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Quality characteristics of instant cendol with fortification of striped snakehead (Channa Striata) flour

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ABSTRACT

The purpose of the study was to determine the effect of the addition of cork fish flour on the quality characteristics of making instant cendol, and determine the best concentration of cork fish flour in making instant cendol. Cendol is one of the traditional Indonesian drinks made from wheat flour or rice flour which is added with natural coloring of pandan leaves. Commercial cendol still has shortcomings in nutritional content with 12.85% carbohydrates, 1.21% protein and 81.25% water, as well as a short shelf life. Nutritional improvement can be done by fortifying cork fish flour as a source of protein with a protein content of 65.3%. The method used is an experimental method, using a non-factorial Completely Randomized Design (CRD) consisting of 4 treatment levels, without the addition of cork fishmeal (C0), the addition of 5% cork fishmeal (C1), the addition of 10% cork fishmeal (C2), the addition of 15% cork fishmeal (C3). The testing parameters in the study were observed quality testing (appearance, aroma, taste, texture) and chemical composition (water content, protein, carbohydrate). The results showed that instant cendol with the addition of 10% cork fish flour (C2) was the best treatment with the characteristics of oragonoleptic, intact, clean, neat, less green color, fragrant pandan aroma, slightly savory rather specific cendol, dry and compact, with chemical values of water content 4.65%, protein 13.85%, and carbohydrates 23.03%.

INTRODUCTION

Cendol is one of Indonesia's most popular traditional drinks. It is often coloured with natural colouring derived from pandan leaves and served with grated brown sugar and coconut milk (Aprilian, 2019). However, commercial cendol, which is commonly consumed, still has nutritional deficiencies, as it is low in nutrients. Per 100 g, cendol contains 8.25 g of carbohydrates, 1.21 g of protein, 6.44 g of fat, and 81.25% water content (Fizriani et al). 2021).

Striped Snakehead is one of the freshwater fish species with high economic value and is one of the fish species with high protein content. In Riau Province itself, snakehead fish production has increased since 2018-2020, from around 43.04 tonnes in 2018 to 75,18 tonnes According to Wirawan et al., (2018), snakehead fish has the following chemical characteristics: water content of 10%, ash content 2.94%, fat content 13.81%, fibre content 21.83% and protein 65.3% content . One type of protein in snakehead fish that is widely used is albumin. This is because snakehead fish contains 13.44% albumin (Fatma et al. 2020), which plays a significant role in the healing process of post-operative wounds. The effectiveness of snakehead fish in the wound healing process is influenced by its high content of non-essential amino acids, namely glycine 7% of the total protein (Robert 2019). Catfish is often utilised as a source of protein and albumin, which play a role in post-operative wound healing and child growth. Therefore, it is hoped that adding catfish flour to instant cendol can increase the nutritional content of instant cendol products.

The high water content in commercially sold wet cendol is often associated with stability during storage. This results in cendol having a short shelf life (Novia et al., 2020); wet cendol usually cannot be stored for long and only lasts for 40 hours when stored at room temperature. High water content causes mould, fungi, yeast, and bacteria to grow more rapidly. According to Dewita et al. (2023), the high water content in cendol can cause a short shelf life. One solution is to make instant cendol in dry form so that it has a longer shelf life. Dry food products have a longer shelf life because their water content is reduced to a certain level (Yuka, 2021).

MATERIAL AND METHODS

Tools and Materials. The materials used in the process of making instant cendol are weighing a total of 6 kg, obtained from Pasar Selasa Panam, Pekanbaru, pandan leaf extract, nutrijell, water, sago flour and rice flour. The chemicals used for chemical analysis are: distilled water, NaOH (sodium hydroxide), H_2SO_4 (sulphuric acid), BO_3 (boric acid) (Merck), HCl (hydrochloric acid), PP indicator, methyl red indicator and methyl blue indicator. Consumables include tissue, label paper, polyethylene plastic, gloves, and masks. Equipment used includes: oven (Memmert), stove, basin, tray, analytical balance (Boeco Germany), digital scale (Kitchen schale), blender, (Miyako), dropper pipette, Erlenmeyer flask (Pyrex), porcelain dish, clamp, desiccator (Duran), distillation apparatus, measuring cylinder, spectrophotometer, beaker, micropipette.

