EXPERIMENTAL STUDY OF NUTRITION FACT ON FREE GLUTEN FLOUR AND CHOCOLATE CUPCAKE DERIVED FROM COCONUT DREG FLOUR THROUGH DEHYDRATION PROCESS

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Abstract: Malaysia has foods based from coconut and white flour. However, coconut dregs discarded from coconut milk factory while common white flour contains gluten causing intolerance to some people. Nevertheless, coconut dregs can be utilized to produce nutritious and high fiber flour. Therefore, a research was conducted to create new formulation of chocolate cake premix (CCP) from free gluten coconut dreg flour. Objectives are to determine gluten value of coconut dreg flour (CDF) and examine nutrition facts of CDF and CCP formulated. Immunochemical analysis used to determine gluten markers in CDF while Gas Chromatography- Mass Spectrometry (GC-MS) to determine nutrition value of CDF and CCP. Result indicated in 100g CDF no gluten presence and protein 9.1g/100g, carbohydrate 67.2g/100g, fat 17.8g/100g and total energy 465kcal/100g. While in 100g CCP, protein 8.81g/100g, carbohydrate 21.3g/100g and total energy 417kcal/100g. In conclusion, CDF contains nutrients, free gluten and suitable as wheat flour replacement in CCP.

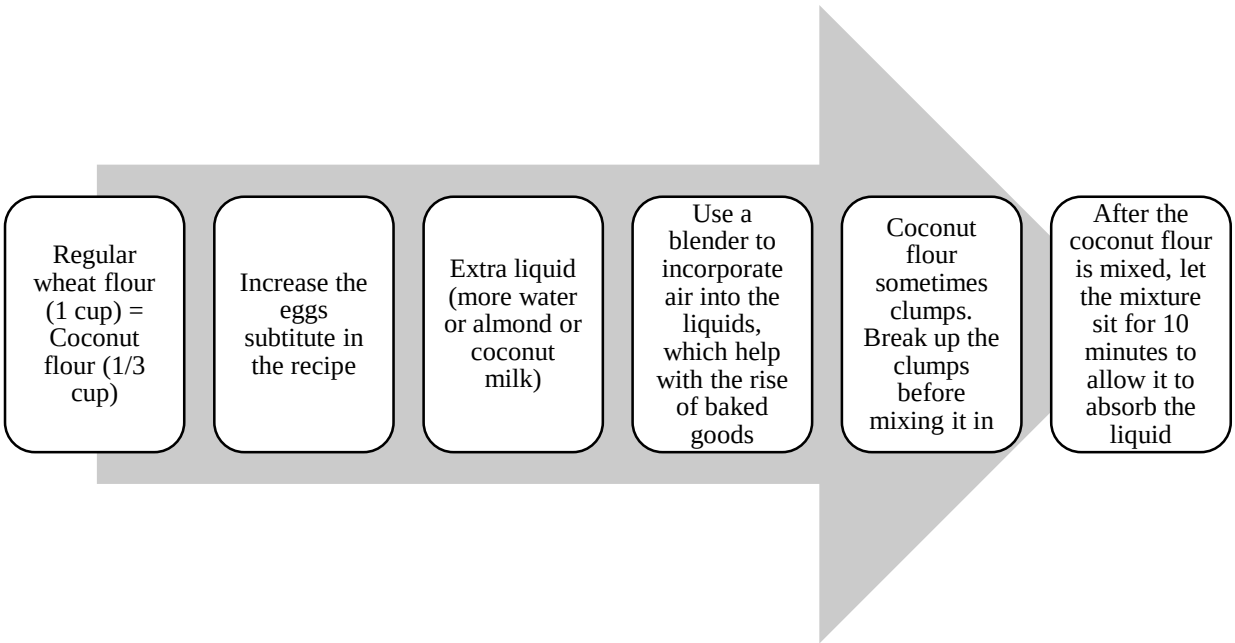
***Keywords**: coconut dreg, gluten free, flour, nutrients*

