Turning strawberry jam into slice: a new way of consuming strawberry fruits preservation products.

D Wahyuningtias¹, A Caroline¹, M P Adiati¹*, F Levyta¹, I Kusumawardhana¹
¹Department of Hotel Management Department, Faculty of Economic and Communication, Bina Nusantara University, Jl. K.H. Syahdan No.9 Palmerah Jakarta Barat 11480, Indonesia*

Abstract. The goal of this article is to discover an acceptance and preference of consumer towards innovative products of slice strawberry jam. While an ordinary fruit preserves often made as a jam. Sliced jam is a new way of fruit preservation to consume. Through an organoleptic study, the paper starts to examine and compare between an original product of strawberry jam to sliced jam. A quantitative tradition of research employs an experimental approach to eighty untrained respondents. Data analysis and validity were generated from SPSS statistic software to measure the result of questionnaires towards a favorite between the two and its characteristics such as texture, taste, smell, and color. The findings reveal that the new form of strawberry jam slices is favored among the major respondents. The strawberry jam slice’s texture, taste, smell, and color also attract the consumerism. Despite the limitation of the study, the article introduces a new way of consuming strawberry fruits preservation products. Thus, the research discussion would take forward business development idea, particularly on fruit preserves preparation.

1. Introduction
Along with the development of agricultural science and technology that is increasingly advanced, strawberries now receive attention in the development of tropical climates, including Indonesia. Strawberries (Fragaria sp), although including subtropical fruit, can grow in Indonesia [1]. According to the Central Statistics Agency in [1], “Strawberry production in Indonesia reached 12,091 tons in 2016, 7,575 tons of which were in West Java 2,173 tons and then in Bali and 625 tons in East Java [1]. Indonesia sends around 150 tonnes of premium strawberries per year from South Korea, the United States and Australia. The need for local quality strawberries reaches more than 5,000 tons per year (Sudarmadi 2017). To meet the needs of strawberries, Indonesia is trying to expand the strawberry producing areas. "The potential for expansion of strawberry cropping areas in Indonesia is 529 ha, including in the districts of Bandung (184 ha), Garut (160 ha), Purbalingga (60 ha), Bedugul (40 ha), Batu (25 ha), Brastagi (60 ha), Hanif and Ashari in [1]. "Areas at an altitude of more than 100 meters above sea level which are indeed for strawberry development include Cianjur and Kuningan, West Java, Purwokerto and Temanggung, Central Java, Sembalun, West Nusa Tenggara, Bener Meriah, Aceh, and others. Strawberry has also begun to be developed ", Indonesian Hydroponic Society in [1].

“Apart from being consumed fresh, strawberries can also be processed into various products such as syrup, jam, and stup (compote)”, Indonesian Hydroponic Society 2014 in [1]. "Generally, these processed products come from fruit strawberries that do not meet fresh fruit standards but are still acceptable for consumption. This has already been developed by farmers in Kalisoro Tawangmangu and an agribusiness company in Cirebon. Even farmers in Lembang, West Java that uses local varieties of Bengal and Pineapple which are suitable for making processed foods such as jam ”, Hanif and Ashari 2012 in [1].
Strawberry is included in perishable commodities. "Strawberries have a high-water content so they easily rot due to the activity of enzymes or microorganisms", Garcia et al. In [1]. One of the things that make strawberries easily damaged is the transportation process. "Problems in strawberry farming was including the distance between the garden and the market, the rugged terrain, and the poor transportation roads". Sukasih [2019].

With the basic characteristics of strawberries that they are perishable and with the transportation and distribution problems, the potential for damage to strawberries is even greater. This research makes an alternative to processed strawberries to use the supply of strawberries in the market. An alternative is to make jam strawberries into sheets so you can enjoy them immediately.

Product innovation which is a combination of various processes that influence each other. Product innovation is categorized as a new product for the world, new product lines, additions to existing new product lines, improvement and revision of existing products, redefining and reducing costs [2, 10].

Slice strawberry jam is an innovation in the form of solid jam that is added to the compacting material. Some compacting material which are commonly used are Karangenan, gelatin, pectin, jelly powder, and konyaku. Slice strawberry jams are more practical compared to the regular jams that have to be spread first. Slice strawberry jam is still not sold yet but there has been a lot of research on slice strawberry jam. Research on slice strawberry jams has not been optimal can be re-innovated using other fruits. Slices jam can also be developed for entrepreneurship [3, 9].

