



Spreadability, Total Dissolved Solids and Likeability of Mango Jam with a Combination of Mango Flesh and Peel Arum Manis (*Mangifera Indica* L)

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ABSTRACT

After being harvested, mango fruit will quickly spoil due to the high water content in the fruit, so efforts need to be made to process it to extend its shelf life, one of which is processing it into jam. To get good jam you need the right composition of sugar, acid and pectin. The part of the mango fruit that is widely consumed and processed is the flesh, while the skin and seeds are not widely used even though the skin of the mango fruit contains quite high pectin. This research aims to determine the effect of the combination of mango flesh and mango skin on spreadability, total soluble solids, and panelists' preferences for jam. The method used is Completely Randomized Design (CRD) 1 factor, namely a combination of mango skin and mango flesh with 5 treatment levels: P1 (20% : 80%), P2 (30% : 70%), P3 (40% : 60%), P4 (50% : 50%) and P5 (60% : 40%). Parameters observed: spreadability, total dissolved solids, and preference test. Data were analyzed using Variance Analysis and the smallest significant difference (if there is a difference) with a confidence level of 5%. The liking test will be carried out on 30 panelists (untrained) using a 5-level liking scale: very dislike (1), dislike (2), neutral (3), like (4) and very like (5). The results of the study showed that the higher the use of mango peel pulp and the less mango fruit pulp, the lower the spreading power, where the highest spreading power was in treatment P1 and was not different in treatment P2. However, the total dissolved solids value is getting higher. Panelists liked the color, taste and spreadability of treatments P1, P2 and P3 (not significantly different), while the aroma was preferred up to treatment P4.

Keywords : Jam, mango skin, mango flesh, spreadability, total soluble solids, preference test

1. INTRODUCTION

Mango is a seasonal fruit crop that has a sweet and refreshing taste and contains many nutrients that are good for health (Sibuea, *et al* 2016), however Fresh mangoes are very susceptible to microbial biological damage due to their high water content, which results in a shorter shelf life of mangoes (Dereje & Abera, 2020). Considering that the shelf life of mangoes is relatively short, it is necessary to try processing processes to extend the shelf life, one of which is by processing it into jam.

Jam is a semi-solid food in gel form resulting from the interaction between fruit juice as the main ingredient, sugar or sucrose, citric acid, pectin and pieces of fruit (Novita, *et al*, 2017). Jam is basically made by mixing 45 parts of mashed fruit and 55 parts of sugar, which is then





thickened and formed into a semi-solid structure (Gaffaret *al.*, 2018). According to (Yulistianiet *al.*, 2013) to get good jam you need the right composition of sugar, acid and pectin. Improper addition of pectin and sucrose in the jam making process causes crystallization and stiffness of the gel.

The part of the fruit that is widely used and processed is the flesh, while the skin and seeds are only thrown away, this causes mango skin waste to reach 10% (Mardhatillaet *al.*, 2021). Mango peel waste has not been widely used because people do not understand the benefits and contents of mango peel. According to (Fridayanti *et al.*, 2017), mango skin contains three times the amount of flavonoids found in mango flesh. Mango skin also contains quite high pectin, namely 5-11% and this level is influenced by the extraction method and fruit variety (Ajila & Prasada Rao, 2013). Based on Wongkaew's research *et al.*, (2020) showed that from the extraction of mango skin, 13.85% pectin was obtained. Arum Manis mango peel extraction treatment with a pH of 1.0 and an extraction time of 150 minutes showed that the pectin yield was higher, namely 28,168% compared to the watermelon albedo yield which was only 24.43, and showed that the pectin of Manis Arum mango peel contained polygalacturonic acid. amounting to 82.177% (db), thus this pectin still meets the requirements for commercial pectin (Nur Mahmuda, 2004).

According to (Ramadhan, 2011), good jam must have a real fruity aroma and taste. A real fruity taste and aroma is usually found in ripe mangoes, but the pectin levels contained in ripe fruit are generally lower than in young mangoes. Ripe mango fruit only contains 0.35% pectin (Muchtadi& Sugiyono, 2013), so that making mango jam requires the addition of pectin to produce a gel consistency in the jam, one of which can be obtained from mango skin. This research aims to determine the effect of the combination of mango flesh and mango skin on the spreadability, total dissolved solids and organoleptic properties of jam.

