4, with the addition of tamarind extract, also showed good results with a yield of 58%, although lower than T1, it was not significantly different. In contrast, treatment T2 (addition of red ginger extract) and T3 (addition of mango extract) produced lower yields, with 53% and 51.25%, respectively.

The highest yield was obtained in the treatment with the addition of carrot extract (T1) at 61.5%, which was significantly higher compared to red ginger extract (T2) and mango extract (T3). This indicates that carrot extract can positively contribute to the production efficiency of honey candy, possibly due to the fiber and natural pectin content in carrots (Luca et al., 2022), which can increase the stability and consistency of the honey mixture during the candy-making process. Pectin is known as a natural thickening agent that can improve texture and retain more ingredients during the drying process, resulting in higher yields (Wichchukit et al., 2023).

The addition of red ginger extract (T2) and mango extract (T3) showed lower results, with 53% and 51.25%, respectively. This lower yield may be due to the different chemical compositions of the extracts, such as the essential oil content in red ginger and the relatively high water content in mango (Moongngarm et al., 2021; Widayat et al., 2018). The essential oils in red ginger may reduce the mixture's ability to retain water during drying, while the water content in mango tends to evaporate more quickly during heating, contributing to the lower yield.

Meanwhile, the treatment with tamarind extract (T4) produced a yield of 58%, which was not statistically different from carrot extract (T1) (marked by the letter "ab"). This indicates that tamarind extract has a nearly equal effect as carrot in maintaining the final volume of honey candy. The organic acid content in tamarind, particularly tartaric acid, may influence the mixture's viscosity and help preserve its structure during the

drying process. Additionally, tamarind also contains polysaccharide components that may contribute to better water retention during cooking and drying (Suwanamornlert et al., 2023).

The differences in yield in honey candy production are caused by the physicochemical characteristics of the extracts used. Extracts with high fiber content, such as carrot and tamarind, are able to absorb and retain more water during heating, as the fiber acts as a water-binding agent that also stabilizes volatile components, preventing excessive evaporation. Conversely, extracts containing essential oils, such as red ginger, tend to have a lower yield because the volatile components evaporate easily at high temperatures, leading to a loss of mass and the characteristic aroma during the heating process.

Overall, these results show that the type of natural extract added to honey candy affects the production efficiency or yield of the final product. Choosing the appropriate type of extract for honey candy production is essential to maximize yield without compromising the desired sensory characteristics and health benefits. Carrot and tamarind extracts show the most promising results in terms of yield, making them good choices for developing high-quality and economical honey candy.

Thus, the addition of carrot extract (T1) and tamarind extract (T4) provides better yield results compared to red ginger extract (T2) and mango extract (T3). Further research may be needed to explore the interaction between natural extract components and honey base ingredients to optimize the honey candy production process.

The Effect of Adding Natural Extracts on the Organoleptic Taste Value of Honey Candy

The addition of natural extracts had a highly significant effect ($P<0.01$) on honey candy. Treatments T1 (addition of carrot extract), T3 (addition of mango extract), and T4 (addition of tamarind extract) received relatively high organoleptic scores, each being 5.13, 5.17, and 5.21, respectively, with no significant differences among them, as indicated by the superscript letter "a." These results indicate that all three extracts contributed positively to the taste and were well-accepted by the panelists. The combination of the natural sweetness of honey with the added natural extracts of carrot, mango, and tamarind seemed to create a balanced flavor profile without altering the basic

characteristics of the honey candy. Meanwhile, treatment T2 (addition of red ginger extract) had a significantly lower organoleptic score compared to the other treatments, at 4.34, as indicated by the superscript letter "b." The lower score in T2 was likely due to the strong spicy and sharp flavor of red ginger, which may have been less favored by the panelists when applied to honey candy, which is generally expected to have a more dominant sweet taste. The strong spiciness of red ginger appeared not to provide an ideal balance with the honey flavor, thus reducing the organoleptic appeal of this product.