With the current pandemic condition, there has been a change in lifestyle, one of which is that all activities are carried out at home such as working from home and online teaching [16]. Additionally, since people being more aware of health and cleanliness advantages [16], this innovative slice strawberry jam product would be an alternative snack at home as well as while doing outdoor activities.

Based on the description above, with the development of strawberries and has a high economic value the author wants to make new innovations in making jam using strawberry fruit with jelly powder thickener and agar.

2. Experimental method
   2.1. Materials
   The conceptual framework in this research is as shown below:
Research is a very general term for the activities of floating knowledge and education, as well as being an important part in the development of human civilization. If there is no scientific research then it will not develop, no country has developed and succeeded in development, if there were no research activities [4, 15].

The research method is the method used by researchers in conducting research. There are 4 research methods, namely historical methods, descriptive methods, explanatory methods, and experimental methods. This research applied an experimental method. Experimental method aims to find the effect of certain variables on other variables, the emergence of variables to investigate the probable cause and effect by giving treatment to variables and comparing the results with control variables [4, 12].

This study is a qualitative approach. This research variables are things that can be determined by researchers to be studied in order to obtain information about this research objectives and then conclusions can be drawn [4, 5]. Control variables are variables that are controlled or made constant so that the influence of independent variables on the dependent variable is not influenced by external factors under study [4, 17]. The control variable in this study is Strawberry Jam. Furthermore, the purpose of the first experiment research method is to find out a regular strawberry jam turned into strawberry jam slice. The second method is to look for the preferred level of the strawberry jam slice product through comparison of taste, aroma, texture, and colour.

Population is the total amount consisting of objects or subjects that have certain characteristics and qualities determined by researchers to be examined and then drawn conclusions [4, 18]. The population in the research "Innovation of Strawberry Jam into Slice strawberry jam" researchers determined the students of XYZ University.

The sample is part of a number of characteristics of the population that are used for research. If you have a large population, it is not possible for researchers to take all for research for example due to

---

**Figure 1. Conceptual Framework**

Source: Author
limited funds, manpower, and time, so researchers can use samples taken from that population [4, 11]. The sample is 80 students who are not trained. Untrained panellists are used to test the level of pleasure in a product or to test the level of willingness to consume this product [6, 13].

The authors use primary data and secondary data in support of this research findings. The author’s primary data were obtained from a questionnaire that circulated to determine the strawberry jam favourite test in terms of colour, aroma, texture and taste. While the secondary data get from a library research that aims to support the theories needed in this research.

Measurement scale is an agreement that is used as a reference to determine the length of the short interval in the measuring instrument. If the measuring instrument is used for the measurement, it will produce quantitative data. Another instrument was used to measure the value of the variable under study which will depend on the number of variables studied [5, 12].

In the research the instrument used to collect the research data in the form of a questionnaire. While the measurement scale applied the hedonic scale or the scale of preference level. The scale used consists of 6 hedonic scales and numerical scales.

Questionnaire is a data collection technique that is done by giving questions or written statements to respondents to be answered by respondents. Questionnaires are also an efficient data collection technique when researchers know the variables to be measured and know what can be expected from respondents. Questionnaires can be closed/open questions/statements, can be given to respondents directly or sent by post and internet [5].

Literature is a data collection technique carried out by the author by examining the theories, opinions, and points of thought contained in the print media, especially books that support and are relevant to the problems discussed in research. The author uses various books as a useful source in supporting research. Besides books, the author also uses other sources that are useful in supporting research, including journals, online articles, and e-books related to research variables. In quantitative research, the data analysis method used is clear, which is directed to answer the problem formulation or test the hypothesis that has been formulated in the proposal. Because the data is quantitative, therefore the data analysis technique uses statistical methods that are already available [5, 14].

Descriptive statistics are statistics used to analyse data by describing or describing data that has been collected as it is without intending to make generally accepted conclusions or generalizations [5]. In this method the data generated from the questionnaire will be processed and analysed by calculating the average presented in tables, graphs or diagrams. Then frequency analysis is used to calculate the frequency of data on the variable [7, 18].

