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The Use of Durian Seed Waste and Reducing Wheat Flour in Biscuit-Making

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Abstract: This research aims to utilize durian seed waste in the creation of flavored biscuits. The study was conducted at the Agricultural Product Processing and Management Laboratory, Faculty of Agriculture, Santo Thomas Catholic University, North Sumatra, Medan. It utilized a Completely Randomized Design (CRD) to determine the optimal levels of protein, water, ash, pH, and organoleptic characteristics using factorial methodology. The primary focus was on the proportion of durian seed flour mixed with wheat flour, labeled as factor K, with codes ranging from K0 (100% durian seed flour) to K5 (equal parts durian seed flour and wheat flour). Storage duration, classified into five treatment levels denoted as factor L, ranged from L0 (10 days) to L4 (50 days). Data analysis was conducted using analysis of variance, revealing that the blend of durian seed flour and wheat flour significantly impacted protein, water, ash, pH, and organoleptic value, but not fat content. Storage duration significantly affected protein, water, and organoleptic value, and had some effect on fat content, but not on pH. The interaction between flour composition and storage duration significantly affected pH, but not other measured variables. The most favorable biscuit quality was obtained with treatment K_1L_0.

Keywords: durian seed flour, wheat flour, biscuits

Highlights

- Novel approach: Utilizing durian seed waste in biscuit production presents an innovative and sustainable method for food processing.
- Experimental design: The study employed a Completely Randomized Design (CRD) to optimize protein, water, ash, pH, and organoleptic characteristics in the biscuits.
- Significant findings: The blend of durian seed flour and wheat flour had a notable impact on various biscuit properties, while storage duration also influenced certain characteristics.
- Optimal combination: The most favorable biscuit quality was achieved with a specific combination of durian seed flour and wheat flour, highlighting the importance of ingredient proportions.
- Practical implications: The research contributes to the development of eco-friendly food products by repurposing agricultural waste materials.

Introduction

Based on data from the Central Statistics Agency (BPS), the amount of durian fruit waste production in Indonesia in 2020 reached 133,195 tons. Until now, the part of the durian fruit that is commonly consumed is only the flesh, which only weighs around 20-35% of the total weight of the durian fruit. So 65-80% consisting of leather waste and durian seed waste is simply thrown away and has not been utilized optimally. and seed waste (5-15%) where durian seeds have a very high starch content so that they have the potential to be an alternative substitute for food ingredients, or raw materials for pharmaceutical fillers, for example, durian seed starch is known to be used as a binding agent in the formulation of ketoprofen tablets, in During the harvest season, durian is abundant and people only consume the fruit portion or flesh.[1]

The research on the use of durian seed waste in food has recently developed greatly. This is because several nutritional contents are good for the body and prevent various diseases, especially high blood pressure which

functions for blood flow to the heart. The body continuously produces radical compounds and ultimately produces free radicals through normal cellular metabolism, inflammation, nutritional deficiencies, and as a result of responses to influences from outside the body. The environmental pollution such as ultraviolet, cigarette smoke, and others that we inhale without realizing it. One food ingredient that is rich in antioxidants and has the complete nutritional content that is good for the body is Durian Seed Flour [2].

The biscuits, a functional food item, are enjoyed by individuals of all ages, spanning from children to adults. This is because biscuits can be consumed by all groups. Consumer interest in biscuits, especially biscuits made from a mixture of durian seed flour, can be a profitable business opportunity, but because these biscuits are very commonly consumed, people rarely pay attention to the nutritional content of biscuits [3].

The part of the durian fruit that is usually consumed in the flesh, while the seeds are waste and have not been used as waste for making biscuits. The composition of durian seeds contains 2.4 g protein, 28.0 g carbohydrates, 3.0 g fat, 1.062% and 65.5 g water. Durian seeds have great potential as a proven alternative food because they have good nutritional content. Based on the description above, the author is interested in conducting research with the title "Utilizing Durian Seed Waste and Reducing Wheat Flour in Making Durian Flavored Biscuits."