1. Introduction

Coconuts are incredibly nourishing, full of critical vitamins and minerals, antioxidants, fibre, and other healthy nutrients. It is renowned for their flexibility, with applications in everything from foods to cosmetics (Mohamad, 2020). There is a substantial amount of unutilized agro-industrial residue produced in connection with the large-scale production (Gomes et al., 2021). According to de Arajo Neto et al. (2016), the coconut structure contains about 85% trash that the agro-industrial chain does not utilise for the production of new products. Due to the strong demand for coconut-based products, the coconut sector is expanding quickly, and this causes some agricultural waste and byproducts to be produced during the food production process. These materials are typically offered as livestock feed and are extremely non-valuable (Eadmusk, 2022). The extraction of coconut milk produces roughly 30% coconut residue, according to Raghavendra et al. (2004). Sadly, little has been done with this residue. Typically, it is utilised as cheap animal feed or is allowed to decompose. A small number of researchers have looked at the use of coconut residue in food production, despite the fact that it can reduce costs and add value to coconut by-products (Raghavendra et al., 2004). According to the method of extraction, coconut residue contains 4–25 percent protein recently (Rodsamran and Sothornvit, 2018). Coconut residue can be employed as food-grade dietary fibre (Zheng et al., 2021) moreover, in baking goods (Trinidad et al., 2006).

The coconut waste is turned into flour and is thought to provide nutritional fibre. It has been demonstrated that dietary fibre provides significant health benefits in lowering the chance of developing chronic diseases like cancer, cardiovascular disease, and diabetes mellitus (Trinidad et al. 2006). Hewett (2016) claimed that lauric acid, a type of lipid present in human breast milk, is present in coconut oil. The benefit of lauric acid for heart health is that it raises HDL cholesterol. According to Wadl and As' (2006) study, over 92 percent of the fats in coconuts are saturated fats. Due to this, many people now think that coconut fats are "dangerous for health," especially when it comes to ischemic heart disease. The majority of the saturated fats in coconut, however, are medium chain fatty acids, which have distinct physiological characteristics from those of animal origin. The body uses medium chain fatty acids directly to make energy since they do not go through processes of decomposition and re-esterification. Compared to saturated fats, they are not as "dangerous for health."

McGruther (2016) noted that the high protein and fibre content of coconut flour makes it a fantastic thickener. The processes for utilising coconut flour in cooking are shown in Figure 1. Only a third as much coconut flour as conventional flour is required, and twice as much egg substitute. Additionally, coconut flour absorbs liquid significantly more than other gluten-free flours. For it to function properly, the amount of liquid specified in the recipe must be doubled. Sift the coconut flour before using it in baking to ensure that it mixes well with the other ingredients. Additionally, coconut flour works nicely in a range of other coconut-based recipes, including cupcakes.



(McGruther, 2016)

Figure 1. Steps of using coconut flour in cooking

Gluten-free products have recently gained popularity, driving up demand as they appeal to consumers looking for a gluten-free diet as well as those with medical needs. It's critical to consider the nutritional value of their diets as they mature (Pellegrini and Agostoni, 2015).

QonitahAzzahra (2016) claims that bread dregs from coconuts can be developed as a preventative measure for coronary heart disease since they contain high levels of dietary fibre and may lessen the availability of cholesterol. Additionally, it has the ability to bind to bile acids and prevent their reabsorption in the liver, which reduces the formation of cholesterol. Additionally, coconut flour works nicely in a range of other coconut-based recipes, including cupcakes (Hamidah et. al., 2018).

2. Materials and Methods

This study was conducted using quantitative analysis. There are four steps in achieving the research objectives. The first step is the CDF production. The second step is the analysis of nutrition and gluten content of CDF. The third step is determining suitable formulation of CCP and nutritional analysis of CCP. Finally, the Hedonic scale was used to determine the respondents' acceptance level, and SPSS version 25 was used to analyse the mean score. Table 1 displays the level and meaning of the mean score.

