ANALYSIS OF GLUCOSE LEVELS IN CULTIVATED HONEY IN SOUTH KALIMANTAN PROVINCE WITH LUFF SCHOORL TEST

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Abstract

Honey is a complex food ingredient that is produced by nature and can be used by humans as a sweetening agent. Glucose levels in honey are useful for facilitating the work of the heart and can relieve liver disease disorders and as a determinant of the natural sweetness of honey. This study aims to determine the amount of glucose contained in cultivated kelulut honey and compare its levels with the requirements set by SNI 01-3545-2018 in 2018 regarding honey quality criteria and determine the effect of glucose levels on differences in sample locations. The study used an analytical observational cross sectional design. The sample used is cultivated honey. A total of three samples of honey purchased at random from three cultivation sites in South Kalimantan were analyzed using the luff school test. The results showed that the highest glucose levels were seen in honey samples with code BRB 85.63% and the lowest glucose levels were seen in honey samples with TBN codes 72.81%. These results are in accordance with limits set by SNI NUMBER 01-3545-2018. Based on the analysis using independent samples, the p value = 0.001 (p <0.05) indicates that there is an effect of glucose levels on differences in sample locations.

Keywords : Cultivated Honey, Glucose Level, Luff Schoorl Test

Introduction

Honey has been known as a natural food or drink that has an important role in life and health (Nanda et al., 2015). Honey is a complex food ingredient that is produced by nature and can be used by humans as a sweetening agent. Honey is produced by honey bees (Apis sp.) from plant flower extracts (floral nectar) or other parts of plants (extra floral) (Werang, 2019). There are many types of honey found in Indonesia. The diversity of honey is influenced by differences, namely regional origin, season, type of bee, type of plant source of nectar, way of life of bees (cultivated or wild), harvesting method and post-harvest handling. From this diversity, honey standards were developed into three categories, namely forest honey, cultivated honey and stingless bee honey (Trigona) (National Standardization Agency, 2018).

The name of honey is usually based on the nectar that is sucked by the bees. The quality and quality of the honey produced is highly dependent on the origin of the nectar inhaled by the bees (Sakri, 2012). Honey has a low pH with a range of 3.4-6.1, causing honey to be acidic and honey

is also a supersaturated solution because it has a high carbohydrate content in the form of reducing sugar. About 70-80% sugar is contained in honey and about 65% is glucose (National Standardization Agency, 2018).

The composition of honey is very diverse even though it comes from the same tree species. The difference in honey composition can be caused by differences in climate, topography, plants that are a source of nectar, types of bees that produce honey and processing methods (Radam et al., 2016). Honey has the main components in the form of glucose, fructose and water. Glucose and fructose are simple sugars (monosaccharides). Honey also contains disaccharides, such as maltose, sucrose, turanose, and isomaltose. The quality of honey in Indonesia is regulated in the Indonesian National Standard (SNI) Number 01-3545-2018.

Kelulut bees or stingless bees are a group of small bees that belong to a group called Meliponini and are still closely related to the stinging honey bee (Apis spp.) in the Apidae tribe. The characteristics of a stingless bee, among others, its body is divided into three parts including the head, chest (thorax), and abdomen. In the thorax can be found two pairs of wings and three pairs of stalks. Especially on the hind limbs equipped with a pollen basket. On the head there are a pair of compound eyes and 3 simple eyes (ocelli). A pair of antennae, which are organs of touch, are near the eyes (Harjanto et al., 2020).

Glucose is an organic compound in the form of monosaccharide carbohydrates. Monosaccharides are usually referred to as the simplest carbohydrates, cannot be broken down into smaller parts anymore. Thus, glucose is often referred to as a simple sugar. Glucose has a main function, namely as a source of energy for almost all cells in the body. Examples include brain cells, nerves, red blood cells, retina cells and the lens of the eye.

The Luff Schoorl method is a method of chemically determining monosaccharides. In determining this method, what is determined is the cupricoxide in solution before being reacted with reducing sugar (blank titration) and after being reacted with reducing sugar samples (sample titration). Determination of glucose levels can be done by various methods, one method that can be used is the Luff Schoorl method. In this method, glucose is determined based on its reducing properties of copper (II) ions in the Luff Schoorl reagent so that it is declared a reducing sugar (Diyah et al, 2016).

