Journal of Agroscience Indonesia

Volume 1 Number 1 May 2023 page 11 - 16

Journal homepage: https://ojs.unm.ac.id/journalagroscience

Analysis of Value Added Comparison of Characteristics of Millet Flour (*Setaria italica*) of Selayar and Enrekang Local Varieties

Nur Rahmah[1,*], Annisa Aulia Ramadhani Hidayat[2]

[1] *Agricultural Technology Education, Faculty of Engineering, Makassar State University*
[2] *Food Science and Technology, Faculty of Agriculture, Hasanuddin University*
**e-mail of corresponding author: nur.rahmah@unm.ac.id*

ARTICLE INFO

Article History:
Available online 05 June 2023

Keywords:
added value, Enrekang millet, flour, Selayar millet

ABSTRACT

Food diversification by utilizing millet flour (*Setaria italica*) will provide added value that can significantly increase the economic value of various types of food made from millet flour. Therefore this research was conducted to compare the characteristics of the local varieties of Selayar and Enrekang millet flour and to calculate the added value ratio of millet flour. The research method is proximate testing including moisture content, protein content, and ash content; and value added analysis. The results showed that there were characteristic differences between the local varieties of Selayar and Enrekang millet flour. The results of the Selayar local variety millet flour test: Enrekang were 5.04% : 4.85% moisture content; protein content 17.31% : 15.42%; and ash content 10.37 : 8.94%; and the analysis results of added value of millet flour amounting to Rp.32,358/kg of raw material. The conclusion from the research results is that the Selayar variety millet flour has superior nutritional value, namely protein, moisture content, and ash content compared to Enrekang variety barley flour; and millet flour processing has a large added value of zero (32,358)> 0) so that it provides positive added value.

INTRODUCTION

Millet (*Setaria italica*) is better known as bird feed, but it is also cultivated to meet the food needs of the Indonesian people before finally consuming rice as a staple food. Several regions in Indonesia use millet as a raw material in making traditional food to meet consumer demand for traditional food. Along with developments in the field of agricultural cultivation, the level of crop production has increased significantly so that in the current market there is sufficient availability of food and processed products that vary in both type and quality, while on the other hand, the level of consumer knowledge about the importance of the quality of food consumed makes consumers more selective in choosing the type of food, as well as the decision in consuming the type of food made from millet flour. The existence of millet is still very much needed to fulfill the food needs of the people in several areas which are the basis of millet cultivation.

Selayar and Enrekang districts are areas in South Sulawesi which are still cultivating millet, although it is not widely planted. Millet is used as a raw material for traditional food and a food source that has high nutrition, especially protein which is much needed, for example in cases of stunting. Millet is a commodity that has a high carbohydrate content, antioxidant activity, is rich in vitamins and minerals, and has a high dietary fiber content. Processing barley into flour will provide better nutritional benefits and longer shelf life as well as facilitate food diversification.

https://doi.org/10.26858/jai.v1i1.46938

The characteristics of millet flour will be influenced by local varieties where millet is cultivated. Millet as an alternative food source has nutritional value that is not inferior to some other cereal crops and has the potential to be developed because it has high nutritional value, excellent growth ability and can tolerate dry climate conditions making this plant have a great opportunity to be developed into a commodity national food. This plant can be processed into a food source by the community to support food security and anticipate hunger problems. This is in line with Wahyuni et al. (2021) who said that the use of alternative food sources other than rice must be carried out as an effort to diversify food sources.

Millet flour has the potential to be used as a food source that contains nutrients that are expected to be able to meet the needs of human life. The more nutrient content, the better it is used as a food source. According to Puspawati (2009) millet contains about 75% carbohydrates, 11% protein is also rich in vitamins and minerals such as niacin, pyridoxine and folacin. In addition, millet also contains antioxidants, bioactive compounds and high fiber so it has the potential to be a functional food (Pakhri et al., 2017). Furthermore, Rukmi et al. (2015) explained that the high fiber content of millet such as hemicellulose, cellulose, phenolic esters and glycoproteins also contains soluble dietary fiber including glucan and pectin. Barley flour is rich in fiber so it functions to expedite the body's metabolic processes, therefore it is very much needed for people who are on a diet program. The same thing was stated by Salimi et al. (2011), dietary fiber β-glucan is an important component found in sorghum and millet which will have a positive effect on health such as antihypercholesterol, antiradiation, anti-inflammatory and antidiabetic. The phenolic content in millet is useful for anti-tumerogenic, antioxidant and antimicrobial properties (Chandra et al., 2016). Another benefit is that millet has the potential to be developed as a flour substitute because in addition to having a high carbohydrate content it also contains gluten protein (BPTP Balitbangtan, 2016).

