BIOACTIVITY OF SINBIOTICS PRODUCTS BASED ON BANGGAI SWEET POTATO (*Dioscorea* sp) AND SEAWEED (*Eucheuma cottonii*) CARAGENANCE

Nurhaeni1 [a) d)], Jusman [b)], Syamsuddin [c)]
Department of Chemistry, Faculty of Mathematics and Natural Sciences, Tadulako University, Palu, Indonesia

[a)] *eni_kimia64@yahoo.co.id*
[b)] *jusman_palu04@yahoo.com*
[c)] *syamsuddinpalu2023@gmail.com*
[d)] *Corresponding author: eni_kimia64@yahoo.co.id*

ABSTRACT. One of the local agricultural commodities of Central Sulawesi is Banggai sweet potato (*Dioscorea* sp) and seaweed (*Eucheuma cottonii*) which contain nutrients to support public health. This study aims to find a synbiotic drink formulation with the highest bioactivity and best sensory value based on Banggai sweet potato flour and seaweed carrageenan as prebiotics and *L. casei* as probiotics. This research is divided into three stages: the first stage is optimization of the ratio of Banggai sweet potato flour and carrageenan, the second stage is optimization of the addition of *L. casei* to the synbiotic drink formulation, the third stage is fermentation time. The test parameters carried out are: bioactivity test including total lactic acid bacteria (LAB) test using the Total Plate Count (TPC) method, antioxidant activity test (DPPH), total soluble solids (refractometry) and sensory tests including taste, aroma, and texture (Hedonic scoring). The results of the study based on the effect of the ratio between banggai yam and seaweed obtained the best ratio of 2: 1 (% w/b) with total LAB count of 2.03 x108 CFU/mL, total titratable acid of 0.56%, pH 4.16; antioxidant activity of 58.63%.

Keywords: synbiotic, banggai sweet potato, seaweed carragenance, bioactivity

1. INTRODUCTION

Awareness of the importance of a healthy lifestyle is the basis for the development of functional foods. Some local food plants in Central Sulawesi can be utilized to support public health. Banggai sweet potato (*Dioscorea* sp) and seaweed (*Eucheuma cottonii*) are local food sources that contain nutrients and are needed to support public health. Food diversification is needed to support national food security. One form of food diversification is the processing of plant-based food ingredients into synbiotic drinks that have functional properties and become food products with better economic and nutritional value (Tripathi and Giri, 2014).

Functional food development can be done using microorganisms in foods such as probiotics, which are live bacteria, one of which is Lactobacillus casei, which when consumed will have a positive effect on the body in maintaining the balance of bacteria in the digestive tract. The types of probiotic functional foods that have been developed are milk, yogurt, and their fermented preparations. In addition to probiotic foods, diversification of fermented products can be through the development of functional food products by integrating probiotics and prebiotics or prebiotic source foods into synbiotic products (Mani, et al, 2014; Dewi and Ayu, 2014). Banggai yam can be used as a raw material for making synbiotic drinks using Lactobacillus casei starter which has a beneficial effect on the body's health, increasing the body's immune response and inhibiting harmful enzymes. Lactobacillus sp. is the most common species of lactic acid bacteria used as probiotics for fermented dairy products (Boeni and Pourahmad, 2012; Zannini et al, 2016).

2. MATERIALS AND METHOD

Preparation of Banggai Sweet Potato and Seaweed

Banggai sweet potato was washed thoroughly then blanching by immersing in hot water at 80o C for 1 minute until the whole tuber is submerged in water, then peeling the skin. Blanching is done on intact tubers to avoid and reduce browning reactions. The next stage is slicing with a thickness of 1mm - 2 mm then the tubers are

Y. Yuyun et al. (eds.), *Proceedings of the 5th International Seminar on Science and Technology (ISST 2023)*, Advances in Physics Research 10,
https://doi.org/10.2991/978-94-6463-520-1_2

soaked in salt and sodium metabisulfite solution with 5% and 0.3% respectively for 2 hours, to reduce itching caused by the release of calcium oxalate crystals from inside the tuber cells. The use of sodium metabisulfite is to maintain the original color of the tubers and prevent the browning process before processing as well as eliminating the smell and taste of tartness. Tubers are arranged on drying racks in an organized manner to facilitate the drying process and dry tubers evenly. Then the dried tubers were crushed with a blender and sieved with 80 mesh size to produce fine flour. Banggai yam flour is added with water in the amount of 2 times the weight of banggai yam, and forms a slurry then filtered using a filter cloth and the next stage is the precipitation process. The precipitate was separated from the filtrate, and the banggai yam filtrate was used in the manufacture of synbiotic drinks.

