Food Science

Student’s Name

Institution

Date

**Discussion**

The aim of the study was to compare the firmness in the three types of bread and also to discover whether there is a correlation between firmness and water activity in bread. As noted above, the study discovered a significant difference in the firmness of Nagilla sativa bread. The finding of the study indicates that Nagilla Sativa control bread has the highest firmest of 6.78 followed by, Nagilla Sativa powder with 5.18 and Nagilla sativa oil has the lowest firmness of 43.22. It means that control bread has the highest number of chemical composition and physicochemical characteristic of lipid fractions and therefore, it takes a lot of energy to break the lipid bonds. And therefore, there is significantly different in the way each type of bread reacts when exposed to the same temperature. In table 1 below, it is indicated that Nagilla Sativa control, oil, and powder reacts different exposed to the same temperature.

|  |  |  |  |
| --- | --- | --- | --- |
| **Variable** | **Firmness** **Mean (SD)** | **WA****Mean (SD)** | **Temperature Mean** **(SD)** |
| **Control (n=25)** | 6.78± 4.7 | 0.97(0.03) | 21.39(049) |
| **Oil (n=25)** | 4.22± 3.9 | 0.97(0.02) | 21.40(0.50) |
| **Powder (n=25)** | 5.18± 4.9 | 0.97(0.3) | 21.39(0.49) |
| **Overall (N=75)** | 5.39± (3977.93) | 0.97(0.03) | 21.39 (0.49) |

**Table (1) Descriptive statistics bread firmness and water activity**

However, a study conducted by the University of Maryland Department of Food Technology established that Nagilla Sativa control has the firmness of 9.14, Oil 40.5 and powder or dry Nagilla has a mean of 20.84 (Hadjadj, Djamila, Hakima, & Feriel, 2018). The study was done using dry Nagilla Sativa seed and therefore, it contains a high concentration of moisture and oil.

The study conducted to discover the correlations between the firmness of the bread and the water activities established that there is a correlation between the water activities and the firmness of the bread. The analysis of the data indicates that the P-Value of firmness and water activity since the P-value is 0.05. This means that there is significantly different between firmness and water activities in every type of Nagilla Sativa bread. A study conducted by Al-Jassir (2015), established that each type of Nagilla Sativa contains a variety of chemicals, which include lipid and therefore, water cannot be the determiner factor of the firmness of Nagilla Sativa. The study conducted to the established relationship between day (1) and day (3) indicates that it is significantly different. The p-value is 0.05 and therefore, there is a correlation between the number of days it takes and the firmness of Nigella Sativa. It means that the more days it takes the firm it becomes. In this case, it means that if the Nagilla Sativa takes more days inside the high temperature it loses its chemical compounds and become weaker. According to Mohtashami, Behzad, Leila, and Mohammad (2016), the bread without Nagilla Sativa has a high concentration of moisture compared to bread with Nagilla Sativa. It, therefore, means that when Natigilla Sativa control and oil are exposed to temperature each loses the content of moisture and it depends on the number of days it is exposed to high temperature. The result also established a significant difference between the mean of each type of bread every day from day one. Based on the table below (Table 1), it is clear that there is a significant difference between day1, day, 2, 3, day 4 and day 5 since each day indicates a different mean and SD.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Variables | N | Mean | Std. Deviation | 95% Confidence Interval for Mean | Minimum | Maximum |
| Lower Bound | Upper Bound |
| Firmness | Day 1 | 15 | 372.2306 | 87.87428 | 323.5674 | 420.8938 | 181.68 | 584.84 |
| Day 2 | 15 | 1902.2817 | 799.47586 | 1459.5468 | 2345.0167 | 921.68 | 3636.91 |
| Day 3 | 15 | 6258.2319 | 2714.85257 | 4754.7966 | 7761.6671 | 3158.42 | 10865.35 |
| Day 4 | 15 | 8427.9507 | 2484.84798 | 7051.8878 | 9804.0137 | 3918.45 | 12069.72 |
| Day 5 | 15 | 8751.2713 | 2639.43367 | 7289.6017 | 10212.9410 | 4396.61 | 12198.33 |
| Total | 75 | 5142.3933 | 3977.92696 | 4227.1554 | 6057.6311 | 181.68 | 12198.33 |
| WA | Day 1 | 15 | .9680 | .01265 | .9610 | .9750 | .95 | .98 |
| Day 2 | 15 | .9980 | .00561 | .9949 | 1.0011 | .99 | 1.01 |
| Day 3 | 15 | .9707 | .00961 | .9653 | .9760 | .96 | .99 |
| Day 4 | 15 | .9773 | .02815 | .9617 | .9929 | .92 | 1.02 |
| Day 5 | 15 | .9427 | .03011 | .9260 | .9593 | .88 | .98 |
| Total | 75 | .9713 | .02637 | .9653 | .9774 | .88 | 1.02 |

**Table (1) Mean rank for firmness and water activity for bread types overall according to days**

However, a study conducted by a group of Food science and nutritionists established that the firmness of bread depends on the chemical or ingredients used to bake bread (Wanjuu, George, Daniel, & Simon, 2018). It states that 54% of Nagilla Sativa bread components or ingredients are chemical and about 14.27% is water and therefore, water makes the little percentage of Nagilla Sativa and therefore, the firmness of Nagilla Sativa bread does not depend on the composition of water as an ingredient. According to Wanjuu, George, Daniel, and Simon (2018), bread has water at 14.27% flour 48.7% sugar 1.7%, salt 0.8% fat 2.32% yeast 0.71%, and others and therefore, water could not be used as a factor to determine the firmness of bread, including the Nagilla Sativa bread. Bhise and Kaur (2014) pointed that the chemical composition of bread depends on its days and firmness and it is the reason Nagilla Sativa bread with oil takes much time and has the highest firmness among the three pieces of bread.