***Tools and materials*.** The tools used in this study were: (a) a roll meter, to measure water depth and beach length and width; (b) a current drogue, to measure current velocity; (c) a waterpass (levelling instrument), to measure beach slope; (d) a Secchi disk, to measure water clarity; and (e) snorkelling gear, to observe dangerous biota in the water.

***Research Design*.** The research method used was an experiment, namely processing instant snakehead fish flour cendol. The research design used was a non-factorial completely randomised design (CRD) with four treatment levels, namely: C0 (0% without snakehead fish flour fortification, rice flour 100g, sago flour 300g, nutrijell 30 g, salt ½. pandan leaf extract 500 mL and water 800 mL), C1 (5% with snakehead fish flour fortification, rice flour 100g, sago flour 300g, nutrijell 30 g, salt ½. pandan leaf extract 500 mL and water 800 mL), C2 (10% with snakehead fish flour fortification, ice flour 100g, sago flour 300g, nutrijell 30 g, salt ½. pandan leaf extract 500 mL and water 800 mL), C3 (15% with snakehead fish flour fortification, rice flour 100g, sago flour 300g, nutrijell 30 g, salt ½. pandan leaf extract 500 mL and water 800 mL) percent calculated from the total amount of flour used in the instant cendol manufacturing process. Each treatment was carried out 3 (three) times, resulting in a total of 12 experimental units.

Research Procedure

Preparation of Snakehead Fish Flour (Dewita et al. 2023). The cleaned snakehead fish were then washed, gutted and discarded (scales, gills, entrails, head and bones). They were then washed thoroughly until there was no blood or mucus on the fish meat. The cleaned snakehead fish were then drained and weighed. After that, the steaming process is carried out by heating the water first until it reaches a temperature of 100°C and steamed for 10 minutes,The steamed fish meat is then dried in an oven for 24 hours at a temperature of 50°C. The dried fish meat is then blended and sieved using a 100-mesh sieve to produce gabus fish flour.

Procedure for making cendol (Dewita et al. 2023). Mix all ingredients, namely sago flour and rice flour, according to the treatment concentration, then add other ingredients such as snakehead fish flour (according to the concentration) and nutrigell. Then mix all the dough and cook it with water at 100°C for 15 minutes until it forms a gel. After cooking, the dough is moulded using a cendol mould with a diameter of 0.5 cm, which has a container underneath. The moulded cendol is then dried in an oven at 50-60°C for 12 hours. Dried cendol is often referred to as instant cendol.

RESULTS AND DISCUSSION

Organoleptic Assessment. Organoleptic assessment, also known as sensory testing, is a study that involves the human senses as instruments. According to Dendi et al. (2021), sensory testing or sensory evaluation uses the human senses as the primary tools, including sight/vision, smell/nose, taste/tongue, and touch/hands. The organoleptic assessment of the quality of instant cendol fortified with snakehead fish flour was conducted using 25 moderately trained panelists. The results of the organoleptic assessment of quality can be seen in Table 1.

Table 1. Organoleptic Assessment Results Appearance Score

Treatment	Appearance	Flavour	Taste	Texture
C_0	6,01±0,23b	6,55±0,25b	7,00±0,34^b	5,80±0,08^a
C_1	7,35±0,09c	6,81±0,12^b	7,05±0,04^b	6,20±0,04^a
C_2	7,43±0,12c	7,11±0,04^c	7,21±0,25^c	7,37±0,12^b
C_3	5,11±0,16a	5,37±0,30a	6,01±0,12^a	7,03±0,25^b

Note: (C0 control); C1 (5% fish meal); C2 (10% fish meal); C3 (15% fish meal) Numbers followed by different letters indicate significantly different treatments, and numbers followed by the same letters indicate treatments that are not significantly different.

Based on Table 1 above, it can be seen that the average appearance score of instant cendol fortified with snakehead fish flour ranges from 7.43 to 5.11. The highest appearance score was found in treatment C2 (7.43) and the lowest in treatment C3 (5.11). Based on the BNJ follow-up test, treatment C2 (7.43) was the best treatment with specific appearance (intact, clean, neat and less green in colour). This is because the green colour of instant cendol is still preferred, and the colour is less green due to the addition of fish flour itself. According to the addition of 7% fish flour, it still has the highest colour value.