Based on previous research conducted by Rama Ridoni, et al (2020). This study found the glucose content of 54.13%. Glucose levels in kelulut honey are not in accordance with the standards set by SNI due to honey sampling in the rainy season, while according to research by Devyana Dyah

Wulandari (2017) the results of the analysis of glucose levels in honey at room temperature have levels of 51.625%.

Material and Methods

In this study, an analytical observational research design was used with a cross sectional research design for the sample where this research will be carried out in a laboratory with the aim of analyzing glucose levels in cultivated honey in the province of South Kalimantan. The sampling technique in this research is purposive sampling. The sampling sites were carried out in several areas in South Kalimantan Province, including in Tabunganen Village (Barito Kuala), Tapin Regency (Banua Pandang), and Barabai Regency (Pantai Hambawang).

Tool and material

The tools that will be used in this study were analytical balance, 100 mL Erlenmeyer, upright cooler, 100 mL volumetric flask, 250 mL volumetric flask, 500 mL volumetric flask, 5 mL volumetric pipette, 10 mL, 25 mL, glass funnel, beaker, hotplate. , measuring cup, burette, dropper, clamp and stand. The materials that will be used in this study were hydrochloric acid (HCL) 3%, sodium hydroxide (NaOH) 30%, luff schoorl solution, potassium iodide (KI) 30% solution, sulfuric acid (H2SO4) 25% solution, sodium thiosulfate solution (Na2S2O3) 0.097 N, 1% starch indicator, aquadest, and honey.

Methods

Making luff schoorl solution

Weigh 35.95 grams of Na2CO3 then dissolve it with aquadest. Weigh 12.5 grams of citric acid then dissolve it with distilled water. Weigh 6.25 grams of CuSO4.5H2O then dissolve it with aquadest. Put the three solutions into a 250 mL volumetric flask, add aquadest to the mark and shake. Then leave it overnight.

Making 25% H2SO4 solution

Pipette 64.43 mL of H2SO4 p.a 97% into a 250 mL measure which already contains 2⁄3 aquadest from the volume of the flask, then add aquadest to the mark and then shake until homogeneous.

Making 3% HCl solution

Pipette 20.2 mL of HCL p.a 37% into a 250 mL volumetric flask which already contains 2⁄3 aquadest from the volume of the flask, then add aquadest to the mark and then shake until homogeneous.

Making NaOH solution

Weigh 30 grams of NaOH into a beaker, then dissolve it with aquadest until dissolved, then put into a 100 mL volumetric flask, add aquadest to the limit line, then homogenize.

Making 30% KI solution

Weigh as much as 30 grams of KI put into a beaker glass, then dissolve with aquadest until dissolved, then put into a 100 mL volumetric flask, add aquadest to the limit line, then homogenize.

Making Na2S2O3 solution

Weigh as much as 12.41 grams of Na2S2O3, put it in a beaker then dissolve it with aquadest until dissolved, then put into a 500 mL measuring flask, add aquadest to the limit, then homogenize.

Making K2Cr2O7 solution

Weigh 0.49 grams of K2Cr2O7 put into a beaker, then dissolve with aquadest until dissolved, then put into a 100 mL volumetric flask, add aquadest to the limit line, then homogenize.

Determination of normality of Na2S2O3

Then pipette 10 mL of K2Cr2O7 solution into a 50 mL Erlenmayer. Add 15 mL of KI solution and 20 mL of 4N HCl solution. Then titrate with Na2S2O3 solution until the color changes to yellow. Then add 3-5 drops of 1% starch indicator. Titrate until the color changes to light blue. Then repeat 3 times

Blank testing using the Luff Schoorl method

Pipette 10 mL of distilled water, then put it in a beaker. Then add 25 mL of Luff Schoorl solution and boiling stones and add 25 mL of distilled water. Heat the mixture on a hot plate for 10 minutes and then cool it using running water. Add 15 mL of 30% KI solution and 25 mL of 25% H2SO4 solution, then the solution is transferred to Erlenmayer Titrate using sodium thiosulfate until the color changes to light yellow. Then add 2 mL of 1% starch indicator, then the color will

change to blue. Titrate again using sodium thiosulfate until the color changes to a cloudy white color.