**The firmness of oil bread based on days**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Dependent Variable | (I) Day | (J) Day | Mean Difference (I-J) | Sig. | 95% Confidence Interval |
| Lower Bound | Upper Bound |
| Firmness | Day 1 | Day 2 | -814.33020\* | .009 | -1383.8796 | -244.7808 |
| Day 3 | -3268.22740\* | .000 | -3955.8860 | -2580.5688 |
| Day 4 | -6014.11000\* | .008 | -9618.3096 | -2409.9104 |
| Day 5 | -7701.90900\* | .033 | -14541.7345 | -862.0835 |
| Day 2 | Day 1 | 814.33020\* | .009 | 244.7808 | 1383.8796 |
| Day 3 | -2453.89720\* | .000 | -3183.0415 | -1724.7529 |
| Day 4 | -5199.77980\* | .012 | -8764.1549 | -1635.4047 |
| Day 5 | -6887.57880\* | .048 | -13704.2552 | -70.9024 |
| Day 3 | Day 1 | 3268.22740\* | .000 | 2580.5688 | 3955.8860 |
| Day 2 | 2453.89720\* | .000 | 1724.7529 | 3183.0415 |
| Day 4 | -2745.88260 | .118 | -6288.5387 | 796.7735 |
| Day 5 | -4433.68160 | .189 | -11236.5375 | 2369.1743 |
| Day 4 | Day 1 | 6014.11000\* | .008 | 2409.9104 | 9618.3096 |
| Day 2 | 5199.77980\* | .012 | 1635.4047 | 8764.1549 |
| Day 3 | 2745.88260 | .118 | -796.7735 | 6288.5387 |
| Day 5 | -1687.79900 | .941 | -8104.8886 | 4729.2906 |
| Day 5 | Day 1 | 7701.90900\* | .033 | 862.0835 | 14541.7345 |
| Day 2 | 6887.57880\* | .048 | 70.9024 | 13704.2552 |
| Day 3 | 4433.68160 | .189 | -2369.1743 | 11236.5375 |
| Day 4 | 1687.79900 | .941 | -4729.2906 | 8104.8886 |

**Table (3) multiple comparisons of firmness for oil bread according to days**

The finding of the study indicates that there is a significant difference between oil firmness of day 1 and 2, 2, day 3, and day 4 and day 5, of a P-Value of 0.05. According to Mello, Ishida, and Steel (2014), when the P-Value is equal or greater than 0.05, it means that there is a significant difference between the two variables. And in this case, it means that there is a correlation between days and the firmness of the oiled bread. It is also stated that the firmness of the Nagilla depends on the storage condition. A study conducted by Konopacka and Plocharski (2012), indicates that Nagilla Sativa releases moisture or water when kept and the amount of water or other contents depend on the condition. The Nigella Sativa stored in a high temperature and in humid or cold place would automatically have different firmness. And therefore, it is evident that firmness of the oiled bread is based on the day, since each day has different moisture and condition of storage.

The findings also indicate that it is significantly different between day 1 and day 2, 2 days and day 3, 3 days and day 4, day 4 and day 5 of firmness of oil bread. The result shows that the P-Value for all the five days is 0.05 and therefore, it means that there is significantly different, which means that there is a correlation between the five days in regard to the firmness of the oiled bread.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Firmness | WA | Temperature |
| Firmness | Pearson Correlation | 1 | -.358\*\* | .008 |
| Sig. (2-tailed) |  | .002 | .944 |
| N | 75 | 75 | 75 |
| WA | Pearson Correlation | -.358\*\* | 1 | -.428\*\* |
| Sig. (2-tailed) | .002 |  | .000 |
| N | 75 | 75 | 75 |
| Temperature | Pearson Correlation | .008 | -.428\*\* | 1 |
| Sig. (2-tailed) | .944 | .000 |  |
| N | 75 | 75 | 75 |

**Table (4) Correlation matrix between water activity and firmness and temperature for all types of bread**

The finding of the study indicates that there is no significant difference between water activity and firmness and the temperature of the bread. The analysis of the data of water activity, firmness and temperature of the bread, indicates that the P-Value is 0.02, which is less than significant level of 0.05 and therefore, it means that there is no significant difference. In this case, it translates that there is no correlation between firmness, water activity and the temperature of the bread. It means the temperature; water has no significant effect on the firmness of the bread. The study to find out the amount of temperature, which affects the bread, the result indicates the highest temperature, affect the bread. It is also discovered that it does not significantly different between the firmness and the water activities. It means that water activity does not have any impact on the firmness of the bread. And therefore, the notion that the less the water the firmness the dread does not apply in this study.

**Limitation**

A major limitation of the study was the lack of enough finances. This was required to purchase reagent and conduct the study. There was also fluctuation of temperature or humidity, which could affect the study but necessary steps were to prevent any interference with the reagent.

**Conclusion**

Based on the study, it is evident that there is no correlation between firmness, water activity and the temperature of the bread. It, therefore, means that the firmness of the bread is determined based on the chemical composition of the bread, which water and oil make an insignificant part of the component. It is also established that control, powder, and oil has the highest rate firmness based on the order. And this is because control has the highest amount of component followed by powder and then bread oil. The chemical component in these three types of bread differs and therefore, their chemical reaction when exposed to the same temperature differs.

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