The objective of this study is (1) to investigate the impact of durian seed flour and storage duration on the quality of biscuits, (2) The find out how to make biscuits from Durian seed flour, (3) The find out the nutritional content contained in biscuits made from durian seeds.

The research hypothesis

1. They suspected that there is an effect of adding durian seed flour to wheat flour on the quality of biscuit making.
2. They suspected that the storage time influences the quality of biscuit making.
3. They suspected that there is an interaction effect between the addition of durian seed flour and wheat flour and storage time on the quality of biscuit-making

2. Method

The materials employed in this study encompass durian seeds, the primary ingredient for producing durian seed flour, in addition to eggs, butter, refined sugar, wheat flour, baking powder, milk flour, and vanilla, constituting the fundamental components for biscuit preparation. Various tools such as knives, boilers, scales, baking sheets, ovens, molds, stirrers, mixers, and Hammer Mild were utilized. Reagents including H2SO4, NaOH, CuSO4, alcohol, NaCl, and K2SO4 were also employed. The investigation took place at the Agricultural Product Processing and Management Laboratory, Faculty of Agriculture, Santo Thomas Catholic University in Medan, utilizing a Completely Randomized Design (CRD) arranged in a factorial manner. Factor 1 pertained to the percentage combination of durian seed flour and wheat flour, coded as K, with distinct compositions: K0 representing 100% durian seed flour, K1 denoting 90% durian seed flour with 10% wheat flour, K2 indicating 80% durian seed flour with 20% wheat flour, K3 representing 70% durian seed flour with 30% wheat flour, and K4 indicating 60% durian seed flour with 40% wheat flour. Factor 2 involved storage duration, categorized into five treatment levels and coded as L: L0 for 10 days, L1 for 20 days, L2 for 30 days, L3 for 40 days, and L4 for 50 days.

The design model

This study employed a factorial Completely Randomized Design (CRD) framework, structured as follows:

$$Yjjk = \mu + \alpha i + \beta j + (\alpha\beta)jj + \varepsilon ijk$$ [4]

The research implementation

1. Making Durian Seed Flour
   The main research was carried out, namely making biscuits, the first step was making durian seed flour. The durian seeds are first separated from the durian fruit, then cleaned, boiled, peeled, cut into small pieces, then soaked in distilled water for 2 hours, then dried in an oven at 60^0C for 2 days. The dried material is floured using a hammer mill and filtered using a 60-mesh sieve.
2. The biscuit making

The making biscuits, wheat flour with 100% durian seed flour: 0%; 90%: 10%; 80%: 20%; 70%: 30%; 60%: 40%; 50%: 50%; and added 0.25% egg, 0.30% sugar flour, 0.25% butter, 0.25% full cream milk, 0.01% salt, 0.02% baking powder, and 0.01% vanilla as an aroma enhancer. then mixed using a mixer until it forms a perfect and homogeneous sheet of dough, the dough sheet is formed and molded in a baking pan with a thickness of 3 mm. Next, it is baked in the oven at a temperature of 1600C for 15 minutes. Before baking, the baking sheet is first coated with fat to avoid sticking to produce biscuits. which is good and not sticky, and analyzed (Pasha I, 2011).

3. Observation and Data Collection of protein content, determination of moisture content, determination of ash content, determination of fat content, pH, and determination of organoleptic values (AOAC, 2005) [5]

3. Results

Based on the findings of the study, it is evident that the manipulation of the ratio between durian seed flour and wheat flour affects various parameters of the resulting biscuits, as illustrated in Table 1 provided below

Table 1. illustrates the impact of varying proportions of Durian Seed Flour and Wheat Flour on Observed Parameters

The percentage of durian flour to wheat flour (K)	The protein content (%)	The water content (%)	The content ash (%)	The Content fat (%)	pH	The organoleptic Value
K_1 = 100 %	8,02	5,13	2,36	12,35	5,68	4,58
K_2 = 90 % : 10 %	7,79	5,22	2,37	12,10	5,65	4,47
K_3 = 80 % : 20 %	7,43	5,41	2,34	11,90	5,63	4,38
K_4 = 70 % : 30 %	7,22	5,65	2,32	11,81	5,63	4,22
K_5 = 60 % : 40 %	7,23	6,03	2,04	11,58	5,64	3,78

The storage time also affects the biscuits produced. The effect of long storage treatment on each parameter of the biscuits produced is revealed in Table 2.