Treatment C3 (intact, less neat, reduced green colour) is the lowest treatment. This is because changes in the appearance of cendol are also influenced by the amount of snakehead fish flour added to the dough; the more snakehead fish flour used, the less green the pandan leaves will be. The colour change includes a slightly brownish yellow. The yellowish-brown colour is caused by the snakehead fish meat itself, which is generally dark in colour. In line with Imandira's (2013) research, it states that the more dumbo catfish flour is substituted, the more brown the biscuit colour will be. Appearance is one of the main things that consumers pay attention to because if the appearance of a product is more attractive, consumers will be interested and will try the product. If the appearance of a product offered is not attractive, this will reduce consumer appeal towards the product (Suparmi et al. 2020).

***Aroma value*.** Based on Table 1 above, it can be seen that the average aroma value of instant cendol fortified with snakehead fish meal ranges from 7.11 to 5.37, with the highest aroma value in treatment C2 (7.11) and the lowest in treatment C3 (5.37). Based on the BNJ follow-up test, treatment C2 (7.11) was the best treatment with aroma specifications (pandan leaf fragrance). The pandan fragrance was still noticeable due to the addition of a small amount of fish flour, which was preferred. In line with the research by Egidya et al. (2023), it was stated that the addition of 10% fish meal was the most preferred. Meanwhile, C3 (5.37) had the lowest value with aroma specifications (slightly fragrant pandan aroma). This occurred because fish meal has a fairly strong aroma, which masks the aroma of pandan leaves. In line with the research by Nadimin et al. (2018), fish has a distinctive smell, with a sharp aroma that is generally difficult to neutralise. If added in large quantities, this sharp fish aroma will reduce consumer preference for a product. Aroma is the smell produced by a chemical stimulus detected by the olfactory nerves in the nasal cavity when food enters the mouth (Winarno, 2004).

***Taste value*.** Based on Table 1 above, it can be seen that the average taste score for instant cendol fortified with snakehead fish flour ranged from 7.21 to 6.01, with the highest taste score in treatment C2 (7.21) and the lowest in treatment C3 (6.01). Based on the BNJ follow-up test, treatment C2 (7.21) was the best treatment with taste specifications (slightly savoury, somewhat specific to cendol). The savoury taste produced in the cendol was influenced by a mixture of several other ingredients added to the dough. The addition of 10% snakehead fish flour was preferred because of the combination of sweet and savoury flavours from the snakehead fish (Gita & Sarwo, 2018). The savoury flavour comes from glutamic acid, which is an amino acid found in protein (Taufik et al. 2022). Meanwhile, treatment C3 (6.01) had the lowest score with taste specifications (bland, slightly fishy). The least preferred taste was mackerel biscuits with 15% fish flour substitution. Furthermore, according to Nadimin (2017), the concentration of shellfish flour should not exceed 10%. Taste is one of the assessments that uses the sense of taste (Nadimin et al. 2019). Furthermore, according to Silvina (2010), taste is one of the assessments in determining a consumer's decision to accept or reject a product, even if other parameters are good, but if it does not taste good, it will be rejected.

***Texture value*.** Based on Table 1 above, it can be seen that the average texture value of instant cendol fortified with snakehead fish meal ranges from 7.37 to 5.80, with the highest texture value in treatment C2 (7.37) and the lowest in treatment C0 (5.80). Based on the BNJ follow-up test, treatment C2 (7.37) was the best treatment with dry and compact texture specifications. The addition of fish flour will affect the texture of a product. This is in line with the research (Egidya et al. 2023) which states that fish flakes with the addition of 10% tilapia fish meal have a drier, crispier and more compact texture. Meanwhile, treatment C0 (5.80) had the lowest value with a neutral texture specification. According to Febrianto et al. (2014), the crispiness of a product closely related to the composition of the ingredients contained, especially the amylopectin, amylose and protein content in the food ingredients. The high concentration of fish meat added will affect the starch gelatinisation process. In line with Trimutri's (2003) research, which states that the addition of fish flour will affect the texture or crispness of a cracker product, adding 30% flour will inhibit product development or reduce the crispness of crackers.
Texture is a sensory perception associated with touch or feel, with characteristics often observed being hardness, cohesiveness, and water content (Darni, 2018).