Seaweed preparation, namely: seaweed samples are cleaned using clean water, then cut into small pieces, added with distilled water in a ratio of 1: 1 and blended then filtered, the filtrate obtained is used for making synbiotic drinks

Preparation of Synbiotic Drink

Banggai sweet potato filtrate and seaweed were mixed according to the treatment of ratio variation (v/v), namely: 1:1, 1:2, 2:1 then pasteurized at 80oC for 15 minutes. Next, skim milk and 4% glucose were added and cooled. After the filtrate temperature reached 40oC, the addition of Lactobacillus casei culture inoculum was carried out with a concentration variation of 0.5; 1.0, and 1.5% (v/v).The next stage was incubation at 37o C with variations in incubation time, namely: 3, 6, and 9 hours. The synbiotic drink products formed were analyzed for each test parameter

Synbiotic Product Testing

The stages of testing synbiotic products include: a) bioactivity testing, namely: total lactic acid bacteria (LAB) using the Total Plate Colony (TPC) method (Horackova et al., 2015)), resistance to low pH (Mawar et al., 2018) total soluble solids (AOAC, 2015), pH (using a pH meter), antioxidant activity testing using the DPPH method (Sayuti et al., 2015). (b) Sensory value testing includes taste, aroma, and texture using the Hedonic scoring method (Febriyanti and Yunita, 2018)). Each treatment variable was repeated three times, so the total number of experimental units was 81 units. The experimental design used a Randomized Complete Factorial Pattern (ALPF) design, the data from this study were then statistically analyzed using One Way ANOVA through the SPSS 17.0 program. If there is a difference, it is continued with Duncan Multiple Range Test (DMRT) at the 5% significance level

3. RESULTS AND DISCUSSION

The results of the analysis showed that the length of fermentation influenced the total lactic acid bacteria (LAB) of banggai sweet potato-seaweed synbiotic drink. The highest total LAB log was produced by the synbiotic drink fermented for 36 hours, which amounted to 1.24 x 109 CFU/mL (Figure 1). The increase in the number of bacterial cells at the fermentation time of 36 hours fermentation arena 0 to 36 hours, the cells are in the logarithmic phase, which is a phase where lactic acid bacteria divide rapidly and constantly follow a logarithmic curve. The logarithmic phase is a period of balanced growth or steady state with a constant specific growth rate (Judoamidjojo, et al., 1990). In the entire fermentation process, the chemical composition of the media changes because nutrients will be consumed and metabolites will be produced, so the environment is in a steady state. According to Caldwell (1994), cells will divide at a constant rate, cell mass increases and cell growth is in a balanced state in the logarithmic growth phase. Then the decline in the number of microbial populations can be caused by the exhaustion of nutrients in the media and the energy reserves in the cells have been exhausted. In addition, the results of microbial metabolism itself may be toxic, so it can be the cause of cell death. According to Caldwell (1994), the number of cells that die is more so that there is a decrease in the number of microbial populations. This shows that the longer the fermentation time, the higher the amount of Lactobacillus casei. According to Magala et al. (2013), the longer the fermentation time, the more pyruvic acid, acetic acid and lactic acid produced by lactic acid bacteria.

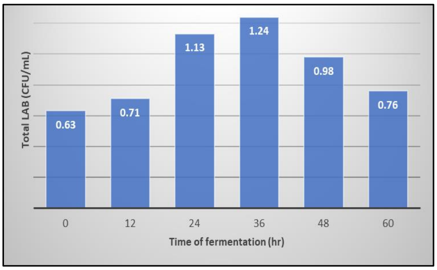

Figure 1. Effect of Fermentation Time on Total LAB Count of Synbiotic Drinks

The results showed that the length of fermentation had a very significant effect on the total acid of green grass jelly leaf extract synbiotic drink. The synbiotic drink fermented for 60 hours produced the highest total acid value, which was 0.42%. (Figure 2). The total acid calculated in this synbiotic drink is mostly lactic acid and a small portion is short-chain fatty acids such as acetic, propionic, and butyric acids. Sreeramulu et al. (2000) stated that during the fermentation process, glucose and fructose are broken down by bacteria which then produce organic acids which will increase along with the longer fermentation time

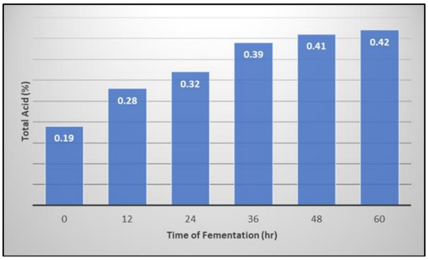

Figure 2. Effect of fermentation time on total acid content of synbiotic beverage

Total phenol during cooking can occur in two ways, namely dissolved in the processing liquid and through the oxidation process (Pratt, 1992). The higher the temperature and the longer the processing process can cause the phenol content to decrease. According to McQue and Shetty (2005), the decrease in phenolic compounds due to the process of degradation of phenolic structures by microbes as a form of detoxification strategy by antimicrobials, the results of total phenol analysis can be seen in (Figure 3).