Paired sample T-Test or Paired Sample T-Test is used to test the average difference between two pairs of paired data [7]. In this study two samples were used, namely strawberry jam and strawberry jam slice. The application used in the calculation of Paired Sample T-Test is SPSS. SPSS is a program for statistical data processing abbreviated from Statistical Product and Service Solution [7].

The preference test can be called the hedonic test. In this test, the panellists were asked for their personal responses regarding their ‘likes’ or ‘Dislike’ slightly and their level. This favourite level is called the hedonic scale. For example, in han ‘likes’ it can have a hedonic scale like: very, Like Very Much, Like Very Much, like, somewhat like, neither like nor dislike slightly, Dislike Slightly This hedonic scale can be stretched or reduced. Hedonic tests are widely used to assess the final output [1, 9].

The hypothesis is a temporary answer to the formulation of a research problem. The formulation of the research problem has been stated in the form of a statement sentence. It is said temporarily, because the answers given are only based on relevant theories, not yet based on empirical facts obtained through data collection [5, 16]. According to [7], if significance > 0.05 then Ho is accepted H1 is rejected, if significance < 0.05 then Ho is rejected H1 is accepted.

In a study required valid and reliable research results and measured with valid and reliable instruments as well. Where if the instrument is valid means the measuring, instrument used to measure data is also valid. While a reliable instrument that is if used several times to measure the same object also gets the same data [5, 13]. According to [5, 14], the results of the study are said to be valid if there is a
similarity of data between the data collected and the data that actually occurs on the object under study. In other words, if the object under study is red and the data collected is white, the research results are said to be invalid. To test the validity, the author will use a computerized system, namely SPSS. The questionnaire is declared valid if the correlation coefficient value is greater than the listed correlation value ($r_{\text{arithmetic}} > r_{\text{table}}$).

According to [5, 14] Reliable research results, if there are similarities of data at different times. While a reliable instrument that is if the instrument is used several times to measure the same object, will produce the same data. A reliable test in this study was conducted to determine whether the questionnaire instruments used in this study were reliable and could be used more than once and still produce the same data. To test the reliability of the data, the author will use a computerized system, namely SPSS. The questionnaire was declared reliable if the Cronbach’s Alpha value $> 0.6$.

### 3. Results and discussion

#### 3.1. Experimental Method 1

In this Experimental Method 1 resulted the innovative slice strawberry jam as described as follow.

| Method | Result |
|--------|--------|
| Ingredients: strawberry, sugar, lemon, jelly powder and gelatin. |
| The Process: |
| • Cook the strawberry into liquid. |
| • Add sugar, lemon water to mix with the strawberry liquid. |
| • Add more ingredients of jelly powder and gelatin. |
| • Cook until boiled. |
| • Place the liquid in the form of thin, elastic, and non-sticky form |
| • Wait until it cold, then stored in the refrigerator |

![Figure 2. The square slice strawberry jam](Source: Authors)

To create a good square shape, the author creates a specific molder. However, if the specific molder is not available, then it could be replaced by silicone baking mat. After the thick slice strawberry jam is set, it can be cut to the desired shape.

#### 3.2. Experimental Method 2

Panelist assessments were carried out through questionnaires. There are 6 scales according to the hedonic scale, namely 1 (Dislike Slightly), 2 (Neither Like nor Dislike Slightly), 3 (Like Slightly), 4 (Like Moderately), 5 (Like Very Much), and 6 (Like Extremely).

| Table 1. Assessment of Untrained Panelists on Strawberry Jam and Strawberry Slices |
|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| Strawberry      | Colour | Flavour | Texture | Taste |
| Like Extremely   | 17     | 12     | 17     | 33 |
| Like Very Much   | 28     | 29     | 27     | 32 |
| Like Moderately  | 27     | 20     | 26     | 25 |
| Like Slightly    | 4      | 9      | 11     | 5  |
| Neither Like Nor| 3      | 5      | 3      | 6  |
| Dislike Slightly | 3      | 3      | 3      | 6  |
| Dislike Slightly | 1      | 0      | 0      | 3  |
Panelists are not trained on strawberry jam and strawberry slices. In terms of the color of strawberry jam, there are 1 panelist choosing to Dislike Slightly, and there are 3 people choosing neither like nor dislike slightly, 4 people choosing rather like slightly, 27 people choosing like moderately, 28 people choosing Like Very Much, 17 people choosing like extremely, and for strawberry slices there are no panelists choosing dislike slightly, and there are 3 people choosing neither like nor dislike slightly, 3 people choosing like slightly, 24 people choosing like moderately, 28 people choosing Like Very Much, and 19 people choosing like extremely. In terms of the flavor of strawberry jam, there is 1 person choosing Dislike Slightly, 5 people choosing neither like nor dislike slightly, 10 people choosing like slightly, 23 people choosing like moderately, 28 people choosing Like Very Much, 12 people choosing like extremely, and for flavor strawberry slices there are no panelists choosing dislike slightly, 5 people choose neither like nor dislike slightly, 9 people choose like slightly, 20 people choose like moderately, 29 people choose Like Very Much, and 17 people choose like extremely.