Millet processing for food in the form of rice or seeds or flour is relatively easy and cheaper. Millet seeds are milled, then roasted to make cake ingredients or finely ground as flour as raw material in making various alternative foods. The various functions and benefits of millet flour can increase the demand for millet flour products which in turn will affect the added value and selling value of millet flour. Based on these description, this research was conducted to compare the characteristics of the local varieties of Selayar and Enrekang millet flour and to calculate the added value ratio.

MATERIALS AND METHODS

The manufacture of millet flour refers to Ningrum et al. (2017) and Atmaja & Sari (2017). Barley seeds used in this study were obtained from Enrekang and Selayar Islands Regencies.Each of the 2000 grams of sorted millet seeds was soaked in 2000 ml of water for 4 hours at room temperature. The soaked millet seeds are then washed using running water and drained. Furthermore, the millet seeds were dried for 5 hours using a cabinet dryer at 60°C. After that, the millet seeds were crushed using a blender and sieved with a size of 70 mesh.

Analysis of Moisture Content (SNI 01-2891-1992)

Porcelain dish is heated in the oven at 105° C for 30 minutes, cooled in desiccator for 15 minutes and then weighed. A total of 2 grams of each sample was put in porcelain dish of known weight, dried in oven at 105°C for 3 hours, then cooled for 15-30 minutes in desiccator. Furthermore, the porcelain dish that contains the sample was weighed and heated in oven for 1 hour, cooled in desiccator for 15-30 minutes, and weighed again.

Analysis of Protein Content

Testing the protein content of millet flour based on the principle and formol titration. The test was carried out by first preparing a blank solution by adding 0.4 ml of saturated K-oxalate to 20 ml of distilled water, 3 drops of phenolphthalein indicator, and 2 ml of 40% formaldehyde into Erlenmeyer. After that, the blank solution was titrated with 0.1 N NaOH until the color changed to pink. The titration of the sample solution is carried out by weighing 10 grams of sample and dissolving it with 100 ml of distilled water in a volumetric flask, then homogenizing. Pipette 10 ml of sample solution and dissolve it with 20 ml of distilled water in Erlenmeyer, then add 0.4 ml of K-oxalate (1:3 v/v) and 3 drops of phenolphthalein indicator. The solution was mixed and left for 20 minutes. Then the sample solution was titrated with 0,1N NaOH to pink. After titration, the sample was

added with 20 ml of 40% formaldehyde and 3 drops of phenolphthalein indicator, then titrated again using 0.1N NaOH until it turns pink.

Analysis of Ash Content (SNI 01-2891-1992)

Porcelain dish is heated in furnace at 550° C for 30 minutes, cooled in desiccator for 30 minutes and then weighed. A total of 2 grams of each sample was put in porcelain dish of known weight and dried in furnace at 550°C for 30 minutes. Furthermore, the porcelain dish that contain the sample was cooled for 30 minutes in desiccator, then the final weight was weighed.

RESULTS AND DISCUSSION

Moisture Content

Moisture content is the amount of water contained in a food ingredient expressed in units of percent. Moisture content is also a factor in identifying one of the functional characteristics of flour, namely the water absorption capacity which affects the solubility and swelling power of flour (Yonata et al., 2021). The results of testing the water content of millet flour can be seen in Figure 1.