Overall, these results show that the addition of carrot, mango, and tamarind extracts is more suitable for enhancing the taste of honey candy, while red ginger extract requires more attention regarding flavor balance in the candy product. The addition of carrot extract (T1) provided a fairly good organoleptic taste score (5.13) and was almost comparable to mango extract (T3) and tamarind extract (T4), with scores of 5.17 and 5.21, respectively.

Carrot itself contains beta-carotene, which provides a naturally sweet and mild flavor (Ikram et al., 2024), that may be preferred by the panelists because it does not interfere with the honey flavor, which is the main ingredient of the candy. Additionally, carrot does not have a strong taste, so it does not overpower the sweetness of honey but rather provides a more balanced flavor sensation. Mango extract (T3) received the second-highest organoleptic taste score (5.17). The sweet and mildly tangy flavor of mango adds an attractive tropical touch to honey candy. The combination of honey's sweetness with the sweet and sour taste of mango creates a balanced and refreshing flavor, making the candy more appealing to the panelists. This suggests that mango extract can work well as a natural flavoring in candy products, offering a captivating taste that aligns with consumer preferences.

Tamarind extract (T4) provided the highest organoleptic taste score (5.21). Tamarind is known for its sweet-sour taste, which can balance the sweetness of honey. This combination seems to be the most preferred by the panelists, as it provides a unique and refreshing sensation. The sourness contributed by tamarind is not too dominant, so it does not overpower the honey flavor but instead creates a harmonious balance between sweetness and sourness, resulting in a more complex and interesting taste experience.

Conversely, the addition of red ginger extract (T2) resulted in the lowest organoleptic taste score (4.34). Red ginger has a strong and sharp spicy taste, which may

not align with the panelists' preference for honey candy, which is generally expected to have a sweet or refreshing taste. The spiciness of red ginger may be too dominant and disrupt the natural sweetness of honey, thus lowering the organoleptic score. This also suggests that, although red ginger has good health benefits, its use in candy products should be carefully considered to avoid reducing the overall flavor appeal.

Overall, these results show that the addition of natural extracts that provide sweet, sweet-sour, or balanced flavors (such as carrot, mango, and tamarind) are preferred in honey candy compared to extracts with sharp or spicy flavors like red ginger. This study also confirms that flavor combinations that align with the characteristics of honey can enhance consumer acceptance of honey candy products. In conclusion, among the treatments tested, the addition of tamarind (T4), mango (T3), and carrot (T1) extracts yielded high organoleptic scores and showed no significant differences, indicating that these three extracts can be used as good flavor enhancers for honey candy. However, the use of red ginger (T2) should be more carefully considered, given its lower organoleptic score and less favorable reception by the panelists.

The Effect of Adding Natural Extracts on the Organoleptic Texture Value of Honey Candy

The natural extracts added to honey candy had a highly significant effect ($p<0.01$) based on the results of the organoleptic texture test. The average texture scores of honey candy for each treatment were as follows: T1 (2.25c), T2 (3.91a), T3 (4.08a), and T4 (3.32b). These figures indicate significant differences among the treatments in terms of panelist acceptance of the honey candy texture. Treatment T1, which used carrot extract, received the lowest organoleptic texture score (2.25c). Conversely, treatment T3 (addition of mango extract) obtained the highest organoleptic texture score (4.08a), indicating that the panelists preferred the texture of the candy with mango extract. Treatment T2 (addition of red ginger extract) also showed a high texture score (3.91a), although slightly lower than T3. Treatment T4 (addition of tamarind extract) scored 3.32b for texture, which was in between T2 and T1. Overall, these organoleptic results suggest that the addition of mango extract (T3) and red ginger (T2) provided the most preferred texture results, while carrot (T1) resulted in a less favored texture. These findings emphasize the

importance of selecting the right type of extract to achieve an optimal honey candy texture in accordance with consumer preferences.

In the T1 treatment (addition of carrot extract), the honey candy texture was rated the lowest with an average score of 2.25. This indicates that the panelists did not favor the texture of honey candy with the addition of carrot extract. One factor that may have influenced this is the fiber content in carrots, which can make the candy have a rougher and less smooth texture. The fibrous nature of carrot extract tends to make the candy's texture harder or grainy, thus lowering the sensory acceptance by the panelists. Additionally, carrots have a relatively high water content, which may contribute to an unstable texture after the drying process (Kowalski et al., 2013).