In terms of strawberry jam texture, there are no panelists choosing dislike slightly, 3 people choose neither like nor dislike slightly, 26 people choose like moderately, 27 people choose Like Very Much, 13 people choose like extremely, and for texture of strawberry jam slices there are 3 panelists choosing dislike slightly, 3 people choosing like moderately, 12 people choosing like extremely, and for texture of strawberry jam slices texture, there are 3 panelists choosing dislike slightly, 3 people choosing like slightly, 6 people choosing like moderately, 12 people choosing like, 23 people choosing Like Very Much, and 33 people choosing like extremely.

In terms of the taste of strawberry jam, there are no panelists choosing dislike slightly, 6 people choose neither like nor dislike slightly, 5 people choose like slightly, 25 people choose like moderately, 32 people choose Like Very Much, 12 people choose like extremely, and for strawberry jam slices taste, there are 3 panelists choosing dislike slightly, 6 people choosing neither like nor dislike slightly, 2 people choosing like moderately, 12 people choosing like, 24 people choosing Like Very Much, and 33 people choosing like extremely.

### 3.3. Validity Test

In the research which has a total of 80 panelists. Through the validity test calculation using the SPSS application, the data will be declared valid if $r_{count} > r_{table}$, where $r_{table} = 0.220$ (N = 80).

|                  | Strawberry Jam | Strawberry Slices Jam |
|------------------|----------------|-----------------------|
| **R count**      | .860           | .792                  |
| **R tables**     | 0.220          | 0.220                 |

**Table 2. Test the Validity of Strawberry Jam and Strawberry Slices Questionnaire Data**

In the study "Innovation of Strawberry Jam into Slice strawberry jam" From the table above it can be seen that the results of the calculation of validity obtained from SPSS $r_{count} > r_{table}$ so that it can be declared valid.

### 3.4. Reliability Test

The method used by researchers in the reliability test to measure the consistency of the measuring instrument is Cronbach's Alpha, where a research instrument can be declared reliable if the Cronbach's Alpha value $> 0.6$

For strawberry Jam have cronbach’s Alpha .850 and strawberry slice have cronbach’s alpha .891. Data reliability test questionnaire the reliability calculation using SPSS is 0.891. It said the data was reliable because the results were $> 0.6$
Table 3. Reliability Test Strawberry Slices Jam for Strawberry Data Questionnaire

| Paired Differences | 95% Confidence Interval of the Difference | t | df | Sig. (2-tailed) |
|--------------------|------------------------------------------|---|----|----------------|
|                    | Mean | Std. Deviation | Std. Error | Lower | Upper |      |    |         |
| Pair 1 Colour_A - Colour_B | -.138 | 1,376 | .154 | -.444 | .169 | -.894 | 79 | .374 |
| Pair 2 Flavor_A - Flavor_B | -.175 | 1,310 | .146 | -.467 | .117 | -1.195 | 79 | .236 |
| Pair 3 Texture_A - Texture_B | -.400 | 1,580 | .177 | -.752 | -.048 | -2.264 | 79 | .026 |
| Pair 4 Taste_A - Taste_B | -.350 | 1,714 | .192 | -.732 | .032 | -1.826 | 79 | .072 |

3.5. Paired Sample T-Test

In the paired sample T-test results above, it can be seen that: Hypothesis 1, results of the paired sample T-test on the color get a sig value. (2-tailed) of .374 which means that H0 is accepted, H1 is rejected which means there is no preference for the color of strawberry jam slices. Thus hypothesis 2, results of Paired sample T-test on Aroma get a sig value. (2-tailed) of .236 which means that H0 is accepted, H1 is rejected which means there is no preference for the aroma of strawberry jam slices.