Table 1. Mean score interpretation

Mean Score	Interpretation	Level
1.00 until 2.33	Low	Weak
2.34 until 3.66	Medium	Medium
3.67 until 5.00	High	Good

(Mohd Najib, 2003)

2.1 Sample collection and coconut dreg flour (CDF) production

Referring to Figure 2, the coconut dreg was collected aseptically from NSL Delima Niaga; a Small Medium Industry (SME) producing fresh coconut milk that had sign a collaborative agreement with Politeknik Merlimau. Then, the coconut dreg sample (CDS) was thinly spread inside a food dehydrator. The dehydration process was done at 65^{o}C for 12 hours. Next, the coconut dreg was milled at Malaysian Flour Mill to produce fine CDF.

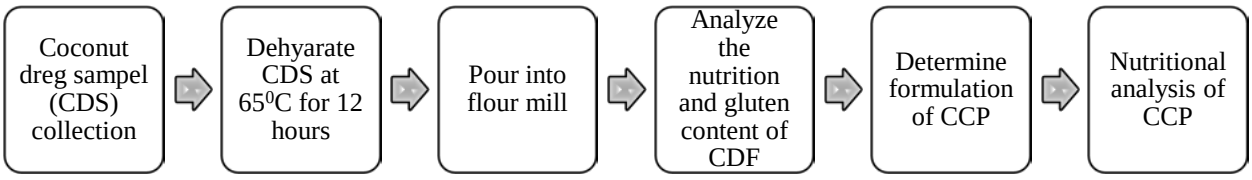


Figure 2. Production and analysis flow of Chocolate Cake Premix (CCP).

2.2 Formulation of Chocolate Cake Premix (CCP)

The standard formulation of CCP is as in Table 2, where the formulation comprises of 100g CDF, 80g coco powder, 100g fine sugar, 10g baking powder and 10g soda bicarbonate.

Table 2. Standard formulation of Chocolate Cake Premix (CCP)

Metric	Ingredient
100 gram	Coconut dreg flour
80 gram	Coco powder
100 gram	Fine sugar
10 gram	Baking powder
10 gram	Soda bicarbonate

2.3 Gluten test and nutritional analysis of coconut dreg flour (CDF) and comparison of nutrition content between CDF and wheat flour

For nutrition content analysis, sampel of CDF was sent to Melaka Institute of Biotechnology. 100g of CDF sampel was analyzed using Gas Chromatography- Mass Spectrometry (GC-MS) to determine the nutrition values. The test parameter are moisture, crude ash, total fat content, crude protein content, total carbohydrate and energy content.

The immunochemical analysis used to determine gluten markers in CDF. 250g of CDF sample was sent to SGS (Malaysia) Sdn Bhd to identify the gluten value in the sample. Finally comparison of nutrition content between CDF and wheat flour was made.

3. Results

Findings were based on three analysis made on CDF and CCP. Result also covers comparison of nutrition content between CDF and wheat flour.

3.1 Gluten analysis of Coconut Dreg Flour (CDF) and comparison of nutrition content between CDF and wheat flour

Referring to Table 3, the nutrition analysis result signifies that the in 100g sampel of CDF contains 9.1g protein, 67.2g carbohydrate, 17.8g fat, 0g gluten and 465kcal energy

Table 3. Comparison of nutrition content between Coconut Dreg Flour (CDF) and wheat flour

Test Parameter	Coconut Dreg Flour(CDF)	Wheat flour
Protein	9.1 g/100g	15.8 g/100g
Carbohydrate	67.2 g/100g	84.21 g/100g
Fat	17.8 g/100g	1.67 g/100g
Gluten	0 g/100g	2.21 g/100g
Energy	465kcal/100g	368kcal/100g

3.2 Nutrition content of Chocolate Cake Premix (CCP)

Table 4 shows the nutrition analysis in 100g of CCP signifies that the sampel of CDF contains 3.3g moisture, 5.0g crude ash, 15.9g total fat content, 9.63g crude protein content, 66.2g carbohydrate and 446kcal energy

Table 4. Nutrition content of Chocolate Cake Premix (CCP)

