

Proximate Analysis of Donuts Substituted with Corn Cob Flour (*Zea mays*)

Sufrotun Khasanah^{1✉}, Mahfud Nugroho², Fitria Yuni Astuti³

¹ Industrial Engineering, Engineering Faculty, Universitas Selamat Sri, Indonesia

^{2,3} Manajemen, Faculty of Economics and Business, Universitas Selamat Sri, Indonesia

✉ **Corresponding Author** : Sufrotun Khasanah (e-mail: sufrotun.kimia@gmail.com)

Article Information	ABSTRACT
Article History Received : December 12, 2024 Revised : December 30, 2024 Published : January 10, 2025 Keywords : <i>Corn cob flour;</i> <i>Donuts;</i> <i>Proximate analysis.</i>	Corn cobs are agricultural waste that contain nutrients that are good for humans. Corn cobs have high crude fiber, so they are good for health and safe to consume. One of them that can be used as a processed food product is donuts. Wheat flour is the raw material for making donuts, which is imported from various countries. Therefore, the use of wheat flour must be reduced by focusing on components that are abundant in Indonesia and have high nutritional content. The aim of this research is to analyze nearby donuts produced from wheat flour substituted for corn cob flour. Donuts were made with varying concentrations of 5%, 10%, and 15% corncob flour addition. The parameters tested in proximate analysis are water content, ash content, protein, fat, and carbohydrates. The research results showed that the values of water content, ash content, protein, and fat tended to increase along with increasing the number of corn cobs in the donut formulation. Meanwhile, the carbohydrate content decreases with increasing corncob flour. This donut proximate analysis is in accordance with SNI 01-2000 standards. Donuts made with a higher percentage of corncob flour will be tastier.

INTRODUCTION

Indonesia is an agricultural country that has abundant agricultural products of superior quality. One agricultural product that is very familiar is corn. In Indonesia, corn is the biggest staple food after rice. The Central Statistics Agency notes that total corn production from 2020 to 2023 tends to increase. In 2020 national corn production reached 12.93 tons. In 2021 it rose 3.76% to 13.41 tons. In 2022 there will also be a very significant increase, namely 23.20%, or the equivalent of 3.11 tonnes to 16.59 tonnes. Meanwhile, in 2023 there will be a decrease of 12.50% to 14.46 tons (BPS, 2023). The benefits of corn are very diverse, starting from the stems, leaves, skin, seeds, and cobs. The stems and leaves contain good nutrition, so they are often used as animal feed; corn husks are usually used as craft materials, the seeds are used as food for humans and animals, and corn cobs are high in fiber, so they are not good to eat. Animal feed, so that corn cobs only become waste that is not used.

Corn cobs are agricultural waste that has good nutrition for humans. This corn cob has high crude fiber, so it is good for health and safe to consume (Wardhani et al., 2024). Because of its nutritional content, corn cobs have the potential to be used as processed food. Nutritious food innovations from corn cobs are not yet widely available on the market. This is certainly a potential that must be developed, considering that corn cobs can be processed into flour as a food ingredient, namely donuts. Corncob flour has a water content of 14.32%, an ash content of 0.075%, and a

protein content of 17.49% (Mirnawati & Afdaliah, 2021). Processing corn cobs into flour for human use can increase the economic value of donuts while reducing corn cob waste (Mahardhika & Dewi, 2014).