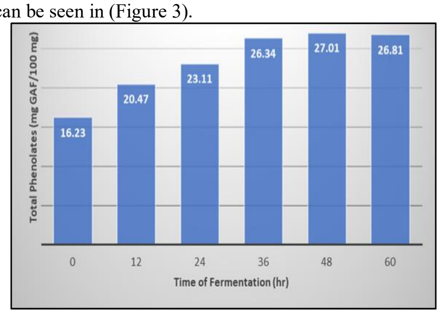

Figure 3. Effect of fermentation time on total phenolics content of synbiotic drink

The results (Figure 4) show that during fermentation there was an increase in antioxidant activity in the synbiotic drink which was originally 61.07% and then increased to 74.82% in the synbiotic drink with 12 hours fermentation time treatment and further increased in the 60 hours fermentation time treatment. The increase in antioxidant activity is due to antioxidant compounds that are more stable in acidic conditions formed during the fermentation process. According to Yu and Van (2005), lactic acid in yogurt contains α-hydroxi acids (AHA) which have antioxidant properties, so that the antioxidant activity influenced by lactic acid from probiotics acts as a hydrogen atom donor for atoms that have unpaired electrons in their outer orbit (free radicals).

4. CONCLUSIONS

Bioactivity test including total lactic acid bacteria (LAB) test using the Total Plate Count (TPC) method, antioxidant activity test, total soluble solids. The results of the study based on the effect of the ratio between banggai sweet potato and seaweed obtained the best ratio of 2: 1 (% w/b) and fermentation time at 60 hours with total LAB count of 2.03 x108 CFU/mL, total acid of 0.56%; pH 4.16; antioxidant activity of 58.63%.

REFERENCES

AOAC., 2019. Official Methods of Analysis Association of Official Analytical Chemists 21st edition. Benjamin Franklin Station, Washington DC. 1500 pp.

Boeni, S. dan Pourahmad, R. 2012. Use of Inulin and Probiotic Lactobacilli in Synbiotic Yogurt Production. Annals of Biological Research 3(7): 3486-3491

Caldwell, D.R. 1994. Microbial Physiology and Metabolism. Wm.C. Brown Publishers

Dewi, D., dan Ayu., L. N. P., 2014. Formulasi Minuman Sinbiotik dengan Penambahan Puree Pisang Ambon (*Musa paradisiaca var sapientum*) dan Inulin Menggunakan Inokulum *Lactobacillus casei*. Agritech (34): 259–263

Horackova, S., Muhlhansova, A., Slukova, M., Schulzova, V., and Plockova, M., 2015. Fermentation of Soymilk by Yoghurt and *Bifidobacteria* Strains. Czechnia Journal Food Science (33): 313–319

Judoamidjojo, M., A.A. Darwis, dan E.G Sa'id. 1990. Teknologi Fermentasi. Rajawali Pers. Jakarta

Magala, M., Kohajdová, Z. dan Karovicová, J. 2013. Preparation of Lactic Acid Bacteria Fermented WheatYoghurt Mixtures. Acta. Sci. Pol., Technol. Aliment. 12(3):295-302.

Mani-López, E., Palou, E., and López-Malo, A., 2014. Probiotic Viability and Storage Stability of Yogurts and Fermented Milks Prepared with Several Mixtures of Lactic Acid Bacteria. Journal of Dairy Science (97): 2578–2590

Mawar L.A., Aini, N., Wijonarko, G. 2018. Formulasi Minuman Sinbiotik dari Susu dan Ubi Jalar Menggunakan Lactobacillus casei. Jurnal IJITIPARI (5):74-84

Pratt, D.E. 1992. Natural Antioxidant from Plant Material. Am. Chem. Society, Washinton DC.

Sayuti, I. ., Wulandari, D., dan Sari, S., 2013 Efektivitas Penambahan Ekstrak Ubi Jalar Ungu (*Ipomoea batatas var. Ayamurasaki*) dan Susu Skim Terhadap Kadar Asam Laktat dan pH Yoghurt Jagung Manis (*Zea mays L. Saccharata*) Dengan Menggunakan Inokulum *Lactobacillus acidophilus* dan *Bifidobacterium* sp. Jurnal Biogenesis (9): 21–27.

Sreeramulu, G., Zhu, Y. dan Knol, W. 2000. Kombucha Fermentaion and It's Antimicrobial Activity. Journal of Agricultural Food Chemistry. 48(6):2589-2594.

Tripathi, M. K., and Giri, S. K., 2014. Probiotic Functional Foods: Survival of Probiotics During Processing and Storage. Journal of Functional Foods (9): 225–241

Yu, R.J. and Van-Scott, E.J. 2005. α-hydoxyacids, Polyhydroxy Acids, Aldobionic Acids and Their Topical Actions.In : Baran, R., Maibach, H.I., Taylor and Francis, editors. Textbook of Cosmetic Dermatology. Third Ed. Boca Raton Taylor and Francis, USA.

Zannini, E., Waters, D. M., Coffey, A., and Arendt, E. K., 2016. Production, Properties, and Industrial Food Application of Lactic acid Bacteria-Derived Exopolysaccharides. Applied Microbiology and Biotechnology (100): 1121–1135