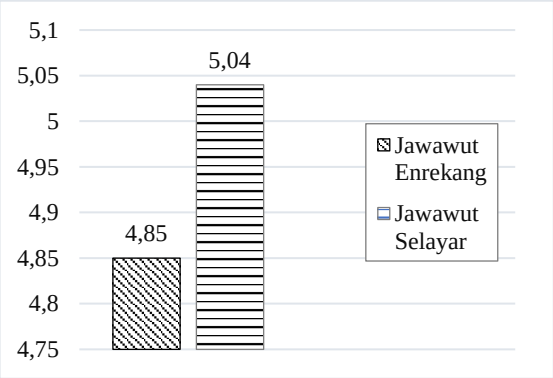

Figure 1. Moisture Content of Millet Flour of Enrekang and Selayar Varieties

Based on Figure 01, Enrekang millet has a moisture content of 4.85% and Selayar millet has a moisture content of 5.04%. Relevant research by Mane et al. (2022) also obtained a water content of millet flour of 8.65%. The percentage value of the water content of the two flours was not significantly different. The percentage of different water content of the two flours is influenced by millet varieties. Santos et al. (2016) stated that the variety and location of planting millet plants will result in a different percentage of chemical composition, such as water content. Millet grown in the Enrekang is Proso Millet (*Panicum sp.*) and Foxtail millet (*Setaria italica*) is planted in the Selayar. Proso millet has a characteristic round to oval shape with a length of 3 mm and a diameter of 2 mm; creamy white, yellow, red or black; contains ±28% amylose and ±72% amylopectin; starch granule size ±8µm; resistant to cold temperatures; and so on (Mathanghi et al., 2020; Pandarinathan & Geethanjali, 2023). Foxtail millet has a slightly oval shape with a length of 1.5-2 mm and a width of 1-1.5 mm; cream, brownish cream, or brick red; contains ±18% amylose and ±82% amylopectin; starch granules measuring ±12µm; resistant to high temperatures; and so on (Ramlah et al., 2020; Pandarinathan & Geethanjali, 2023). Amylose and the size of starch granules in millet play an important role in determining the percentage of water content. The Selayar variety millet has larger starch granules and a higher amylose content than the Enrekang variety. Starch with a large granule size has a high ability to absorb water. The high amylose content increases the ability to absorb water because amylose has hydrophilic properties with the content of hydroxyl groups (OH) in the polymer. So that the more amylose content in starch, the greater the water absorption. This is in accordance with Widjanarko & Suwasito (2014), that several factors can affect the moisture content of flour, including starch granule size, amylose content, flour fineness level, grinding speed and duration, flour shelf life, temperature, and additives contained in the flour. The water content value of millet flour of the Enrekang and Selayar varieties has complied with the SNI requirements based on the quality standard of wheat flour in SNI 3751-2009 (2009) which states that the maximum water content value of wheat flour is 14.5% per 100 g. According to Maulani et al. (2019), flour with a water content of 10-14% is safe enough to prevent mold growth which can reduce flour quality.

Protein Content

Protein is a group of macronutrients that play a role in the process of forming enzymes

and hormones that can regulate metabolic processes in the body, and as antibodies. The quantity of protein in food can be determined from the protein content (Satpathy, 2020). The results of testing the protein content of millet flour can be seen in Figure 2.