2. RESEARCH METHOD

The research was carried out at the Agro-Industry Study Laboratory, Vocational Faculty, University 17 August 1945 Surabaya in April – June 2023. The tools used in this research were blenders, scales, knives, stoves, basins, pans, plates, Teflon pans, stirrers, and bottles. / packaging, while the ingredients used are sweet arum mangoes obtained from mango farmers in the West Surabaya area with ripe old mangoes on trees, granulated sugar, citric acid and water.

This research is an experimental study using (Yuwono & Tri, 1998) a 1 factor Completely Randomized Design (CRD), namely a combination of fruit skin and flesh of arum Manis mango





with 5 levels of treatment, namely P1 (20% : 80%), P2 (30% : 70%), P3 (40% : 60%), P4 (50% : 50%) and P5 (60% : 40%).

The research was carried out in 3 stages, namely (1) making mango skin pulp which was done by cleaning the mango fruit with clean running water, then peeling it to separate the skin and flesh of the mango fruit, then cutting the skin into small pieces to make crushing easier. Weighed and put into a blender with the addition of water 1:1 to be crushed using *blender* so that you get mango skin pulp; (2) making mango pulp which is done by cutting the cleaned mango flesh into smaller pieces so that it is quicker and easier to crush, weighing it, then crushing it using *blender* by adding water 2:1 to get mango pulp; (3) Making jam is done by weighing the pulp of mango skin and pulp of each fruit according to the treatment, after which they are mixed and added with granulated sugar 50 g / 100 g of raw material which is then cooked at a temperature of $\pm 70^{\circ}\text{C}$ for ± 10 minutes in Teflon pan by adding 0.2 g citric acid. After the jam is cooked, it is put into a jam bottle and then closed when the jam has cooled.

The parameters observed include (1) spreadability, by gluing two pieces of glass measuring 20 cm x 5 cm the tip of the dabbing knife and smeared on the smear area to the furthest distance that can be reached, where the furthest distance is the distance that the sample reaches without stopping the smear. The farthest distance that the sample can reach is measured with a ruler. Spreading power = furthest distance (cm) (Yuwono & Tri, 1998); (2) Total Dissolved Solids with using Brix Degrees (*Hand Refractometer*) (Sukardi, 2015), the principle of total dissolved solids analysis is to use a refractometer to determine the sugar content based on the refractive index of the solution. The observation step is to open the prism glass cover, calibrate the tool by dripping distilled water (2 -3 drops) on the prism glass. Direct the refractometer towards the light, and look at the scale reading through the telescope hole, there is a scale of 0° Brix. Clean the prism glass with a tissue. Open the glass prism cover, and put jam (2 – 3 drops) onto the surface of the glass prism. Close the prism glass, and point it towards the light. Read the scale printed on the boundary line; (3) The panelists' liking for jam was tested organoleptically, including color, aroma, taste and texture (spreadability) which was carried out on 30 panelists to provide personal responses regarding the level of liking for a product using a 5-level scale of liking, namely very dislike (1), don't like (2), neutral (3), like (4) and really like (5).

The collected data was analyzed using analysis of variance (ANOVA) and Least Significant Difference (BNT) if there was a difference at the 5% level. The panelists' favorite data is ordinal data so it is transformed into interval data using the method *successive interval* (MSI)





first before carrying out variance analysis. If the analysis results show an influence, continue with the Least Significant Difference (BNT) test.

3. RESULTS AND DISCUSSION

The results of the analysis of spreadability (physical properties) and total soluble solids of mango jam using a combination of using mango skin and flesh can be seen in Table 1 below.