Donuts are one of the popular snack foods in Indonesia that children like and are often found in elementary school canteens (Ningtyas et al., 2019). Generally, donuts have a distinctive shape, namely a flat round shape and a hole in the middle like a ring. Donuts are made from fermented bread dough and fried, usually donuts sprinkled with sugar or something else (Anggraini & Kristiatuti, 2015). Currently, the types of donuts are very diverse, from large donuts to small donuts, and there are various donut flavors (Setianingsih & Nurhadi, 2016). Donuts are often made with wheat flour, which has a high protein content and consists of gliadin and glutenin, which combine to produce gluten and give the donut its elastic quality (Nurcahyo et al., 2014). Protein (7.5%–15%), ash (0.30%–1%), fat (1%–1.5%), and carbohydrates (68%–76%) in the form of starch constitute the nutritional composition of wheat flour (Eugene & Asmoro, 2022). Imports of wheat flour from America, Canada, and Europe amounted to 775 thousand tons. To limit the use of wheat flour, look for components that are abundant in Indonesia and have good nutritional value (Anggraini & Kristiatuti, 2015). The aim of this research is to determine the characteristics of the proximate content of donuts with the substitution of corncob flour so that they are safe and can be consumed by the public and can reduce corncob waste.

RESEARCH METHODS

This research was carried out in September 2024. Making corn cob flour, making donuts, and proximate testing at the Chemistry Laboratory at Semarang State University. This research was designed using an experimental method with several variations in the addition of corn cob flour.

The ingredients used in this research were wheat flour, corn cob flour, instant yeast, granulated sugar, powdered milk, margarine, eggs, water, salt, and cooking oil. The tools used in this research were flour sifters, analytical scales, measuring cups, basins, bowls, pans, frying pans, plates, trays, spoons, and knives.

Making Corn Cob Flour

Making corn cob flour begins by finding corn cobs, then cutting them into small pieces with a knife, then washing them clean, and then draining them. After that, it is dried using a 1000C oven for 6 hours until the corn cobs are completely dry, then ground using a blender. The grinding results are then sieved. Corn cob flour that passes through the sieve is packed in plastic bags.

Making Donuts from Corn Cob Flour

After the corn kernel flour has been successfully made, the flour is then used as a basic ingredient for making donuts. Corncob flour is then used as a substitute for wheat flour with a ratio of wheat flour and corncob flour (95%:5%), (90%:10%), and (85%:15%). Mix wheat flour and corn cob flour according to the ratio above, granulated sugar, instant yeast, powdered milk, eggs, water, salt, and margarine, and stir until the dough is smooth and smooth. Then let it rest for 15 minutes, flatten the dough until each weighs about 15 grams, then round it into a donut shape. After that, place the dough on a tray sprinkled with flour and let it rest for 45 minutes until the dough rises. Then fry the mixture and drain it. After the mixture has cooled, smear it with butter and sprinkle it with chocolate sprinkles.

Proximate Analysis

Donuts with a ratio of 5%, 10%, and 15% were then subjected to proximate analysis, including water content, ash content, protein, fat (AOAC, 1990), and carbohydrates (Musita, 2019) (Winarno, 2004).

RESULTS AND DISCUSSION

The research results showed that the formulation of corn cob flour and wheat flour in the donuts produced had an effect on water content, ash content, protein, fat and carbohydrates.

Protein Content

The research results showed the highest protein content.

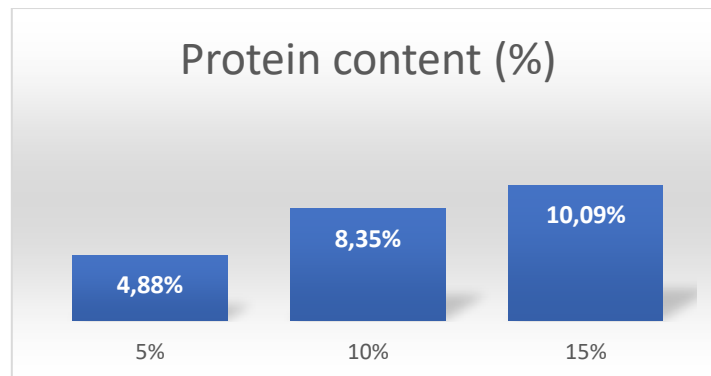


Figure 1. Effect of percentage of corn cob flour on donut protein

Protein is an important micronutrient for the body because it functions as a builder and regulator as well as fuel used for the body's energy needs (Winarno, 2004).