Table 2 presents the influence of different storage time treatments on the observed parameters of the biscuits

The effect of storage time treatment (L)	The protein content (%)	The water content (%)	The content ash (%)	The Content fat (%)	pH	The organoleptic Value
L_0 = 10 days	8,18	5,41	2,23	12,33	5,66	4,50
L_1 = 20 days	7,80	5,46	2,26	12,17	5,64	4,41
L_2 = 30 days	7,51	5,44	2,27	11,96	5,66	4,30
L_3 = 40 days	7,23	5,53	2,34	11,76	5,64	4,18
L_4 = 50 days	6,97	5,60	2,32	11,53	5,64	4,04

Table 1 shows that between treatments K_0 and K_2, K_3, and K_4, between treatments K_1 and K3, K4 the differences are very significant, while between treatments K_0 and K_1, K_1, and K2, and between K_2, K_3, and K_4 the differences are not significant. In the K0 treatment, the biscuit exhibited the highest protein content at 8.02%, whereas the lowest content was observed in the K3 treatment at 7.22%. The relationship between the ratio of durian seed flour to wheat flour and the protein content of the biscuits is depicted in Figure 1.

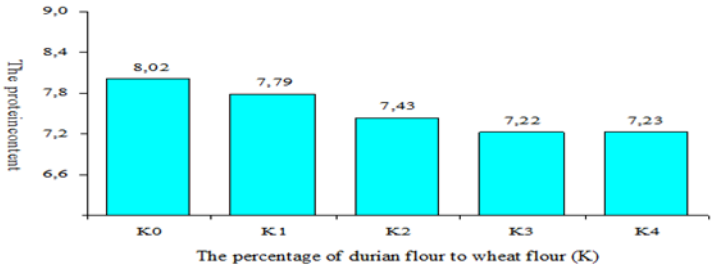

Figure 1. The relationship between the ratio of durian seed flour to wheat flour and the protein content of the biscuits

As the proportion of durian seed flour rises and wheat flour is incorporated, the protein content of the resulting biscuits also increases. According to [6], durian seed flour contains 10.41% protein. According [7] wheat flour has a protein content of 8 – 9%. Using durian seed flour with a higher percentage will produce biscuits with a higher protein content.

The effect of long storage treatment on protein content

Table 2 shows that between treatments L_0 and L_2, L_3 and L_4, between L_1 and L_3, L_4, and between L_2 and L_4 are significantly different, while between L_0 and L_1, L_1 and L_2, L_2 and L_3, and between L_3 and L_4 are different. not real. In treatment L0, the biscuit exhibited the highest protein content at 8.18%, while the lowest content was observed in treatment L4 at 6.97%. The association between the duration of storage and the protein content of the biscuits adheres to the linear regression equation presented in Figure 2

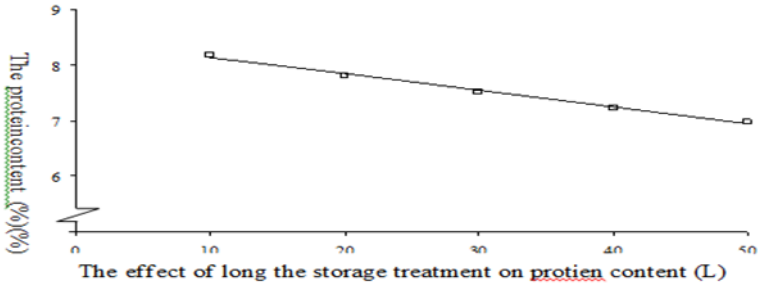

Figure 2. The association between the duration of storage and the protein content of the biscuits adheres to the linear regression equation

During storage, there is a decrease in the biscuit's protein content. According to [8], the decrease in protein during storage is caused by damage to the protein due to humidity in the air and the growth of microbes during the storage process, where microbes degrade the protein, resulting in a decrease in protein levels. During storage, there is a decrease in the biscuit's protein content.