Hypothesis 3, results of paired sample T-test on the texture get sig values. (2-tailed) of .026, which means that H0 is rejected, H1 is accepted, which means there is a preference for the texture of strawberry jam slices. Moreover, hypothesis 4, results of the paired sample T-test on taste get sig. (2-tailed) of .072 which means that H0 is accepted, H1 is rejected which means there is no preference for the taste of strawberry slices jam.

3.6. Average Preference Test on Strawberry Jam and Strawberry Slices, Statistics of Average Comparison Test Results (Mean)

Table 4. Statistic Mean Strawberry Jam and Slices

|        | Strawberry Jam | Strawberry Slices |
|--------|----------------|-------------------|
| Colour | Taste | Colour | Taste |
| A      | A     | A      | A     |
| Valid  | 80    | 80     | 80    | 80    | 80    | 80    | 80    |
| Missing| 0     | 0      | 0     | 0     | 0     | 0     |
| Missing| 4.61  | 4.38   | 4.45  | 4.49  | 4.75  | 4.55  | 4.85  | 4.84  |

Figure 3. Average Column Chart of Strawberry Jam and Strawberry Slices
3.7. Conclusion The Average Preference Test on Strawberry Jam and Strawberry Slice

Table 5. Average Total of Strawberry Jam and Strawberry Jam Slice

| Organoleptic | Strawberry Jam | Strawberry Slices Jam |
|--------------|----------------|-----------------------|
| Colour       | 4.61           | 4.75                  |
| Flavor       | 4.38           | 4.55                  |
| Texture      | 4.45           | 4.85                  |
| Taste        | 4.49           | 4.84                  |
| Total        | 4.48           | 4.74                  |

In Figure 3 can be seen the average preference test results (mean) in the form of bar charts in terms of color, aroma, texture, and taste. The Figure shows that the strawberry jam slice is preferred over the strawberry jam. Overall in table 10 there is a total average of strawberry jam and strawberry jam slice. Where the average strawberry jam is 4.48 and the average strawberry jam is 4.74. Then it can be concluded that the strawberry jam slice has an acceptability in the community.

4. Conclusion

This research concluded the discussion into two parts. First, levels of preference of panelists for strawberry jam slices tested in terms of color, aroma, texture, and taste. The panelists on average chose slice strawberry jam. In terms of the color of the jam the average panelist judges by choosing like moderately leading to Like extremely. In terms of the aroma of jam slices, the average panelist judged that he likes extremely. Then in terms of texture of the jam slice has a higher value than strawberry jam by choosing likes moderately leads to Like extremely. While in terms of taste panelists prefer slice strawberry jam by judging from likes moderately leading to like slightly. Where the average total of strawberry jam is lower than the average of strawberry jam slices. Then it can be concluded that the strawberry jam slice has an acceptability in the community.

Second, the power of acceptance in terms of color, aroma, texture, and taste of strawberry jam slices. The paired sample T-test results show the acceptability in terms of color, aroma, texture, and taste of the strawberry jam slice. In terms of color, there is no preference for slice strawberry jam. Then in terms of aroma shows there is no fondness for strawberry jam slices. While in terms of texture shows that there is a fondness for strawberry jam slices. In terms of taste it shows that there is no liking for strawberry jam slices. Therefore, we can conclude that in terms of color, aroma and taste shows that there is no liking for strawberry jam slices. Then only in terms of texture which shows that there is a fondness for strawberry jam slices.

Finally, in this research, the authors want to be able to add insight for students at XYZ University and the reader. Previously the only jam that we know is in the form of jelly. However, this research shows that regular strawberry jam can be restructured into slices to produce a high economic value and attract the consumerism. This slice strawberry jam is also can be made by strawberry farmers to add their revenue rather than selling the raw strawberry which has a risk of damage. Also the strawberry slice strawberry jam is be able as the alternative for filling the plain bread while stay at home.

Furthermore, this research can be continued by an interest researcher to conduct a further study. Then it is expected to be re-examined using different fruit ingredients in the making of jam slices. In making this slice of strawberry jam the key to its success is to follow an accurate measure by following an existing recipe.