The results of protein content analysis showed that the highest protein content of corn cob donuts was obtained from donuts with the addition of 15% corn cob flour, where the protein content was 10.09%. Meanwhile, the lowest protein content was obtained in donuts with the addition of 5% corn cob flour. This shows that the protein content of donuts increases along with increasing corncob flour concentration. The more concentrated corncob flour is added, the more protein in the donuts will increase. This is because the protein content of corn cob flour is greater than the protein of the raw material used.

Fat content

Fats and oils are found in almost all food ingredients with varying contents. Fats and oils are often deliberately added to food with the aim of improving the texture and taste of the food (Winarno, 2004).

Fats and oils are found in almost all food ingredients with varying contents. Fats and oils are often deliberately added to food with the aim of improving the texture and taste of the food (Figure 2).

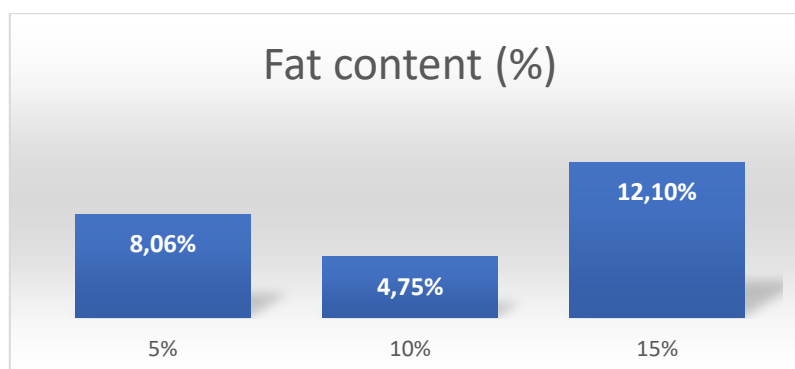


Figure 2. Effect of corncob flour percentage on donut fat content

The results of the donut fat content analysis show that the high fat content is caused by the raw materials used, such as margarine, eggs, powdered milk, and oil, which can increase the fat content. The fat content of donuts is influenced by the raw materials such as eggs, milk, butter, and so on (Dalimunthe, 2012). Oil absorption is influenced by temperature, frying time, material properties, and material porosity. The fat content measured in the donuts shows that the cooking oil was absorbed into the ingredients during the frying process. High temperatures cause more dehydration on the surface of the material so that more empty space is filled with oil.

Regarding donut quality requirements, SNI 01-2000 states that the maximum standard for donut content is 33%, and the results of this research have fulfilled the SNI donut requirements, namely the fat content from adding 5-15% corn cobs is around 8.06%-12.10% or lower specified limit.

Water content

Water is an important component in food because it can affect the appearance, texture, and taste of food. The water content of food also determines the acceptability and durability of food (Winarno, 2004).