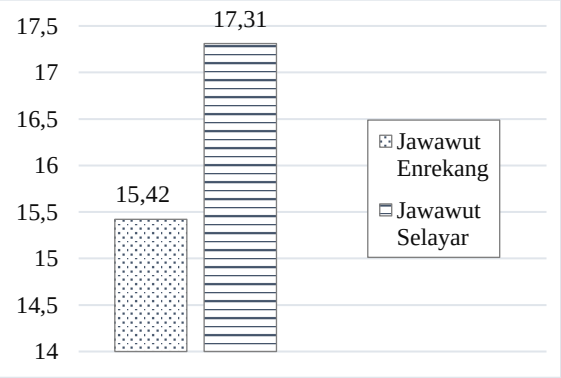

Figure 2. Protein Content of Millet Flour of Enrekang and Selayar Varieties

Based on Figure 2, Enrekang millet has a protein content of 15.42% and Selayar millet has a protein content of 17.31%. Relevant research by Mane et al. (2022) obtained a protein content of millet flour of 12.29%. The percentage value of the protein content of the two flours was not significantly different. The insignificant difference in value produced between the two flours was not affected by the drying method, in this case drying with a cabinet dryer; but by the growing environment and the age of the millet harvest. The millet samples used came from the Enrekang and Selayar areas with different harvesting ages. The millet planted in the Enrekang area is the Proso millet type which is harvested after 60-75 days and the millet planted in the Selayar area is the Foxtail millet type which is harvested after 75-90 days (Singode et al., 2023; Hariprasanna, 2023). According to Haryani et al. (2018), the crude protein content will decrease as the harvesting age of the plant increases. This is because a long harvest time will reduce the digestibility of plants, so that the length of fiber, holocellulose, and alpha-cellulose increases while the crude protein content decreases. In addition, the protein content of most cereal-based flours is influenced by climate, soil fertility, fertilization, crop cultivation, genetic modification, and storage conditions (Jamal et al., 2016; Stone et al., 2019).

Ash Content

Ash content is the amount of minerals in a food, which is dominated by inorganic components, such as potassium, calcium and sodium. Determination of the ash content of foodstuffs occurs through the process of evaporation of water, volatile compounds, and combustion of organic compounds at 500-600°C (Afify et al., 2017). The results of testing the ash content of millet flour can be seen in Figure 3.

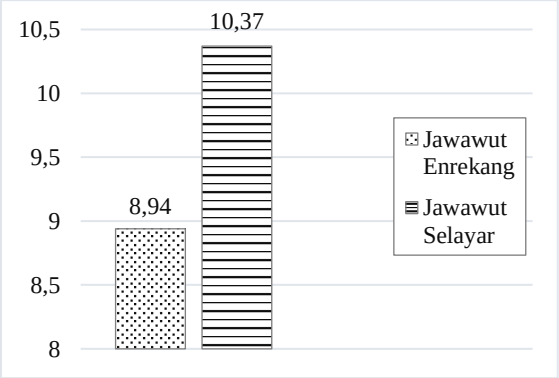

Figure 3. Millet Flour Ash Content Of Enrekang And Selayar Varieties

Based on Figure 3, Enrekang millet has an ash content of 8.94% and Selayar millet has an ash content of 10.37%. Relevant research by Mane et al. (2022) obtained an ash content of millet flour of 2.42%. The percentage value of the ash content of the two flours was not significantly different. The insignificant difference in value produced between the two flours was also not affected by the drying method, in this case drying with a cabinet dryer; but by the mineral content of the millet plant which is also strongly influenced by the minerals contained in the soil where it grows. Minerals in the soil will be absorbed by plants which then these minerals will be stored in several parts of the plant. Minerals are the main constituents of soil which are the result of physical and chemical weathering of the soil parent material, namely rocks which play a very important role as an indicator of the availability of nutrients in the soil. Mineral absorption from the soil can occur

because some plants have phytoextraction properties (Hasbullah and Umiyati, 2017; Rohmah et al., 2021). Millet is one of the plants that has phyto-extraction properties so that an increase in ash content in millet processed products will occur along with an increase in minerals in millet plants. The ash content value of millet flour of the Enrekang and Selayar varieties has met the SNI requirements based on the quality standard of wheat flour in SNI 3751-2009 (2009) which states that the maximum value of the ash content of wheat flour is 0.7% per 100 g.

Added Value of Millet Flour

Added value is an increase in the quality of a product due to better processing treatment. The flow of added value increases occurs in every production activity starting from the procurement of raw millet materials to the final consumer. Analysis of the added value of millet flour processing can show an increase in the economic value of millet flour.

Illustration of the profit obtained from the processing of one kilogram of millet flour is IDR 7,569. This value is net added value because it has been deducted by direct labor benefits. The profit level of millet flour processing is 17%. The profit rate is calculated by subtracting the output value from the price of raw materials. Remuneration for factors of production other than the main raw materials is shown through the margin obtained by subtracting the value of output with the price of raw materials. In the process of processing the raw material input of millet flour requires additional inputs besides raw materials and labor. The profit margin earned is IDR 45,600. The amount of the margin will be distributed to the factors of production consisting of 7% of labor income, 76% for contributions of other inputs and 17% for profits.