Table 1. Average Value

Treatment	Parameter	
	Spreading Power (cm)	Total Dissolved Solids (⁰ Brix)
P1	9.1000 ± .26458 a	61.5000 ± .86603 a
P2	8.5333 ± .37859 a	62.8333 ± 1.25831 a
P3	7.3667 ± .20817 b	66.1667 ± 1.44338 b
P4	6.5667 ± .40415 c	68.8333 ± 1.04083 c
P5	5.6667 ± .32146 d	70.3333 ± .57735 d

*Differs at 5% level

Spreadability

Spreadability is the ability of jam to spread evenly on bread. The spreadability of jam is closely related to the water content, spreadability and viscosity of the jam. One of the qualities that really influences the quality of jam is spreadability, because good quality jam has a gel consistency that has good spreadability (Harto et al., 2016). Based on the results of the BNT test on spreadability, it shows that treatments P1 and P2 show no difference, whereas treatments P3 to P5 show significant differences. The lowest results in spreadability were in treatment P5 (use of 60% mango skin and 40% mango flesh) with an average of 5.6667 cm and the highest spreadability was in treatment P1 (use of 20% mango skin and 80% mango flesh) with an average 9.1000 cm but not significantly different from treatment P2. This shows that the more mango peel pulp you use and the less mango pulp you use, the lower the spreadability produced because the texture of the jam becomes thicker and tends to clump. Spreadability is related to the texture of the jam which is influenced by the gel formation that occurs in the jam making process where the formation of jam is influenced by pectin, acid and sugar (Yulistiani et al., 2013). Mango skin has a higher pectin content than the fruit, so the more mango skin you use, the higher the pectin that can form a strong



gel.. (Panjaitan & Rosida, 2021), stated that the formulation with more watermelon albedo and less red guava produces a firmer or chewier jam texture, because watermelon albedo contains higher levels of pectin than red guava. The same thing was also shown in research (Megawati, *et al* 2017), which states that the greater the amount of watermelon albedo pulp and the less tamarillo pulp, the chewier the sheet texture is because watermelon albedo contains more pectin than Dutch eggplant.

Total Dissolved Solids

Based on the test results on total dissolved solids, treatments P1 and P2 showed no real difference to total dissolved solids, while treatments P3 to P5 showed a real difference in effect on total dissolved solids. The combination of increasing use of mango peel pulp and less use of mango pulp shows higher levels of total soluble solids, this is because total soluble solids are related to the level of fruit pectin used. According to (Winarno, 2008) apart from being influenced by the addition of granulated sugar, total dissolved solids are also influenced by dissolved pectin. The total dissolved solids content of an ingredient includes reducing sugars, non-reducing sugars, organic acids, pectin and protein (Desroiser, 1988).

Like Test

The results of the organoleptic test analysis on mango jam using a combination of using mango skin and flesh, which includes color, aroma, taste and texture (spreadability) can be seen in Table 2 below.

Table 2. Average value of Organoleptic tests

Treatment	Parameter			
	Color	Aroma	Feel	Texture (spreadability)
P1	3.9396 ± .90489 a	4.2272 ± .89146 a	4.2271 ± .88808 a	4.1588 ± .91204 a
P2	4.2270 ± .90176 a	4.2269 ± .92554 a	3.9395 ± .94332 a	4.2270 ± .93622 a
P3	3.6149 ± .89310 a	4.2268 ± .93171 a	3.9393 ± .93635 a	4.2271 ± .93411 a
P4	2.9397 ± .93523 b	3.7978 ± .88519 a	3.2269 ± .95032 b	2.9397 ± .96813 b
P5	2.4000 ± .95427 c	3.2267 ± .94827 b	2.9080 ± .91278 c	2.0907 ± .93880 c

*Differs at 5% level

Color

The results of the organoleptic test for color parameters showed that the most preferred treatment was treatment P2 (30% mango skin and 70% mango flesh) with an average value of



4.2270, but it was not different from treatment P1 (20% mango skin and 80% flesh mango) and P3 treatment (40% mango skin and 60% mango flesh) with an average value of 3.9396 and 3.6149 with a brownish yellow color. The lowest average value is 2.4000. obtained in the P5 treatment (60% mango skin and 40% mango flesh) so that this treatment was less liked by the panelists because the color was dark brown and tended to be black. This shows that the more mango skin pulp you add and the less mango flesh pulp you add, the browner the resulting color. Color is influenced by materials and composition during manufacture. The flesh of ripe mangoes is yellow and the skin of mangoes is green (Pracaya, 2011), so that with more use of mango skin pulp the color of the jam becomes darker.