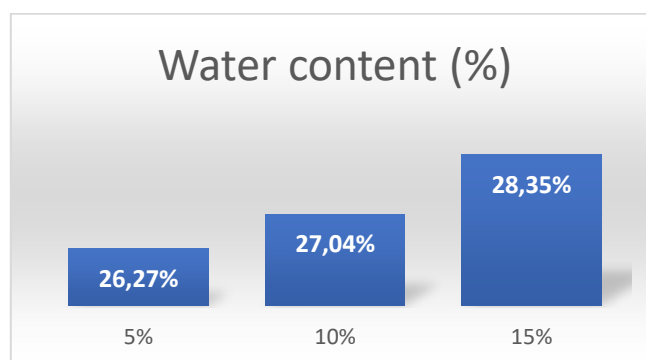


Figure 3. Effect of percentage of corn cob flour on donut water content

The results of the analysis of the water content of the donuts substituted with corncob flour, which are presented in Figure 3, show that the water content of donuts with 5%, 10%, and 15% corncob flour added was 26.27%, 27.04%, and 28.35%. The greater the concentration of corn flour added, the more directly proportional the increase in the donut's water content. The water content of a food product is also influenced by the water content of its constituents. The water content of corn cob flour is 14.32% (Mirnawati & Afdaliah, 2021) (Yanti et al., 2020) (Astawan, 2006). The 2000 Indonesian National Standard states that the maximum water content in donuts is 40%. The water content of donuts from corn cobs is still below the maximum limit determined by the Indonesian National Standard. The water content of a food also determines the freshness and durability of the food. High water content makes it easy for bacteria, mold, and yeast to reproduce, resulting in changes to food ingredients that can speed up spoilage (Winarno, 2004).

Ash Content

The ash content is known as a mineral element or inorganic substance. Around 96% of food consists of organic materials and water, while the rest is mineral elements (Winarno, 2004). Ash content is generally related to the amount of minerals contained in a food product. The high or low levels of ash contained in donuts are influenced by the ingredients from which the donuts are made, especially those containing minerals.

The highest donut ash content was obtained in donuts with 15% corn cob flour added, where the ash content reached 0.73%. Meanwhile, the lowest donut ash content was obtained in donuts with the addition of 10% corn cob flour, where the ash content was 0.09% (Figure. 4). The high or low ash content is caused by the mineral content in the donut ingredients or the presence of other ingredients that increase the ash content in the product (Yunindya & Murtini, 2020).

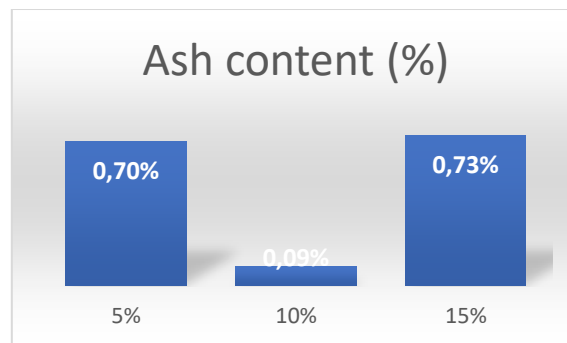


Figure 4. Effect of percentage of corn cob flour on donut ash content

The SNI 01-2000 donut quality requirements state that the maximum standard for donut ash content is 3%, and the research results for donuts from corn cobs have met the specified SNI donut requirements. The low ash content is due to the heating process in frying, which reduces minerals and does not produce organic substances. The results of the analysis of the low ash content in the products produced were caused by the heating carried out so that it did not produce organic substances (carbonates, chlorides, sulfates, and nitrates), which are combustion residues organic material (Ligo et al., 2017). The ash content of a food product is determined by the type of ingredient, ashing technique, length of time, and temperature during frying. The longer the time and the higher the temperature, the greater the ash content (Riansyah et al., 2013).

Carbohydrate Levels

Carbohydrates are the main source of calories for humans. Carbohydrates also play a role in determining the characteristics of food ingredients, for example, taste, color, and texture. Apart from that, carbohydrates in the body are useful for preventing excessive breakdown of body protein, loss of minerals, and helping fat and protein metabolism (Musita, 2019) (Winarno, 2004).

The results of donut carbohydrate analysis in Figure 5 show that the highest carbohydrate content of donuts was obtained by adding 5% corn cob flour, namely 60.10%, while the lowest carbohydrate content was obtained by adding 15% corn cob flour, namely 48.74%. The higher the concentration of corn cob flour added, the lower the carbohydrate content in the donut. If the average water, ash, protein, and fat content increases, the carbohydrate content will decrease proportionally (Junianto, 2022). The observation results showed that the levels in donuts decreased along with increasing corn cob flour concentrations. This is because corn cob flour has a lower carbohydrate content than wheat flour. There are no carbohydrate content criteria in the Indonesian National Criteria SNI 01-2000 which regulates donut quality criteria. Based on the findings obtained, it can be concluded that donuts prepared with alternative ingredients of wheat flour and corn flour can be enjoyed by all customers (Ligo et al., 2017)