Calculations using the hayami method can be seen that the conversion factor in millet flour processing is quite high causing the value added ratio obtained to be 6%. From the processing of millet flour, an added value of Rp.32,358 was obtained, which means that the analysis of the added value of processing millet flour from zero (32,358) > 0) is positive and the utilization of millet flour provides added value so that this business is declared feasible to be established.

CONCLUSION

Millet flour of the Selayar variety has superior nutritional value, namely protein, moisture content, and ash content compared to millet flour of the Enrekang variety. Analysis of the added value of the millet flour processing business plan obtained an added value of IDR 32,358/kg of raw material. That is, a large added value of zero (32.358)> 0) means that millet flour processing provides added (positive) value.

REFERENCES

Afify, A. S., Abdalla, A. A., Elsayed, A., Gamuhay, B., Abu-Khadra, A. S., Hassan, M., Athalla, M., & Mohamed, A. (2017). Survey on the Moisture and Ash Contents in Agricultural Commodities in Al-Rass Governorate, Saudi Arabia in 2017. *Assiut J. Agric. Sci.*, 48(6), 55-62.

Atmaja, R. P., & Sari, R. Y. (2017). Pembuatan Tepung Millet Terfermentasi dan Pemanfaatannya dalam Produk Mie Kering. *Jurnal Teknologi Hasil Pertanian*, *10*(2), 115-122.

BPTP Balitbangtan. 2017. Potensi Dan Teknologi Budidaya Tanaman Jewawut (*Setaria Italica)* di Sulawesi Barat.

Chandra D, Chandra S, and Sharma, P. A. K. (2016). Review of Finger Millet (*Eleusine coracana* (L.) Gaertn): A Power House of Health Benefiting. *Food Science and Human Wellness*, 5(3), 149-155.

Hariprasanna, K. (2023). Foxtail Millet: Nutritional Importance and Cultivation Aspects. *Indian Farming*, 73(1), 47-49.

Hasbullah, U. H. A. A., & Umiyati, R. (2017). Perbedaan sifat fisik, kimia dan sensoris tepung umbi suweg (Amorphophallus campamulatus BI) pada fase dorman dan vegetatif. *PLANTA TROPIKA: Jurnal Agrosains (Journal of Agro Science)*, *5*(2), 70-78.

Jamal, S., Qazi, I. M., & Ahmed, I. (2016). Comparative Studies on Flour Proximate Compositions and Functional Properties of Selected Pakistani Rice Varieties. Proceedings of the Pakistan Academy of Sciences: Pakistan Academy of Sciences B. *Life and Environmental Sciences*, 53(1), 47–56.

Mane, R. P., Kshirsgar, R. B., Patil, B.M., Agarkar, B.S., & Katke, S. D. (2022). Physicochemical, Functional and Nutritional Properties of Millet Grains. *The Pharma Innovation Journal*, 11(11), 1596-1600.

Maulani, T. R., Utami, R., & Mulyanah, A. (2019). Pengembangan produk makaroni dari tepung talas beneng dengan penambahan daun kelor (Moringa oleifera L). *Gorontalo Agriculture Technology Journal*, *2*(2), 69-78.

Pakhri, A., Yani, N., Mas'ud, H., & Sirajuddin. (2017). Cookies Dengan Subtitusi Tepung Jewawut. *Media Gizi Pangan*, 24(2), 21-27.

Pandarinathan, S., & Geethanjali, S. (2023). Profiling of Nutritional and Anti-nutritional Factors in Selected Minor Millets. *Biological Forum-An International Journal*, 15(3), 524-529.

Puspawati, G. A. (2009). Kajian Aktivitas Proliferasi Limfosit dan Kapasitas Antioksidan Sorgum (*Sorghum Bicolor* L Moench) dan Jewawut (*Pennisetum sp*) Pada Tikus Sprague Dawley. *Tesis*. Institut Pertanian Bogor.