The Moisture Content

The impact of varying proportions of durian seed flour and wheat flour on the moisture content of biscuits.

Table 1 indicates significant differences among treatments, specifically noting very significant disparities between treatments K0 with K2, K3, and K4, as well as between treatments K1 and K2, K3, K4, K2 and K3, K4, and K3 and K4. Additionally, there are significant differences observed between treatments K0 and K1. The K4 treatment exhibited the highest moisture content of biscuits at 6.03%, while the lowest was noted in the K0 treatment at 5.13%. The relationship between the proportion of durian seed flour and wheat flour and the moisture content of the biscuits is illustrated in Figure 3

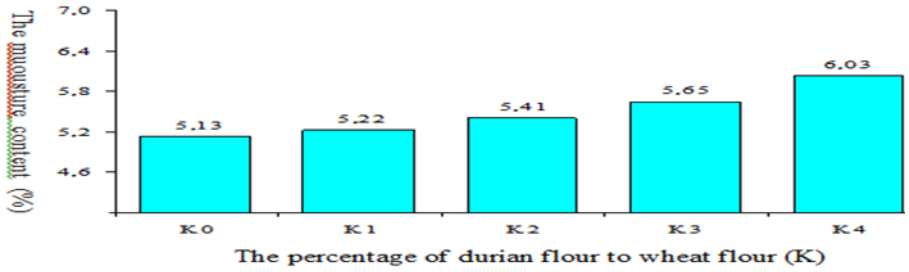

Figure 3. Relationship between the percentage of Durian seed flour and wheat flour with the moisture content of biscuits

Utilizing a greater proportion of wheat flour will elevate the moisture level in the biscuits. This is attributed to the presence of gluten in wheat flour, a water-insoluble protein with strong hydrophilic properties, thereby enhancing water retention in the dough. Gluten is a protein complex that is insoluble in water but binds water and functions as a skeletal structure. Glucosamine and gluten which produce good viscoelastic properties. Glucosamine plays a role in intermolecular bonds forming hydrogen bonds. Glucosamine causes high elastic properties. The characteristics contained in glucosamine make a dough that can be made into sheets, rolled, or made to rise [9].

The effect of long storage treatment on biscuit moisture content

Table 2 shows that between treatments L_0 L_3 and L_4, the differences are very significant, between L_1 and L_2 the differences are significant, while between L_0, L_1, L_2, and between L_3 and L4 the differences are not significant. The highest biscuit moisture content was in treatment L_4 at 5.60% and the lowest was in treatment L_0 at 5.41%. The correlation between the duration of storage and the moisture content of the biscuits adheres to the linear regression equation illustrated in Figure 4.

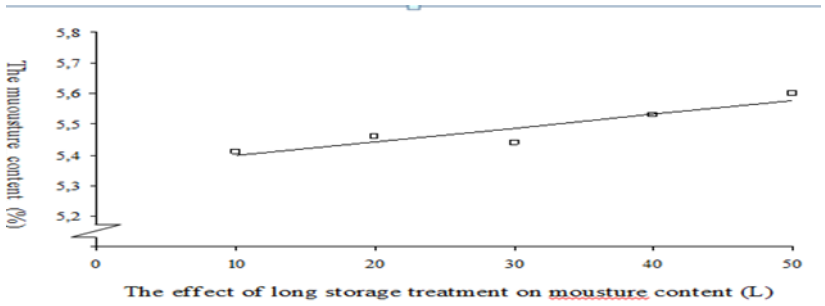

Figure 4. The relationship between storage time and biscuit moisture content

During storage, the moisture content of the biscuits increases. The moisture content during storage is greatly influenced by the relative humidity of the air surrounding the material. High moisture content can cause products to be damaged more easily due to the presence of spoilage microbes that use the water in the product as a growth medium. The higher the moisture content, the easier it is for microbes to reproduce so that food products will experience changes both physically, chemically, and microbiologically [10],