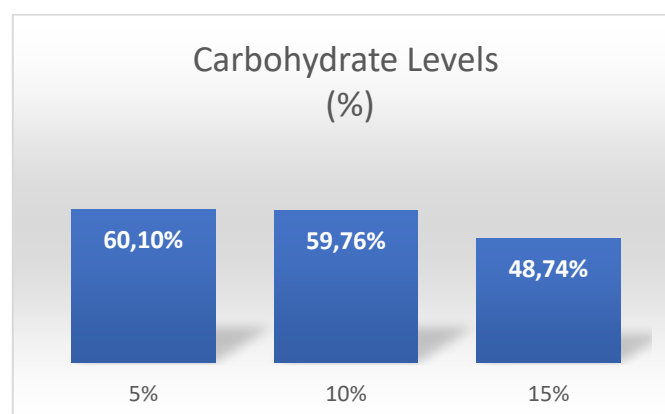


Figure 5. Effect of percentage of corn cob flour on donut carbohydrates

Wheat flour is the main source of carbohydrates in making donuts. Wheat flour is a food product that has a carbohydrate content of 77.3%, while corn cob flour has a carbohydrate value of 82.47%.

CONCLUSION

Based on the research results, it can be concluded that replacing corn cob flour with donuts with a corn cob concentration of 5%, 10%, and 15% produces moisture content values of 26.27%, 27.04%, and 28.35. %, respectively. The protein concentrations were 4.88%, 8.25%, and 10.09%, respectively. Donuts produced with corn cob flour have a fat content of 8.06%, 4.75%, and 12.10%. Currently the ash content is 0.70%, 0.09%, and 0.73%, respectively. This proximate analysis appears to increase as the amount of corn cob flour in the donut increases. The carbohydrate percentages are 60.10%, 59.75%, and 48.74%. The carbohydrate value decreases as the amount of corn cob flour increases. This donut proximal analysis meets the SNI 01-2000 criteria. Donuts made with a higher percentage of corncob flour will be tastier.

REFERENCES

- Anggraini, E. F., & Kristiatuti, D. (2015). Pengaruh Substitusi Bekatul (Rice Bran) Terhadap Sifat Organoleptik Donat. *E-Journal Boga*, 4(8), 63–70.
- AOAC. (1990). *Official Methods of Analysis of Association of Official Analytical Chemists*. Washington DC: AOAC Inc.
- Astawan. (2006). *Membuat Mie dan Bihun*. Jakarta: Penebar Swadaya.
- BPS. (2023, Oktober 16). Luas Panen dan Produksi Jagung di Indonesia 2023 (Angka Sementara). Retrieved from <https://www.bps.go.id/id/pressrelease/2023/10/16/2049/luas-panen-dan-produksi-jagung-di-indonesia-2023--angka-sementara-.html>
- Dalimunthe, H. (2012). *Karakteristik Fisik, Kimia Dan Organoleptik Donat Kentang Ready To Cook Setelah Proses Pembekuan*. Padang: Jurusan Teknologi Hasil Pertanian Fakultas Teknologi Pertanian.
- Eugene, & Asmoro, T. A. (2022). Pembuatan Pizza Bebas Gluten Berbahan Dasar Tepung Ubi Ungu dan Tepung Mocaf. *Journal of Social Sciences*, 1(2), 125–137.
- Junianto. (2022). Pengaruh Penambahan Tepung Spirulina Terhadap Komposisi Proksimat Donat. *Juvenil*, 3(3), 73–78.
- Kemendikbud. (2016). *Desain Induk Gerakan Literasi Sekolah*. Jakarta: Direktorat Jenderal Pendidikan Dasar dan Menengah Kementerian Pendidikan dan Kebudayaan.
- Ligo, H., Kandou, J., & Mamujaja, C. (2017). Pengaruh Substitusi Tepung Kimpul (*Xanthosoma sagittifolium*) Dalam Pembuatan Roti. *Cocos E-Journal UNSRAT*, 8(2).
- Mahardhika, & Dewi, F. R. (2014). Analisis Pengembangan Usaha Pemanfaatan Limbah Bonggol Jagung Menjadi Produk Kerajinan Multiguna. *Jurnal Manajemen Dan Organisasi*, V(3), 214–226.
- Mirawati, & Afdaliah, I. (2021). Uji Kualitas Tepung Jagung Alternatif dari Limbah Tongkol Jagung Menggunakan *Lactobacillus casei* Mirawati. *Al-Kimia*, 9(1), 16–22.
- Musita, N. (2019). Kajian Fisikokimia dan Organoleptik Biskuit Coklat Pisang Batu. *Prosiding Seminar Nasional II Hasil Litbangyasa Industri Palembang*, 149–157.
- Ningtyas, D. I., Darmawan, S., & Septiani. (2019). Hubungan Karakteristik, Pengetahuan Gizi, Dan Sikap Terhadap Penjaja Makanan Di Kantin Sdn Jakarta Timur. *Binawan Student*