Meanwhile, T2 (addition of red ginger extract) and T3 (addition of mango extract) received the highest organoleptic texture scores, with 3.91 and 4.08, respectively. These scores show that these two treatments were the most preferred by the panelists in terms of texture. Red ginger extract may have provided a softer and chewier texture, as red ginger contains finer fiber and a warming effect that may influence the sensory experience. The addition of ginger extract may also enhance the homogeneity of the mixture, resulting in a more cohesive and appealing texture for consumers. Furthermore, mango extract tends to impart a natural sweetness and mild acidity, which may also influence the panelists' preference for the candy’s texture. Mango contains natural pectin, which contributes to a chewier and smoother texture in candy, making it more appealing to the panelists (Gallo et al., 2022).

For T4 (addition of tamarind extract), the texture score of the honey candy was 3.32, which is between the results of T2 and T3 but higher than T1. Tamarind extract tends to provide a fairly good texture, though not as favorable as red ginger or mango. This could be due to the natural acid content in tamarind interacting with the sugar and honey, resulting in a slightly firmer texture compared to candy with mango or ginger extract. Nonetheless, candy with tamarind extract was still liked by the panelists, as it provided a fresh and slightly chewy sensation. However, the strong acidity of tamarind may also contribute to a slightly harder texture after drying, which could affect the panelists' preference for the texture.

Overall, the organoleptic results indicate that the addition of red ginger and mango extracts had a positive impact on the texture of honey candy, with these treatments being

the most preferred by the panelists. This suggests that both extracts were able to provide a good balance between chewiness and softness, which are desirable characteristics in candy products. On the other hand, the addition of carrot extract negatively affected the texture of honey candy, likely due to the physical properties and fiber content of carrots that are less suitable for honey candy products. Meanwhile, the addition of tamarind extract provided moderate results, with a texture that was fairly liked but not as good as red ginger and mango.

These results indicate that the type of natural extract added to honey candy plays an important role in determining the final texture of the product. Natural extracts with fine fiber content and physical properties that do not strongly affect texture tend to produce candy with better texture, which is favored by consumers. In contrast, extracts with high fiber content or that influence the water balance in candy may result in less desirable textures. In the development of honey candy products, the addition of red ginger and mango extracts can be considered the best options to improve texture quality, while carrot extract may require further modification to achieve the desired results.

The Effect of Adding Natural Extracts on the Organoleptic Aroma Value of Honey Candy

Based on the observation results, it was found that the addition of natural extracts to honey candy had a highly significant effect ($p<0.01$) on the aroma of honey candy. The results of the organoleptic aroma test for the various treatments showed significant variation in the panelists' acceptance of aroma, with average values varying for each treatment. Treatment T1, with the addition of carrot extract, received the highest average aroma score, namely 4.33. Meanwhile, treatment T2, with the addition of red ginger extract, obtained the lowest average score, namely 2.22. Treatment T3, using mango extract, achieved an average aroma score of 4.21, close to the result for T1. Treatment T4, with the addition of tamarind extract, obtained an average score of 4.13, which was also considered high.

Overall, the results of this aroma test indicate that carrot (T1), mango (T3), and tamarind (T4) extracts provided aromas that were more preferred by the panelists, while red ginger extract (T2) was less favored when combined with honey. The harmonious combination of natural ingredients and honey aromas is a key factor in enhancing the

aroma acceptance of honey candy by consumers (Melina et al., 2023). In the T1 treatment, with the addition of carrot extract, the honey candy received an average score of 4.33, the highest among all treatments. This score indicates that the panelists greatly enjoyed the aroma of honey candy with the addition of carrot extract. The sweet and fresh aroma of carrot seemed to blend well with honey, creating an aroma that was liked by most panelists. This may be due to the natural aroma of carrots not being too strong, allowing the honey's characteristic aroma to remain dominant.