4. The minerals content

Impact of the proportion of durian seed flour and wheat flour on the mineral content of biscuits.

Table 1 shows that the treatments K_0, K_1, K_2, K_3, and K_4 are very significantly different, while the differences between treatments K_0, K_1, K_2, K_3 and K4 are not significant. The highest biscuit minerals mineral content was in the K0 treatment at 2.36% and the minimum was recorded in treatment K4 at 2.04%. The association between the percentage composition of durian seed flour and wheat flour and the mineral content of the biscuits can be depicted in Figure 5. The increased utilization of durian seed flour results in elevated ash content in the produced biscuits. This occurrence can be attributed to the higher mineral content present in durian flour

compared to wheat flour. The amount of mineral content in the material will affect the mineral content of the material.

The according to Nathanael et al., (2016) that the mineral content contained in durian seed flour is Magnesium (Mg) 1,751.30 ppm, Potassium (K) 9,117.86 ppm, and Sodium (Na) 18.07 ppm, while the mineral content contained in wheat flour ranges from 0.3-1.5% [11].

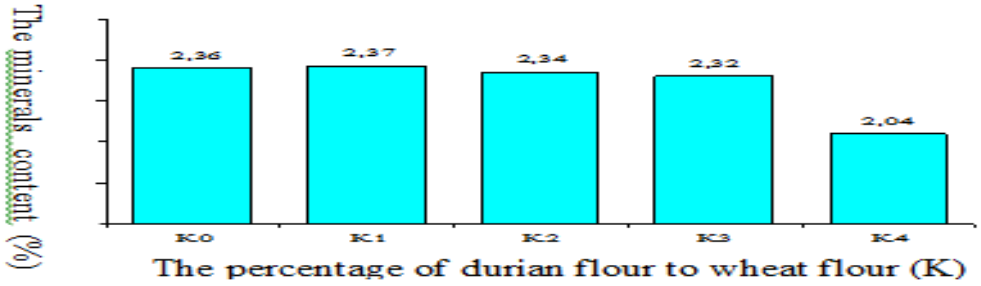

Figure 5. The correlation between the proportions of durian seed flour and wheat flour and the mineral content of the biscuits

4. Regarding fat content

The impact of prolonged storage treatment on biscuit fat content is examined

Table 2 indicates that there are significant differences between treatments L0 and L4, with L1 and L4 being notably distinct. However, the differences between L0, L1, L2, L3, and between L2, L3, L4 are not statistically significant. The highest fat content in biscuit dough was observed in treatment L0 at 12.33%, while the lowest was in treatment L3 at 11.53%.

The correlation between storage duration and biscuit fat content conforms to the linear regression equation presented in Figure 6.