Aroma

The results of the preference test for aroma parameters which can be seen in table 2 show that the most preferred treatment is treatment P1 (20% mango skin and 80% mango flesh) with an average value of 4.2272, but not different from treatment P2 (30 % mango skin and 70% mango flesh), P3 (40% mango skin and 60% mango flesh) and P4 (50% mango skin and 50% mango flesh) with average values of 4.2269, 4.2268 and 3.7978 with a more mango aroma real. The lowest average value of 3.2267 was obtained in treatment P5 (60% mango skin and 40% mango flesh) so that this treatment was less liked by the panelists. Arumanis mango has a sweet fruit taste, fragrant and sharp fruit aroma and contains a lot of water (Ichsan & Wijaya, 2014), so that the reduced use of mango pulp will result in the reduction of the fragrant aroma of the mango flesh.

Feel

Taste can be influenced by many factors, such as the type of ingredient and cooking time, as well as its compounds, temperature, consistency, and interactions with other ingredients (Luthfiyanti et al., 2011). The results of the preference test for mango jam in terms of taste parameters showed that the most preferred treatment was treatment P1 (20% mango skin and 80% mango flesh) with an average value of 4.2271, but it was not significantly different from treatment P2 (30% skin mango and 70% mango flesh), and P3 treatment (40% mango skin and 60% mango flesh). In treatments P4 (50% mango skin and 50% mango flesh) and P5 (60% mango skin and 40% mango flesh) the results showed less favorable (neutral) with an average value of 3.2269 for P4 and 2.908 for P5, this This is because the less mango pulp is used in making jam, the more the taste of the resulting mango will decrease, where ripe mangoes have a sweeter taste than the skin (Pracaya, 2011) so that the taste of the mango is masked by the taste of the mango skin in making jam. Sweet arum mangoes generally have a sweet and slightly sour taste. The taste of the mango fruit can influence the panelists' acceptance.





Texture (Rubbing power)

Likes for texture are carried out by giving personal responses to the ability of the jam to spread evenly on bread. The results of the preference test for the texture (spreadability) of jam showed that the highest average value was 4.2271 in treatment P3 (40% mango skin and 60% mango flesh), but the level of preference was not different from P2 (30% mango skin and 70 % mango flesh) and P1 (20% mango skin and 80% mango flesh) with average values of 4.1588 and 4.2270 respectively. The lowest average value, namely 2.0907, was obtained in treatment P5 (60% mango skin and 40% mango flesh). This treatment was not liked by the panelists. This shows that the use of mango peel pulp up to 40% is preferred, but the use of mango peel pulp with higher (50% and 60%) spreadability is increasingly unpopular. According to (Yulistiani et al., 2013) the gel formation mechanism in making jam is a mixture of pectin, sugar, acid and water. The pectin will coagulate and form fine fibers that can hold liquid which is determined by the amount of pectin added. If the higher the amount of pectin added, the stronger the gel in the jam. Ripe mango fruit only contains 0.35% pectin (Muchtadi & Sugiyono, 2013), while mango peel contains quite high pectin, namely 5-11% (Ajila & Prasada Rao, 2013). Therefore, the more mango skin you use, the more the pectin content in the jam raw material will increase, causing the texture to become firmer and chewier and tend to clump.

4. CONCLUSIONS

The spreadability was lower with the higher the use of mango peel pulp and the lower the use of mango flesh pulp, where the spreadability was highest in treatment P1 and did not differ in treatment P2. The more mango peel pulp is used, the higher the total soluble solids value and The results of the liking test showed that the panelists liked the color, taste and spreadability of treatments P1, P2 and P3 (not significantly different), while the aroma was preferred up to treatment P4.

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