In the T2 treatment, with the addition of red ginger extract, the honey candy received the lowest average score, 2.22. This result indicates that the aroma of honey candy with the addition of red ginger extract was not well liked by the panelists. Red ginger has a very distinct and spicy aroma, which may be considered too strong and incompatible when combined with the natural aroma of honey (Ayustaningwarno et al., 2024). Additionally, red ginger contains gingerol, which gives a sharp and pungent aroma that may be too intense for application in honey candy, which is generally expected to have a sweet and mild aroma (Shaukat et al., 2023).

In the T3 treatment, with the addition of mango extract, the honey candy received an average score of 4.21. This score is almost equal to T1, indicating that the panelists also liked the aroma of honey candy with the addition of mango extract. The sweet and fresh aroma of mango seemed to successfully enhance the aroma of the honey candy without overpowering the characteristic honey aroma itself. This shows that mango has potential as a natural additive in food products like honey candy due to its refreshing and appealing fruit aroma to consumers.

In the T4 treatment, with the addition of tamarind extract, the honey candy received an average score of 4.13. This result indicates that the addition of tamarind extract also produced an aroma that was liked by the panelists, although not as highly as T1 and T3. The slightly sweet and sour aroma of tamarind adds a unique nuance to the honey candy aroma, yet is still considered harmonious by most panelists. The combination of tamarind’s sour aroma with the sweetness of honey seems to create a unique but still appealing aroma sensation.

Overall, these results show that the type of natural extract used has a significant impact on the aroma of honey candy. The panelists gave the highest scores to treatments with the addition of carrot extract (T1) and mango extract (T3), while the addition of red

ginger extract (T2) tended to produce a less preferred aroma. This suggests that very strong or distinct aromas, such as red ginger, may not be suitable for honey candy, which is expected to have a softer and sweeter aroma. Meanwhile, carrot, mango, and tamarind extracts offer a more harmonious aroma balance with the characteristic honey aroma, making them more acceptable to the panelists. The conclusion from this organoleptic test is that the appropriate addition of natural extracts can improve the aroma quality of honey candy. Carrot and mango extracts show great potential as additives preferred by consumers, while red ginger extract requires further consideration regarding its aroma intensity when applied in candy products.

The Effect of Adding Natural Extracts on the Organoleptic Color Value of Honey Candy

This study aimed to determine the effect of adding natural extracts on the organoleptic characteristics of honey candy, specifically on the color parameter. Based on the results of the organoleptic test, the addition of various natural extracts showed a highly significant difference in the perception of honey candy color. The organoleptic color evaluation results showed that the highest average value was found in the treatment with tamarind extract (T4) at 4.06, while the lowest value was given in the treatment with carrot extract (T1) at 3.05. The treatment with tamarind extract (T4) obtained the highest score for color characteristics, indicating that the panelists preferred the color produced by this extract. On the other hand, the treatment with carrot extract (T1) produced the lowest color score (3.05). Treatments with red ginger extract (T2) and mango extract (T3) resulted in almost similar color scores, namely 3.51 and 3.51, respectively. These two extracts still provided a color appearance that was liked by the panelists, although not as prominent as in the T4 treatment.

The addition of carrot extract (T1) resulted in the lowest organoleptic color score, 3.05. Carrots are known to have a high beta-carotene content, which should provide an attractive orange color (Utomo & Ginting, 2023). However, in this case, the beta-carotene in carrots may not have been stable enough during the heating process of candy making, so the color did not appear as prominent to the panelists. A paler or less uniform orange color might be why this treatment received a lower score. Another factor that could have

influenced this is that the concentration of carrot extract used may not have been high enough to produce a brighter and more appealing color.

The addition of red ginger extract (T2) resulted in an organoleptic color score of 3.51. The typical yellowish or bright orange hue of red ginger may have contributed to the assessment of the honey candy's color. Red ginger extract also contains active compounds like gingerol, which, in addition to providing a distinctive aroma and taste, may influence the product's appearance (Agusthi & Romadhan, 2024). However, the color produced by red ginger extract did not make as strong a visual impact compared to other extracts like tamarind. Therefore, while the color was reasonably accepted by the panelists, it did not reach the highest level of preference.