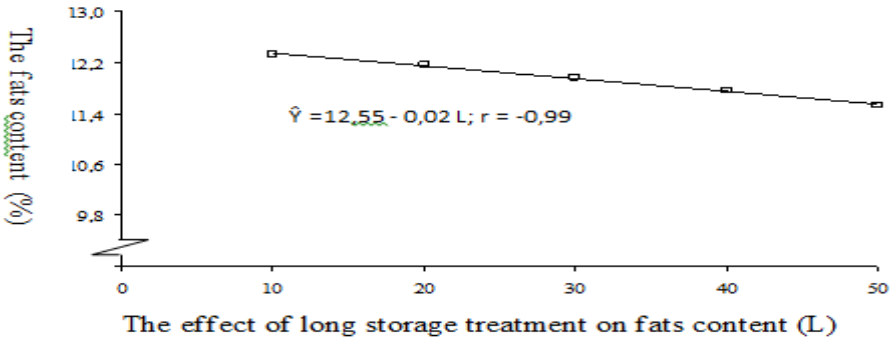

Figure 6. The correlation between storage time and biscuit fat

During storage, the fat content of the biscuits decreased. The decrease in fat content was caused by microbial activity and oxidized fat during storage at room temperature. According to Dyah (2017), fat is damaged if it looks yellow and lumpy, and has a rancid aroma and a sour taste. Rancid odors are caused by enzyme activity in materials containing fat and microbial activity contained in fat or oxidation. The longer storage can result in a decrease in fat content, the decrease in fat content is caused by oxidation [12].

5. pH

The impact of durian seed flour and wheat flour proportions on the pH level of biscuits is examined.

Table 1 demonstrates significant differences between treatments K0 and K2, K3, and K4, with notable

variations also observed between treatments K0 and K1. The highest recorded pH value for biscuits was in treatment K0 at 5.68, while the lowest was in treatment K4 at 5.64. The correlation between the proportion composition of durian seed flour and wheat flour and the pH level of the biscuits can be depicted in Figure 7. The higher the use of durian seed flour, the lower the pH of the biscuits produced. This is because durian seed flour contains organic acids. The according durian seeds contain oxalic acid and cyclo-propene fatty acids which cause shortness of breath and aortic atherosclerosis. Increasing the acid content in flour will reduce the pH of the product.[13] and [14].

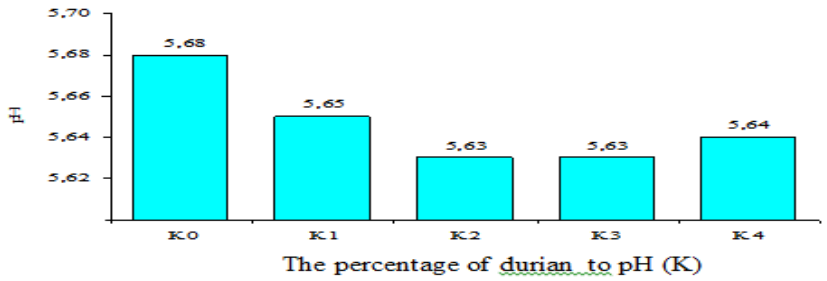

Figure 7. The correlation between the proportion of durian seed flour and wheat flour with biscuit pH

The organoleptic value

The impact of the proportion of durian seed flour and wheat flour on the organoleptic value of biscuits

Table 1 reveals significant differences among treatments, notably between treatment pairs such as K0 with K3 and K4, K1 with K3 and K4, K2 with K3, and K3 with K4. Additionally, significant disparities are observed between treatment pairs K0 and K2, as well as K2 and K3, while no significant differences are found between K0 and K1, and K1 and K2. The highest recorded organoleptic value for biscuits was in treatment K0 at 4.58, whereas the lowest was in treatment K4 at 3.78. The correlation between the proportion composition of durian seed flour and wheat flour and the organoleptic value of biscuits can be illustrated in Figure 8.

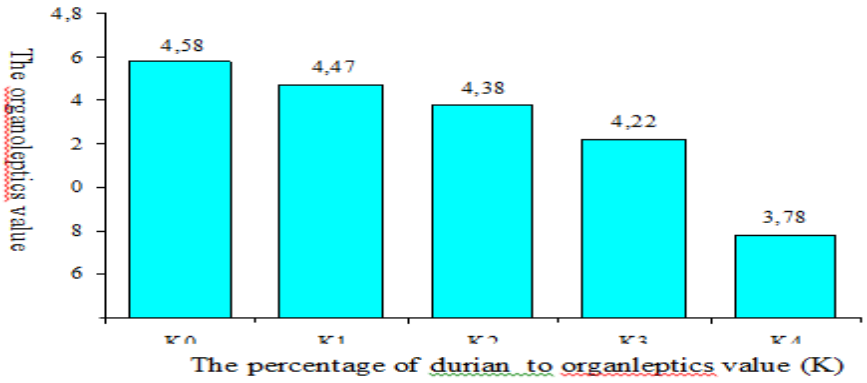

Figure 8. The correlation between the proportion of durian seed flour and wheat flour with the organoleptic value of biscuits