***Chemical Value*.**
***Moisture Content*.** Based on the information in Table 2, it can be seen that the moisture content values obtained with fortified snakehead fish meal show that the average moisture content values range from 3.76 to 6.22%. The highest moisture content value was found in treatment C0, ranging from 6.22%, while the lowest moisture content value was found in treatment C3, ranging from 3.76%.

Table 2. Chemical Composition Test Results

Treatment	Water	Protein	Carbohydrate
C_0	6,22±0,76^c	8,38±0,18^a	30,17±0,72^b
C_1	4,96±0,01^b	10,64±0,52^b	23,54±1,46^a

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Treatment	Water	Protein	Carbohydrate
C_2	4,65±0,11^{ab}	13,85±0,98^{c}	23,03±1,35^{a}
C_3	3,76±0,16^{a}	16,26±0,12^{d}	21,39±0,54^{a}

Note: (C0 control); C1 (5% fish meal); C2 (10% fish meal); C3 (15% fish meal) Numbers followed by different letters indicate treatments that are significantly different, and numbers followed by the same letters indicate treatments that are not significantly different.

Based on the BNJ follow-up test, treatment C2 was the best treatment with a moisture content of 4.65%. According to Riansyah et al. (2013), a decrease in moisture content leads to an increase in the protein content of the material This moisture content complies with the SNI 01-2774-1992 standard for 10% dry products. According to Riansyah et al. (2013), a decrease in moisture content leads to an increase in the protein content of the material.

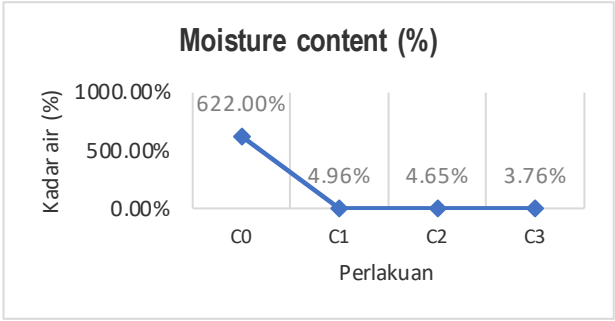

Figure 1. Graph showing the moisture content of instant cendol fortified with snakehead fish meal.

The addition of snakehead fish meal as a raw material in the production of cendol will significantly affect the moisture content produced; the moisture content will decrease as the concentration of snakehead fish meal added increases. This is in line with the research by Yuliana et al. (2018), which states that fish bone flour is believed to replace some of the water in the cendol dough, thereby reducing its moisture content.

***Protein Content*.** Based on the information in Table 2, it can be seen that the protein content obtained by fortifying snakehead fish meal shows that the average moisture content is between 8.38-16.26%. The highest protein content value in treatment C3 was around (16.26), while the lowest protein content value was found in treatment C0, which was around (8.38%). Based on the BNJ follow-up test, treatment C2 was the best treatment with a protein content of (13.85%). This is related to the protein content meeting the protein content standard for a product. The minimum protein content according to SNI 2973:2011 is 5%.

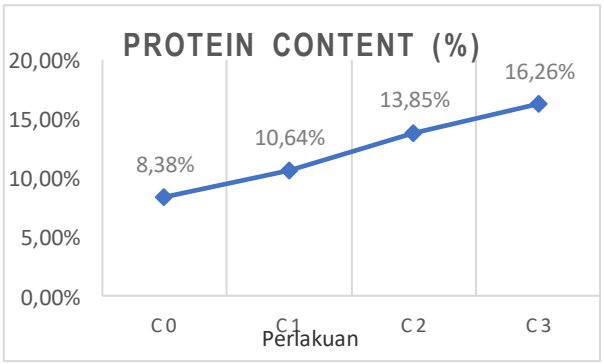

Figure 2. Graph showing the protein content of instant cendol fortified with fish meal.