Mango extract (T3) produced an organoleptic color score of 3.51, almost identical to that of red ginger extract. Mango contains carotenoid pigments that can give yellow to orange hues in food products (Janciauskiene, 2020). The candy color from mango extract might have an appealing and natural appearance but is not particularly striking. This score shows that while the mango color was fairly liked by the panelists, the difference from the candy color produced by red ginger extract was not significant. Both extracts have similar color characteristics, so the panelists' preferences were nearly the same.

The addition of tamarind extract (T4) resulted in the highest organoleptic color score, 4.06. This indicates that the panelists highly favored the color produced by tamarind extract. Tamarind contains high levels of organic acids, which, in combination with honey, may produce a darker, reddish-brown color that looks more attractive and natural in candy. A richer, more contrasting color compared to the natural honey base may have enhanced the panelists' preference for this product. Additionally, tamarind extract may give the honey candy a certain shine, making it more visually appealing.

The organoleptic color results show that the addition of natural extracts had a significant impact on the appearance of honey candy. Color is one of the most important attributes in determining consumer appeal for food products, and the variation in colors from natural extracts has the potential to increase the product's competitiveness in the market (Novais et al., 2022). The highest score for tamarind extract indicates that more intense or contrasting colors are preferred by consumers, while the color produced by carrot extract, which may appear paler, attracted less attention from the panelists.

Overall, the addition of natural extracts provided a wide range of color variations in honey candy, which was well received by the panelists, particularly with the tamarind extract treatment. Factors such as pigment stability, the interaction between honey and the extract, and the heating method used during candy making likely influenced the final color results. Further research may be needed to explore the effects of extract concentration or different processing methods to improve the visual and organoleptic quality of honey candy.

CONCLUSION

This study demonstrates that the addition of natural extracts: carrot, red ginger, mango, and tamarind highly significantly affects the physical and organoleptic properties of honey candy. Carrot and tamarind extracts showed the highest production efficiency, making them the most suitable for enhancing the yield of honey candy. In terms of organoleptic qualities, tamarind extract received the highest preference for taste and color, while mango extract improved the texture. Red ginger, despite contributing to a higher pH, had a lower acceptance in taste and aroma due to its strong spicy flavor. Overall, the use of natural extracts can significantly improve the health benefits and sensory appeal of honey candy, with tamarind and carrot extracts offering the best balance between yield and consumer preference. These findings provide valuable insights for the functional food industry in creating high-quality honey-based candy products using natural ingredients. Further research is recommended to optimize the concentration of natural extracts to achieve better flavor balance and product stability.

LIMITATION

This study has limitations regarding the variation in the amount of natural extracts used, and it did not conduct an in-depth examination of the effects of different heating temperatures in the candy production process. Moreover, the organoleptic testing involving a limited panel of participants may not fully represent broader consumer preferences. Future research should consider using more advanced analytical methods to assess the chemical stability of extract components during processing.

REFERENCES

Agusthi, B. M., & Romadhan, M. F. (2024). Characteristics of Secang Jelly Drink as Functional Drink With the Addition of Red Ginger Extract for Antioxidant Source. *Jurnal Teknik Pertanian Lampung (Journal of Agricultural Engineering)*, *13*(2),

449. https://doi.org/10.23960/jtep-l.v13i2.449-458

Ayustaningwarno, F., Anjani, G., Ayu, A. M., & Fogliano, V. (2024). A critical review of Ginger's (Zingiber officinale) antioxidant, anti-inflammatory, and immunomodulatory activities. *Frontiers in Nutrition*, *11*(June), 1–16. https://doi.org/10.3389/fnut.2024.1364836

Babbar, N., Bansal, P., Aggarwal, P., Singh, K., & Kaur, S. (2023). *Utilisation of Honey in Processed Food Products*. https://doi.org/10.5772/intechopen.107091

Bhattarai, S., & Kusma, R. (2022). Preparation and Quality Evaluation of Sugar and Honey Based Beetroot Candies. *Sustainability in Food and Agriculture*, *3*(1), 15–18. https://doi.org/10.26480/sfna.01.2022.15.18