Test Parameter	Unit	Result
Moisture	g/100g	3.3
Crude Ash	g/100g	5.0
Total Fat Content	g/100g	15.9
Crude Protein Content	g/100g	9.63
Total Carbohydrate	g/100g	66.2
Gluten	g/100g	0
Energy Content	kcal/100g	446

3.3 Respondent acceptance towards Chocolate Cake Premix (CCP)

Table 5 indicated respondents' response towards CCP are high and at good level. Attributes evaluated are about texture, odour and taste of the sampel. The mean score are 3.47, 3.52 and 4.12 for texture, odour and taste respectively.

Table 5. Respondent acceptance towards Coconut Cake Premix (CCP)

Item	Mean	Interpretation	Level
Texture	3.47	High	Good
Odour	3.52	High	Good
Taste	4.12	High	Good

4. Discussion

Referring to Table 3, the nutrition analysis result signifies that the CDF contains protein, carbohydrate, fat and energy comparable to the wheat flour. This in relevant with research by Pellegrini and Agostoni, (2015) and Qonitah Azzahra (2016) stating that the coconut flour contains various nutrients and beneficial in promoting good health as a utilize prevention of coronary heart disease. The results also showed that CDF had more fat than wheat flour, although according to Wadl and As' (2006) study, about 92 percent of coconut fats are saturated fats. This has given rise to the myth that coconut fats are unhealthy. The majority of the saturated fats in coconut, however, are medium chain fatty acids, which have distinct physiological characteristics from those of animal origin. The body uses medium chain fatty acids directly to make energy since they do not go through processes of decomposition and re-esterification. Compared to saturated fats, they are not as "dangerous for health."

Previous research have revealed that coconut flour is likewise gluten-free and that its nutritional composition is very similar to that of wheat flour (Paucean et. al., 2016).It is also proven in Table 3 this gluten analysis test using In-house based on R-Biopharm ELISA Test Kit (R7001) done by SGS (Malaysia) Sdn Bhd indicated that there is no gluten detected in CDF sample. This finding also relevant with Queiroz et. al., (2017), proving by the nutritional qualities of

the gluten-free food were improved by adding coconut flour to the formulations, which increased the fat and protein contents while lowering the carbohydrate level.

After successfully developing the standard formulation, further nutritional study of CCP indicated that sample contains protein, carbohydrates, fat and providing 446kcal energy. This is a positive result considering the main ingredient of CCP in from coconut dreg that normally treated as waste. On top of this, the cake produced from CCP was highly accepted by respondents in term of its organoleptic characteristic and some of respondent even wanted to buy the cake if it is commercialized.

5. Conclusion

In conclusion, the CDF is free gluten. The CCP and CDF contain protein, carbohydrate, fat and energy . CDF also suitable in producing new and nutritious formulation of CCP and it is highly accepted by respondents.

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References

Eadmusik, S., Phungamngoen, C., Panphut, W. and Budsabun, T. (2022). Partially substitution of wheat flour by coconut residues in bakery products and their physical and sensorial properties. *Food Research 6* (1) : 99 – 105. https://www.myfoodresearch.com/uploads/8/4/8/5/84855864/_12__fr-2021-140_eadmusik.pdf

Gomes, M.A., dos Santos Rocha, M.S.R., Barbosa, K.L., de Abreu, Í.B.S., de Oliveira Pimentel, W.R., De Farias Silva, C.E., Almeida, R.M.R.G., de Magalhães Cabral Albruquerque, E.C. and Vieira, R.C. (2021). Agricultural coconut cultivation wastes as feedstock for lignocellulosic ethanol production by Kluyveromyces marxianus. *Waste and Biomass Valorization*, 12, 4943-4951. https://doi.org/10.1007/s12649-021-01345-w

Hamidah Noor Md Yusoh., Wan Nor Hafiza Wan Sulaiman, Ruhana Wati Iran., (2018). Consumer Acceptance Towards Double Cocoa Cupcake from Coconut Dreg Flour and Optimization Study on Nutrition Facts. Proceedings 8th National Conference in Education - (CiE-TVET) 2018, 805 – 813