Journal, 1(2), 63–68.

- Nurcahyo, E., Amanto, B. S., & Nurhartadi, E. (2014). Kajian Penggunaan Tepung Sukun (*Artocarpus Communis*) Sebagai Substitusi Tepung Terigu Pada Pembuatan Mi Kering. *Teknosains Pangan*, 3(2), 57–65.
- Pawestri, D. A. (2023, Januari 27). Pentingnya Kemampuan Literasi Numerasi. Retrieved from SMA Negeri 1 Alian: <https://www.smkn1alian.sch.id/berita/detail/pentingnya-kemampuan-literasi-numerasi>
- Riansyah, A., Supriadi, A., & Nopianti, R. (2013). Pengaruh Perbedaan Suhu Dan Waktu Pengeringan Terhadap Karakteristik Ikan Asin Sepat Siam (*Trichogaster Pectoralis*) Dengan Menggunakan Oven. *Fishtech*, 2(1), 53–68.
- Sadiyah, H. (2022, Juni 15). Kenalkan Literasi Dan Numerasi Pada Anak Usia Dini Lewat Bermain Sambil Belajar. Retrieved from Sekretariat Daerah Kabupaten Bogor: <https://setda.bogorkab.go.id/berita/seputar-opd/kenalkan-literasi-dan-numerasi-pada-anak-usia-dini-lewat-bermain-sambil-belajar>
- Setianingsih, N. F., & Nurhadi. (2016). Pengaruh Persepsi Harga, Keragaman Produk, Dan Suasana Toko Terhadap Keputusan Pembelian. 2, 82–90.
- Wardhani, S., Wardhani, S., Cahyani, S., Yanuar, S. F., Ramadhan, M. R., Khumairoh, A., Akbar, M. D., Deanasvha, N. F., & Umniyyah, Z. (2024). Pelatihan Pembuatan Brownies Dari Tepung Tongkol Training On Making Brownies From Corncob Flour In Tamansari. *Jurnal Pengabdian Kepada Masyarakat*, 4(1), 13–24.
- Winarno, F. G. (2004). *Kimia Pangan dan Gizi*. Jakarta: Gramedia Pustaka Utama.
- Yanti, S., Prisla, E., & Mikhratunnisa. (2020). The Addition Effect of Kelor (*Moringa Oleifera*) Leaves Flour on Organoleptic Characteristics of Donut. 1(1), 1–9.
- Yunindya, R. P., & Murtini, E. S. (2020). The Effect of Added Water Temperatures to The Quality of Potato Donuts. *Jurnal Teknologi Pertanian*, 21(2), 94–105.