Edo, G. I., Onoharigho, F. O., Akpoghelie, P. O., Akpoghelie, E. O., Agbo, J. J., Agoh, E., & Lawal, R. A. (2023). Natural Honey (Raw Honey): Insights on Quality, Composition, Economic and Health Effects: A Comprehensive Review. *Food Science and Engineering*, 265–293. https://doi.org/10.37256/fse.4220232713

Gallo, R. T., Bayuelo-Bonilla, S., Carpio-Ortiz, L., Barreto-Rodríguez, G., & Tirado, D. F. (2022). High-Intensity Ultrasound-Assisted Extraction of Pectin From Mango Wastes at Different Maturity. *International Journal of Food Science*, *2022*, 1–7. https://doi.org/10.1155/2022/4606024

Ganie, T. A., Wani, S. A., Rather, S. A., Masoodi, F. A., Siddiqui, S. A., & Ibrahim, S. A. (2022). Development of Novel Functional Foods Using Himalayan Honey Having Enhanced Nutraceutical and Nutritional Potential. *Frontiers in Sustainable Food Systems*, *6*. https://doi.org/10.3389/fsufs.2022.1006528

Ikram, A., Rasheed, A., Ahmad Khan, A., Khan, R., Ahmad, M., Bashir, R., & Hassan Mohamed, M. (2024). Exploring the health benefits and utility of carrots and carrot pomace: a systematic review. *International Journal of Food Properties*, *27*(1), 180–193. https://doi.org/10.1080/10942912.2023.2301569

Janciauskiene, S. (2020). The beneficial effects of antioxidants in health and diseases. *Chronic Obstructive Pulmonary Diseases*, *7*(3), 182–202. https://doi.org/10.15326/jcopdf.7.3.2019.0152

Kowalski, S. J., Szadzińska, J., & Łechtańska, J. (2013). Non-stationary drying of carrot: Effect on product quality. *Journal of Food Engineering*, *118*(4), 393–399. https://doi.org/10.1016/j.jfoodeng.2013.04.028

Lebaka, V. R., Wee, Y. J., Ye, W., & Korivi, M. (2021). Nutritional composition and bioactive compounds in three different parts of mango fruit. *International Journal of Environmental Research and Public Health*, *18*(2), 1–20. https://doi.org/10.3390/ijerph18020741

Liu, J., Xiao, L., Xie, Y., Guan, F., & Cai, J. (2022). The Stability of Carotenoids From a

Marine Photosynthetic Bacterium <i>Ectothiorhodospira Shaposhnikovii</I> <scp>P2</Scp>. *Journal of Food Processing and Preservation*, *46*(7). https://doi.org/10.1111/jfpp.16724

Luca, M. I., Ungureanu-Iuga, M., & Mironeasa, S. (2022). Carrot Pomace Characterization for Application in Cereal-Based Products. *Applied Sciences*, *12*(16), 7989. https://doi.org/10.3390/app12167989

Melina, M., Adawiyah, D. R., & Hunaefi, D. (2023). Indonesian Honey Consumers' Behavior and Sensory Preference for Commercial Trigona Honey. *Jurnal Teknologi Dan Industri Pangan*, *34*(1), 86–97. https://doi.org/10.6066/jtip.2023.34.1.86

Moongngarm, A., Pranil, T., MANWIWATTANAGUL, G., & Kerr, W. G. (2021). Effect of Storage and Packaging Conditions on Physical Properties and Carotenoid Content of Mango Tablets. *Journal of Sustainability Science and Management*, *16*(2), 138–151. https://doi.org/10.46754/jssm.2021.02.015

Novais, C., Molina, A. K., Abreu, R. M. V, Santo-Buelga, C., Ferreira, I. C. F. R., Pereira, C., & Barros, L. (2022). Natural Food Colorants and Preservatives: A Review, a Demand, and a Challenge. *Journal of Agricultural and Food Chemistry*, *70*(9), 2789–2805. https://doi.org/10.1021/acs.jafc.1c07533