The addition of snakehead fish meal will increase the protein content of cendol. The higher the concentration of snakehead fish meal added, the higher the protein content of cendol. The addition of fish flour will increase the protein content in a product, thereby increasing protein

consumption (Elfrido et al.) In line with the research by Dewita et al. (2023), which found that the protein content in instant cendol was 15.48%. The protein content is inversely proportional to the water content; the higher the protein content, the lower the water content. In line with the statement by Ovdarlin et al. (2023), the increase in protein content is due to the loss of water content during the drying process, which increases the protein content. The lower the water content of a product, the higher the protein content.

Carbohydrate content. Based on the information in Table 2, it can be seen that the carbohydrate content obtained by fortifying snakehead fish flour shows that the average carbohydrate value is between 30.17-21.39%. Based on the BNJ follow-up test, it shows that treatment C1 is not significantly different from treatments C2 and C3 but is significantly different from treatment C0 at a 95% confidence level. The following is a graph representing the carbohydrate content results.

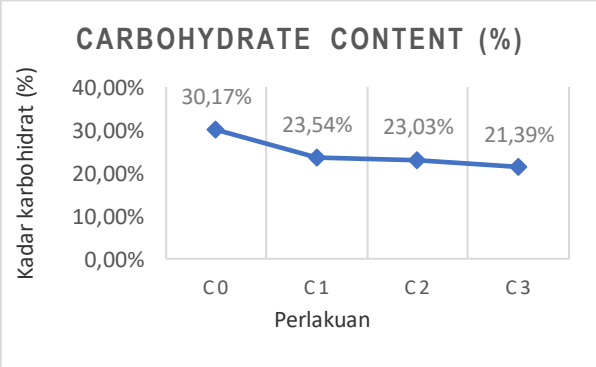

Figure 3. Graph showing the carbohydrate content of instant cendol fortified with snakehead fish meal

The highest carbohydrate value was found in treatment C0, which ranged from 30.17%, while the lowest carbohydrate value was found in treatment C3, which ranged from 21.39%. The decrease in carbohydrates was caused by the addition of fish flour to the instant cendol. In line with the research by Nova et al. (2014), the decrease in carbohydrates in fish crackers was caused by the addition of fish flour; the more fish flour added, the more the carbohydrates decreased. This is in accordance with the research by Goes et al. (2015), pasta is a product that contains complex carbohydrates. The reduction in carbohydrate content in pasta was caused by the addition of tilapia protein concentrate.

CONCLUSION

Fortification of snakehead fish meal with different concentrations (0%, 5%, 10% and 15%) had a significant effect on organoleptic quality (appearance, aroma, taste and texture) and chemical content (water, protein, carbohydrates). Fortification with 10% Striped snakehead fish flour (C2) was the best treatment for instant cendol quality with organoleptic characteristics of whole, clean, neat cendol, less green in colour, fragrant pandan aroma, slightly savoury taste specific to cendol, and a dry and compact texture with chemical characteristics of 4.65% moisture content, 13.85% protein, and 23.03% carbohydrates.

REFERENCES

Alkhamdan, T., & Husain R. (2022). Utilisation of snakehead fish (Channa striata) flour in the production of fish crackers. jambura Fish Processing Journal, 1(1):25-36

Apriliana, A. M. (2019). Substitution of red rice flour (Oryza Nivara) in the production of hunkwe flour cendol on consumer acceptance. Jakarta: Jakarta State University Press

Christina, L., Tasya, A. M., Ashri, I., Fithria, N., Laela, N., & Nurhaidar, R. (2023). Fortification of anchovy flour (Stolephorus sp.) on the physical characteristics and microstructure of sago flour-based noodles. JPHPI, 26(1), 127-13

Darni, L. (2018). Organoleptic testing of purple sweet potato jalangkote as an effort to diversify food, Journal of Food Processing, 3(1), 9-15.