Utilizing a greater proportion of durian seed flour enhances the sensory appeal of the biscuits, as durian seed flour possesses a unique fragrance. The aroma that arises is caused by the volatile compounds contained in the ingredients evaporating during the baking process. Using a durian seed flour composite will strengthen the savory aroma of the biscuits. This is because durian seed flour produces a delicious, savory aroma typical of durian. The biscuit aroma can also be caused by various other components in the dough such as butter, sugar, and baking powder. According to [15] the leavening agent in making biscuits functions as an aroma regulator

The Impact of long storage treatment on the organoleptic value of biscuits

Table 2 reveals significant differences among treatments, particularly between treatment pairs L0 and L3, L4,

L1 and L3, L4, and L2 and L4, which are highly significant. Additionally, there are significant differences between L0 and L2, while no significant differences are observed between L0 and L1, L1 and L2, L2 and L3, as well as between L3 and L4. The highest recorded organoleptic value for biscuits was in treatment L0 at 4.50, while the lowest was in treatment L4 at 4.04.

The correlation between storage duration and the sensory quality of biscuits conforms to the linear regression equation illustrated in Figure 9.

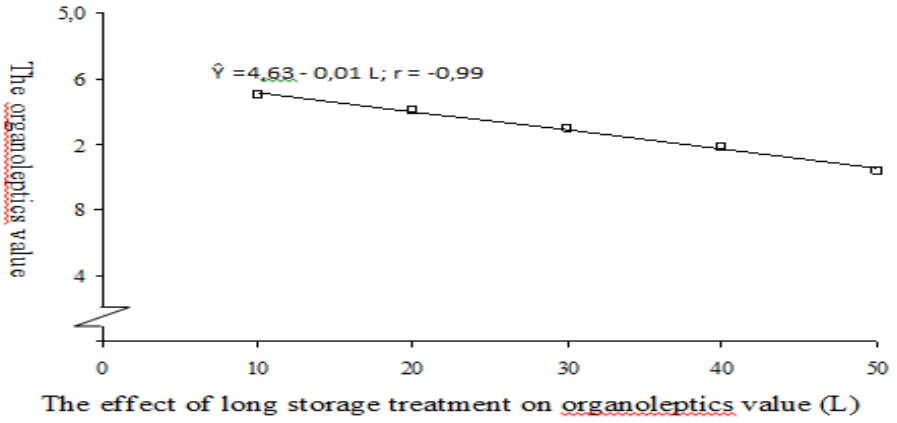

Figure 9. Correlation between organoleptic value of biscuits and storage time

During storage, the organoleptic value of biscuit water decreases. This is due to the emergence of a sour aroma due to microbial activity and protein degradation. According to Haerani (2010) who states that during storage there will be microbial activity in the product which will cause changes in the taste and aroma of the product. They stated that undesirable changes in aroma occur due to interference from microorganisms which produce off odors.[16]

5. Conclusion

The duration of storage significantly influences ($p<0.01$) the protein content, moisture content, and organoleptic quality of the product, with a discernible impact ($p<0.05$) on fat content. However, it does not have a significant effect ($p>0.05$) on pH. Storage duration significantly impacts ($p<0.01$) protein content, moisture content, and organoleptic quality, with a notable effect ($p<0.05$) on fat content, yet it does not significantly affect ($p>0.05$) pH

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Competing Interests
The authors declare that they have no competing interests.

Authors' Contributions
All authors contributed equally to the conception and design of the study

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Information advances science and health by providing access to biomedical and genomic information.

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