5. References

[1] Ermi Sukasih, E., & Setyadjit, S. (Juni 2019). Teknologi Penanganan Buah Segar Stroberi Untuk Mempertahankan Mutu. Jurnal Litbang Pert. Vol. 38 No. 1, 47-54.

[2] M.N. Mohd Naeem a, M.N. Mohd Fairulnizal a,, M.K. Norhayati a, A. Zaiton b, A.H. Norliza b,
W.Z. Wan Syuriahti b, J. Mohd Azerulazree a, A.R. Aswir a, S. Rusidah, "The nutritional composition of fruit jams in the Malaysian market," Journal of the Saudi Society of Agricultural Sciences (2017) 16, 89–96

[3] D. A. Asmarani Ayu Antika Sari, Effect of Proportion of Star Fruit and Tomato Juice and Thickeners (Jelly Powder and Agar) on Organoleptic Properties, Vols. 5, No. 1, no. Edisi Yudisium Periode Februari 2016, pp. 211 - 220, 212., 2016.

[4] Tifani, K. T., Nugroho, L. P. E. and * Purwanti, N "Physicochemical and sensorial properties of durian jam prepared from fresh and frozen pulp of various durian cultivars", International Food Research Journal 25(2): 826-834, 2018.

[5] P. D. Sugiono, Research methodology. Bandung, Alfabeta., 2015.

[6] Hassan, H. E., A. A. Abd El-Rahman, A. A. Khalid Salleh “Quality evaluation of strawberry fruit using visible laser”, AgricEngInt: CIGR Journal Open access at http://www.cigrjournal.org Vol. 20, No. 4 157, december 2018

[7] D. Priyatno, Practical Data Mixing Using SPSS., Yogyakarta, 2017

[8] Tereza Sovová, Barbora Křižová and Jaroslava Ovesná “Determining the Optimal Method for DNA Isolation from Fruit Jams” Czech J. Food Sci., 36, 2018

[9] Irene Darkwa “The Preparation of Jam: Using Star Fruit”, Global Journal of Educational Studies ISSN 2377-3936 2016, Vol. 2.

[10] Anna BanAV, Anna Korus , and JarosBaw Korus, “Texture, Color, and Sensory Features of Low-Sugar Gooseberry Jams Enriched with Plant Ingredients with Prohealth Properties” Hindawi, Journal of Food Quality Volume 2018, Article ID 1646894, 12 pages

[11] M. Moshiur Rahman, "Preparation of Strawberry Jam and Estimation of its Nutritive Value during Storage," Bangladesh Agricultural Research Institute, Gazipur, Bangladesh, 2018.

[12] Ya Luo, Yuanxiu Lin, Fan Mo, Cong Ge,Leiyu Jiang,Yong Zhang, Qing Chen, Bo Sun,Yan Wang, Xiaorong Wang, and Haoru Tang, “Sucrose Promotes Strawberry Fruit Ripening and Affects Ripening-Related Processes” Hindawi, International Journal of Genomics Volume 2019, Article ID 9203057, 14 pages

[13] M. F. M. N. Z. N. S. W. e. a. Naeem, "The Nutritional Composition Of Fruit Jams in The Malaysian Market," The Saudi Society of Agricultural Sciences, p. 90, 2015.

[14] Olugbenga Olufemi Awolu, Grace Oluwasembe Ojewumi, Modupe Elizabeth Ojewumi, Funmilayo Grace Oseyeni, “Functional Jam Production from Blends of Banana, Pineapple and Watermelon Pulp”, International Journal of Food Science and Biotechnology, 2018.

[15] PS Jayasinghe, G Ganegamarachchi and R Perera, "Development of Seaweed based Palmrya (Borassus flabellifer) Jam and Determination of its Quality Parameters," ACTA SCIENTIFIC NUTRITIONAL HEALTH Volume 3 Issue 9 September 2019 DOI: 10.31080/ASNH.2019.03.0404

[16] S. Basu, A. Karmakar, V. Bidhan, H. Kumar, K. Brar, M. Pandit and N. Latha, "Impact of lockdown due to COVID-19 outbreak: lifestyle changes and public health concerns in India," The International Journal of Indian Psychology, pp. 2349-3429, June 2020.