Pang, X., Cao, J., Wang, D.-B., Qiu, J., & Kong, F. (2017). Identification of Ginger (<i>Zingiber Officinale</I> Roscoe) Volatiles and Localization of Aroma-Active Constituents by GC–Olfactometry. *Journal of Agricultural and Food Chemistry*, *65*(20), 4140–4145. https://doi.org/10.1021/acs.jafc.7b00559

Sahlan, M., Ridhowati, A., Hermansyah, H., Wijanarko, A., Rahmawati, O., & Pratami, D. K. (2019). Formulation of hard candy containes pure honey as functional food. *AIP Conference Proceedings*, *2092*(July 2020). https://doi.org/10.1063/1.5096743

Šedí-k, P., Hudecová, M., & Predanócyová, K. (2023). Exploring Consumers' Preferences and Attitudes to Honey: Generation Approach in Slovakia. *Foods*, *12*(10), 1941. https://doi.org/10.3390/foods12101941

Shaukat, M. N., Nazir, A., & Fallico, B. (2023). Ginger Bioactives: A Comprehensive Review of Health Benefits and Potential Food Applications. *Antioxidants*, *12*(11), 1–26. https://doi.org/10.3390/antiox12112015

Singh, R. P., Maurya, M., & Pandey, P. (2024). Analysis of Marketing Cost, Price Spread and Marketing Efficiency of Carrot in Bulandshahr District of U.P. *International Journal of Agriculture Extension and Social Development*, *7*(5), 129–132. https://doi.org/10.33545/26180723.2024.v7.i5b.609

Stupar, A., Vidović, S., Vladić, J., Radusin, T., & Mišan, A. (2024). A Sustainable Approach for Enhancing Stability and Bioactivity of Allium Ursinum Extract for Food Additive Applications. *Separations*, *11*(3), 81. https://doi.org/10.3390/separations11030081

Sukanya Wichchukit, Maelada Fuengfoo, C. T., Chantaratepthimakul, S., Roichimplee, C., & , Saralan Choomchuboon, K. K. (2023). Application of Low Methoxyl Pectin Powder Derived From Palmyra Palm Pulp Wash Water to Enhance Toddy Palm Cake Quality. *Agriculture and Natural Resources*, *57*(6), 1015–1024. https://doi.org/10.34044/j.anres.2023.57.6.12

Susanti, S., Kumoro, A. C., Suzery, M., & Oku, H. (2023). The effect of various sweeteners on the physical, chemical, and organoleptic characteristics of ginger leaf extract syrup. *Food Research*, *7*(2), 164–169. https://doi.org/10.26656/fr.2017.7(2).787

Suwanamornlert, P., Taksima, T., & Thanyacharoen-anukul, P. (2023). Effects of Plasticizers on Characterization of Biodegradable Film Based on Tamarind Kernel Polysaccharide. *Journal of Current Science and Technology*, *13*(3), 630–641. https://doi.org/10.59796/jcst.v13n3.2023.814

Utomo, J. S., & Ginting, E. (2023). Physicochemical Characteristics of Bun Made From Orange-Fleshed Sweet Potato Clones. *Bio Web of Conferences*, *69*, 3001. https://doi.org/10.1051/bioconf/20236903001

Vikram, B., Gautam, D. K., Rahul, Yadav, H. C., Gaurha, A., Kumar, V., Omer, S., & Chawla, R. (2023). Tamarind Cultivation, Value-Added Products and Their Health Benefits: A Review. *International Journal of Plant & Soil Science*, *35*(21), 903–911. https://doi.org/10.9734/ijpss/2023/v35i214060

Widayat, W., Dita, A. S., Cahyono, B., & Satriadi, H. (2018). Study of Rendement of Red Ginger Essential Oil From Red Ginger Waste by Using Steam Distillation Process. *E3s Web of Conferences*, *73*, 7002. https://doi.org/10.1051/e3sconf/20187307002

Yulianto, M. E., Jos, B., & Budiyono, B. (2023). Kinetic Modelling of Liquid-Solid Extraction of Bioactive Compounds From Ginger Waste Using Subcritical Water. *Sainteknol Jurnal Sains Dan Teknologi*, *21*(1), 28–35. https://doi.org/10.15294/sainteknol.v21i1.44589