Dewita, Desmelati, Santhy, W. S., & Taufik Hidayat. (2022). Isolation and Characterisation of Snakehead Fish Meal Extract with Fresh, Boiled, and Steamed Treatments and Its Potential for Health Drinks and Immunomodulators. Pharmacogn J, 14(5), 532-536

Dewita, S.W. Sidauruk, Desmelati. (2022). Amino Acid and Mineral Profiles of Fresh Snakehead (Channa striata) Meat for Potential Use as an Immune System Booster. OP Conference Series: Earth and Environmental Science

Dewita, Santhy, W. S., Desmelati, & Taufik, H. (2023). Hedonic and Chemical Characteristics of Instant Snakehead Fish Cendol with Different Local Carbohydrate Source Formulations. JPHPI, 26(3), 560-570

Egidya, S. Apri, D. A., & Laras, R. (2023). The effect of adding tilapia (Oreochromis niloticus) flour on the quality and acceptability of fish flakes. Journal of Fisheries Science and Technology, 5(1), 52-61

Febrianto, A. B., & Anam, C. (2014). Study of the physicochemical and sensory characteristics of corn tortilla chips with varying alkali solutions in the corn nixtamalisation process. Journal of Food Science and Technology, 3(3), 22-34

Fizriani, A, Quddus, A.A., & Hariadi, H. (2021). The effect of adding butterfly pea flower extract on the chemical and organoleptic properties of cendol drinks. Journal of Food Science and Agricultural Products, 4(2), 136-145.

Gita, R.S.D., & Sarwo, D. (2018). Study on the production of functional biscuits with catfish flour and moringa leaf flour substitution, Journal of Education and Biological Sciences, 1(2), 155-162

Imandira, P. Ayustaningwarno, F. (2013). The Effect of Substituting Catfish Flour (Clarias gariepinus) and Sweet Potato Flour (Ipomoea batatas L.) on the Nutritional Content and Acceptance of High-Protein and Beta-Carotene Biscuits for Toddlers. Journal of Nutrition College, 2(1), 89–97

Meda, C. Ivana, F., Diana, L. (2020). Characteristics of dried noodles substituted with yellow pumpkin flour and tuna fish flour. Journal of Food Technology Applications, 9(4), 181–187.

Nadimin, Nurjaya, & Retna, S.L. (2018). Acceptance of South Sulawesi local snacks substituted with snakehead fish flour (Channa striata), 3(2), 141-148.

Nadimin, Sirajuddin, & Nuraliah, F. (2019). Organoleptic quality of cookies with the addition of rice bran flour and mackerel. Food Nutrition Media, 1(26), 8-15.

Ovdarli, L. Rachel, B., & Syanee, P. (2023). The effect of skipjack tuna (Katsuwonus pelamis) flour concentration and drying time on the chemical characteristics of purple sweet potato (Ipomoea batatas L) tortilla chips. Agrosilvopasture Journal, 2(1), 54-61.

Riansyah, A., Supriadi, A., & Nopianti, R., 2013. The Effect of Temperature and Drying Time on the Characteristics of Salted Siamese Gourami (Trichogaster pectoralis) Using an Oven. Journal, (online), vol. II, no. 01, (http://www.thi.fp.usri.ac.id), accessed on 20 May 2014.

Silvana, D. (2010). The effect of adding ginger (Zingiber Officinale Roscoe) water extract and cold storage on the sensory quality of tuna (Thunnus albacores). Journal of Tropical Fisheries and Marine Sciences, 6(1), 36-40.

Suparmi, Desmelati, Sumarto, and Santhy, W. S. (2020). Fortification of Various Flavours in Catfish (Pangasius hypophthalmus) Macaroni as a Regional Flagship Product. Journal of Coastal and Fisheries Sciences, 9(1), 47.

Taufik, A., & Rahim, H. (2022). Utilisation of snakehead fish (Channa striata) flour in the production of fish crackers. Jambura Fish Processing Journal, 4(1), 25–36.

Tunggadi, R. (2019). The potential of snakehead fish (Ophiocephalus striatus) in accelerating wound healing. Jambura Fish Processing Journal, 1(1), 46-57. P-ISSN: 2655-3465.

Wirawan, W. Alaydrus, S., & Ronaldy, N. (2018). Analysis of the chemical characteristics and organoleptic properties of snakehead fish flour as a basic ingredient in food processing. Journal of Science and Health, 1(9), 479-483.

Winarno, F.G. (2004). Moisture Content Analysis - Virtual Agroindustry Laboratory. Retrieved 4 January 2019, from http://labvirtual.agroindustri.upi.edu/analisis-kadar-air

Yuka, U.F., & Reni, S. N. (2021). Analysis of moisture and ash content in black tea sold in the market using the gravimetric method, 3(2),50-54.