Verification test

Weigh the pro-analysis glucose as much as 1 gram, then add 40 mL of 3% HCl solution. Then simmer for 1 hour in an upright cooler. Cool and neutralize with NaOH solution until it reaches pH 7, then put it into a 100 mL measuring flask and add aquadest to the mark, then filtered. After that, 10 mL of sample was pipetted, then added 25 mL of Luff Schoorl solution and boiling stone and added 15 mL of aquadest into the beaker. Then the mixture is heated on a hot plate. Heat for 10 minutes and then cooled with running water. Add 15 mL of 30% KI solution and 25 mL of 25% H2SO4 solution, then the solution is transferred to Erlenmayer. Titrate using sodium thiosulfate until light yellow. Then add 2 mL of 1% starch indicator, then the color will change to blue. Titrate again using sodium thiosulfate until it becomes a cloudy white color. Repeat 3 times

Sampling

Weigh the three samples as much as 1 gram, then add 40 mL of 3% HCl solution. Then boil for 1 hour in an upright cooler. Cool and neutralize with NaOH solution until it reaches pH 7. Then put it into a 100 mL volumetric flask and add aquadest to the mark, then filtered. After that, 10 mL of sample was pipetted, then added 25 mL of Luff Schoorl solution and boiling stone and added 15 mL of aquadest into the beaker. Then the mixture is heated with a hot plate. Heat for 10 minutes and then cooled with running water. Add 15 mL of 30% KI solution and 25 mL of 25% H2SO4 solution, then the solution is transferred to Erlenmayer. Titrate using sodium thiosulfate until light yellow color. Then add 2 mL of 1% starch indicator, then the color will change to blue. Titrate again using sodium thiosulfate until it becomes a cloudy white color. Repeat to three times

Result and Discussion

Table 1 : verification test

Replication	Volume	Rate	Average
1	19,2 mL	101,36 %	
2	19,3 mL	99,16 %	98,87%
3	19,5 mL	96,11 %	

Verification test was carried out using pro-analytical glucose which was replicated three times and the results were 98.87%.

Table 2 Sodium Thiosulfate Normality test

Replication	Volume	N	Average
1	10,5 mL	0,095 N	
2	10,1 mL	0,099 N	0,097 N
3	10,3 mL	0,097 N	

Table 3 Glucose Levels in Samples test

No	Samples	Glucose Level (%)	Average
1		89,12 %	
2	BRB	85,63 %	85,63 %
3		82,13 %	
1		82,13 %	
2	TPN	78,64 %	80,39 %
3		80,39 %	
1		73,40 %	
2	TBN	75,14 %	72,81 %
3		69,90 %	

The blank test that was carried out got the result that was 23 mL, then continued with testing the sample used. Each sample was replicated three times. In the sample with the BRB code the results were 85.63% and the sample with the TPN code obtained the results of 80.39% and the sample with the code obtained the results of 72.81%.

Tests carried out in this study is by means of iodometric titration. Iodometry is an indirect titration in which the analyzed oxidizing agent is then reacted with excess iodide ion under suitable conditions and titrated with a standard solution or acid. Iodometric titration belongs to the redox titration group which refers to the transfer of electrons (Samsuar et al., 2017).

The standard solution used in most iodometric processes is sodium thiosulfate. This salt is usually available as the pentahydrate Na2S2O3.5H2O. this solution should not be standardized by weighing directly, but must be standardized against the primary standard, in this study K2Cr2O7 was used as the primary standard because sodium thiosulfate solution was unstable for a long time (Samsuar et al., 2017).

Determination of glucose levels in cultivated kelulut honey was carried out using the Luff Schoorl method which is based on the process of reducing Cu2+ to Cu+ by the sugar contained in honey. Luff Schoorl solution contains Cu2+ ions. Reducing sugars such as glucose and fructose will reduce CuO to Cu2O. In testing carbohydrates with the Luff Schoorl method, the pH of the

solution must be carefully considered, because if the pH is too low (too acidic) it will cause the titration result to be higher than it actually is, due to the reaction of iodide ions to I2. If the pH is too high (too alkaline) then the titration result will be lower than it actually is, because at a high pH there will be a risk of error, namely an I2 reaction is formed with water (hydrolysis).