Ramlah., Pabendon, MB, & Daryono, BS (2020). Local Food Diversification of Foxtail millet (*Setaria italica*) Cultivars In West Sulawesi, Indonesia: A Case Study Of Diversity and Local Culture. *Biodiversity*, 21(1), 67-73.

Rohmah, M., Saragih, B., Amaliah, N., Kristopal, K., Putra, YHE, & Rahmadi, A. (2021). Determination of Moisture, Ash, Protein, Polyphenolic, Flavonoids, and Amino Acid Contents and Antioxidant Capacity of Dried Mekai (*Pycnarrhena tumefacta* Miers) Leaf as Potential Herbal Flavor Enhancers. *Biological Sciences Research*, 17, 149-158.

Laksito Rukmi, D., Legowo, A. M., & Dwiloka, B. (2015). Total Polifenol dan Aktivitas Antioksidan Yoghurt dengan Penambahan Tepung Jewawut. *Jurnal Pengembangan Penyuluhan Pertanian*, *11*(22), 10-18.

Salimi, Y.K., Zakaria, F.R., Bambang P. P,, & Widowati, S. (2011). Pengaruh Penyosohan Serealia Sorgum dan Jewawut Terhadap Kandungan Gizi, Ekstrak Serat *β*-Glukan dan Aktivitas Proliferasi Sel Limfosit. *Journal of Saintek*, 6(3), 230-237.

Santosa, I., Winata, A. P., & Sulistiawati, E. (2016). Kajian sifat kimia dan uji sensori tepung ubi jalar putih hasil pengeringan cara sangrai. *Chemica*, 3(2), 55-60.

Satpathy, L. (2020). Quantitation Of Total Protein Content In Some Common Edible Food Sources By Lowry Protein Assay. *Applied Nanobioscience*, 9(3), 1275–1283.

Singode, A., Chapke, RR, Sangappa., Domathoti, B., Padmaja, PG, Bhat, VB, Malathi VM, Venkateswarlu, R., Dheeravathu SN, & Ratnavathi, CV (2023). Proso Millet: Importance and Cultivation. *Indian Farming*, 73(1), 110-111.

Standarisasi Nasional Indonesia (SNI). (1992). *SNI 01-2891-1992 Cara Uji Makanan dan Minuman*. Badan Standardisasi Nasional. Jakarta.

Standarisasi Nasional Indonesia (SNI). (1992). *SNI 3751: 2009 Tepung Terigu sebagai Bahan Makanan*. Badan Standardisasi Nasional. Jakarta.

Stone, A. K., Nosworthy, M. G., Chiremba, C., House, J. D., & Nickerson, M. T. (2019). A comparative study of the functionality and protein quality of a variety of legume and cereal flours. *Cereal Chemistry*, *96*(6), 1159-1169.

Ningrum, A. S., Rahmawati, & Aqil, M. (2017). Karakteristik Tepung Jewawut (*Foxtail Millet*) Varietas Lokal Majene Dengan Perlakuan Perendaman *Jurnal Penelitian Pascapanen Pertanian*, 14(1), 11-21.

Wahyuni, P., Saidi, D., Iriani, D., & Astuti, B. (2021). *Karangtalun Wukirsari Imogiri Bantul Yogyakarta Sebagai Sentra Pengembangan Burung Perkutut*. LPPM UPN "Veteran" Yogyakarta. Yogyakarta.

Widjanarko, SB, & Suwasito, TS (2014). Pengaruh Lama Penggilingan Dengan Metode Ball Mill Terhadap Rendemen dan Kemampuan Hidrasi Tepung Porang (*Amorphophallus muelleri* Blume) [IN PRESS JANUARI 2014] *Jurnal Pangan dan Agroindustri*, 2(1), 79-85.

Yonata, D., Pranata, B., & Nurhidajah. (2022). Pengaruh Waktu Fermentasi terhadap Serat Pangan dan Daya Cerna Protein Tepung Jewawut (Setaria italica) Menggunakan Ekstrak Kubis Terfermentasi. *Jurnal Warta Industri Hasil Pertanian*, 39(1), 1-8.