Hewett. (2016). Are the benefits of coconut oil all a myth?. Health diet. News.com.au. https://www.news.com.au/lifestyle/health/diet/are-the-benefits-of-coconut-oil-all-amyth/news-story/b7d7d8b9bc47ad4ef53e21ea25c56d7b

Mohammad Nor, Nor Amna A'liah and Engku Ariff, Engku Elini and Nik Omar, Nik Rahimah and Zainol Abidin, Ahmad Zairy and Muhammad, Rasmuna Mazwan and Rahim, Hairazi and Nazmi, Mohd Syauqi and Sulaiman, Nurul Huda. (2020). Total productivity and technical efficiency of coconuts in Malaysia. *Economic and Technology Management Review, Vol. 15(2020):* 11 – 22. http://myagric.upm.edu.my/id/eprint/17608/1/02_Nor%20Amna.pdf

McGruther, J. (2016). How to Bake with Coconut Flour: Tips & Tricks for Using this Gluten-free Flour. http://nourishedkitchen.com/baking-with-coconut-flour/

Mohd Najib Abd Ghafar (2003). *Penyelidikan Pendidikan*. Johor Darul Takzim, Universiti Teknologi Malaysia. 129-139

Paucean A., Man S., Muste S., Pop A. (2016). Development of Gluten Free Cookies from Rice and Coconut Flour Blends. Bulletin UASVM Food Science and Technology 73(2)/2016 ISSN-L 2344-2344; Print ISSN 2344-2344; Electronic ISSN 2344-5300

Pellegrini N, Agostoni C. (2015). Nutritional aspects of gluten-free products. Journal of the Science of Food and AgricultureVolume 95, Issue 1. https://doi.org/10.1002/jsfa.7101

Qonitah Azzahra, Alfu Nikmatul Laily, Asiyah Mutmainnah. (2016). Bread Dregs Coconut: Utilization of Coconut Dregs as Prevention of Coronary Heart Disease. International Journal of Advances in Science Engineering and Technology, ISSN: 2321-9009

Queiroz A. M., Rocha R. F. J., Garruti D. S., Silva A. P. V., Araujo I. M. (2017). Preparation and characterization of gluten-free cookies enriched with coconut flour: an alternative for celiacs. Braz. J. Food Technol. vol.20 Campinas 2017. http://dx.doi.org/10.1590/1981-6723.9716

Raghavendra, S.N., Rastogi, N.K., Raghavarao, K.S.M.S. and Tharanathan, R.N. (2004). Dietary fiber from coconut residue: Effects of different treatments and particle size on the hydration properties. *European Food Research and Technology, 218*(6), 563-567. https://doi.org/10.1007/s00217-004-0889-2

Rodsamran, P. and Sothornvit, R. (2018). Physicochemical and functional properties of protein concentrate from by-product of coconut processing. *Food Chemistry, 241,* 364-371. https://doi.org/10.1016/j.foodchem.2017.08.116.

Trinidad, T.P., Mallillin, A.C., Valdez, D.H., Loyola, A.S., Askali-Mercado, F.C., Castillo, J.C., Encabo, R.R., Masa, D.B., Maglaya, A.S. and Chua, M.T. (2006). Dietary fiber from coconut flour: A functional food. Innovative Food Science and Emerging Technologies, 7(4), 309-317. https://doi.org/10.1016/j.ifset.2004.04.003

Wadl, A. & As, D. (2006). Coconut fats. The Ceylon Medical Journal, 51 (2), 47-51

Zheng, Y., Tian, H., Li, Y., Wang, X. and Shi, P. (2021). Effects of carboxymethylation, hydroxypropylation and dual enzyme hydrolysis combination with heating on physicochemical and functional properties and antioxidant activity of coconut cake dietary fibre. *Food Chemistry*, 336, 127688. https://doi.org/10.1016/j.foodchem.2020.127688