Storage time can also affect the level of reducing sugar (glucose) in kelulut honey. The longer the shelf life, the higher the glucose levels accompanied by a decrease in the levels. In addition, other factors that can affect glucose levels in kelulut honey are water content and harvest time. According to Ridoni et al (2020) stated that honey harvested in the rainy season has lower glucose levels than honey harvested in the dry season. In this study, samples of kelulut honey were used in the rainy season (Ridoni et al., 2020). This is due to the high humidity during the rain, thereby increasing the water content. The kelulut honey samples in this study were harvested in the rainy season so that it was the cause of the low glucose levels in the three kelulut honey samples used.

Storage area can also affect glucose levels in kelulut honey. Kelulut honey stored at cold temperatures has a low water content while kelulut honey stored at room temperature has a higher water content. This causes the glucose content at room temperature to be lower than at cold temperatures. The kelulut honey sample used in this study, the kelulut honey sample was stored at room temperature (Wulandari, 2017).

Results of Glucose Levels in Samples. The results obtained were then entered into the SPSS (*Statistical Package for the Social Sciences*) system using a simple linear regression method to determine the significance of the comparison of levels of each sample in different locations. Then the results obtained a significance value of 0.001 which means that this value indicates that there is an influence between the location and glucose levels so that the hypothesis of this study is accepted because Ha <0.05 with the meaning there is an effect.

Conclusion

This study can be concluded that the results of the relationship between glucose levels and the location of the sample obtained a significance value of 0.001 which means that there is an effect of the difference between glucose levels and the location of the sample or the hypothesis in this study is accepted. The results of the quantitative test using the luff school method showed that all samples contained glucose. The highest glucose level was in the BRB sample, which was 85.63%. Meanwhile, the lowest glucose level was in the TBN sample, which was 72.81%. Based

on the 2018 Indonesian National Standard (SNI) regarding honey quality, it stipulates that the glucose level in honey is at least 65%. Based on the results of the study of glucose levels in cultivated kelulut honey, the glucose content contained has met the established Indonesian National Standard (SNI).

Acknowledgement

The researcher would like to thank herself and all parties involved in this research. The researchers also express their gratitude to the Chemistry Laboratory of Sari Mulia University Banjarmasin which has provided facilities to support the implementation of this research.

References

Badan Standardisasi Nasional. (2018). Standar Nasional Indonesia SNI 8664:2018 Madu.

Masturoh, Imas dan Nauri Anggita T. 2018. Metodologi Penelitian Kesehatan Bahan Ajar Rekam Medis dan Informasi Kesehatan (RMIK). Kementerian Kesehatan Republik Indonesia.

Nanda, P. B., Radiati, L. E., & Rosyidi, D. (2015). *Perbedaan Kadar Air, Glukosa Dan Fruktosa Pada Madu Karet Dan Madu Sonokeling*.

Ridoni, R., Radam, R., & Fatriani. (2020). Analisis Kualitas Madu Kelulut (Trigona sp) dari Desa Mangkauk Kecamatan Pengaron Kabupaten Banjar. *Jurnal Sylva Scienteae*, *03*(2), 346–355.

Sakri, F. (2012). *madu dan khasiatnya, Suplemen Sehat tanpa Efek Samping* (D. P. Indonesia (ed.); cetakan 1).

Samsuar, S., Mariana, F., & Setyowati, M. (2017). Analisis Kadar Klorin (Cl2) Sebagai Pemutih Pada Rumput Laut (Eucheuma cottonii) Yang Beredar Di Lampung. *JFL : Jurnal Farmasi Lampung*, *6*(2), 13–22.

Sugiyono. (2016). Metode Penelitian Kuantitatif, Kualitatif dan R&D. Bandung: PT Alfabet.

Werang, L. L. (2019). *Aktifitas Madu Flores Terhadap Pertumbuhan Bakteri Staphylococcus aureus dan Pseudomonas aeruginosa secara In Vitro*. *53*(9).

Wulandari, D. D. (2017). Kualitas Madu (Keasaman, Kadar Air, Dan Kadar Gula Pereduksi) Berdasarkan Perbedaan Suhu Penyimpanan. *Jurnal Kimia Riset*, *2*(1), 16.