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The Effect of Substituting Wheat Flour with Composite Flour (*Cucurbita moschata* and *Daucus carota* L.) on Biscuits as a Source of Beta Carotene for Stunted Children

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Abstrak:
Permasalahan stunting di Indonesia masih cukup tinggi yaitu 21,6% berdasarkan data Survei Status Gizi Indonesia (SSGI) tahun 2022. Salah satu upaya pengendalian stunting yang efektif adalah melalui pemberian makanan tambahan (PMT) seperti biskuit kepada anak. Wortel dan labu kuning merupakan pangan lokal yang kaya akan beta karoten. Karotenoid sebagai sumber provitamin A mampu mengatasi masalah kekurangan vitamin A (VAD) yang menjadi penyebab gangguan tumbuh kembang pada anak. Penelitian ini bertujuan untuk mengetahui pengaruh substitusi tepung komposit labu kuning (*Cucurbita moschata*) an wortel (*Daucus carota* L.) terhadap karakteristik organoleptik meliputi warna, aroma, rasa, tekstur dan kandungan gizi (beta karoten, karbohidrat, protein dan lemak). Penelitian ini menggunakan Rancangan Acak Kelompok (RAK) dengan 3 perlakuan yaitu formula 1 (tepung terigu 150 gram, tepung labu kuning 50 gram, dan tepung wortel 50 gram), formula 2 (tepung terigu 50 gram, tepung labu kuning 60 gram), epung terigu dan 50 gram tepung wortel) dan formula 3 (50 gram tepung terigu, 50 gram tepung labu kuning dan 150 gram tepung wortel) dengan 3 kali pengulangan. Hasil penelitian menunjukkan biskuit formula 3 merupakan formulasi terbaik dari segi sifat organoleptik dengan kandungan beta karoten tertinggi dibandingkan F1 dan F2. Biskuit F3 mengandung 30,97 mg beta karoten, 7,45 gram karbohidrat, 3,22 gram protein, dan 8,89 gram lemak. Kesimpulan penelitian ini adalah substitusi tepung terigu dengan tepung komposit (*Cucurbita moschata* dan *Daucus carota* L.) berpengaruh terhadap kandungan gizi (beta karoten, karbohidrat, protein dan lemak) biskuit. Mengkonsumsi biskuit labu per 100 gram dapat memenuhi syarat sebagai sumber antioksidan beta karoten yang baik.
Kata kunci: Labu, Wortel, Biskuit, Beta Karoten, Stunting

Abstract: The problem of stunting in Indonesia is still quite high, namely 21.6% based on data from the 2022 Indonesian Nutrition Status Survey (SSGI). One effective measure to control stunting is through providing additional food (PMT) such as biscuits to children. Carrots

and pumpkin are local foods that are rich in beta carotene. Carotenoids as a source of provitamin A are able to overcome the problem of vitamin A deficiency (VAD) which is the cause of growth and development disorders in children. This research aims to determine the effect of substitution of yellow pumpkin (*Cucurbita moschata*) and carrot (*Daucus carota* L.) composite flour on organoleptic characteristics including color, aroma, taste, texture and nutritional content (beta carotene, carbohydrates, protein and fat). This research used a Randomized Block Design (RAK) with 3 treatments, namely formula 1 (150 g of wheat flour, 50 g of pumpkin flour, and 50 g of carrot flour), formula 2 (50 g of wheat flour, 60 g of pumpkin flour), flour and 50 g of carrot flour) and formula 3 (50 g of wheat flour, 50 g of pumpkin flour and 150 g of carrot flour) with 3 repetitions. The research results showed that formula 3 biscuits were the best formulation in terms of organoleptic properties with the highest beta carotene content compared to F1 and F2. F3 biscuits contain 30.97 mg beta carotene, 7.45 g of carbohydrates, 3.22 g of protein and 8.89 g of fat. The conclusion of this research is that the substitution of wheat flour with composite flour (*Cucurbita moschata* and *Daucus carota* L.) has an effect on the nutritional content (beta carotene, carbohydrates, protein and fat) of biscuits. Consuming pumpkin biscuits per 100 g can qualify as a good source of the antioxidant beta carotene.
Keyword: Pumpkin, Carrots, Biscuits, Beta Carotene, Stunting

1. Introduction

Children are a valuable asset to a nation; therefore, their growth and development are important indicators to consider. According to SSGI data in 2022, 21.6% of children in Indonesia suffer from stunting [1]. Stunting in children is closely associated with risks of lower academic achievement, limited cognitive abilities, and chronic health issues in adulthood [2]. Beyond affecting individual health, stunting also carries significant economic implications. Countries with high stunting rates face challenges in achieving inclusive and sustainable economic growth [3]. Effective interventions include promoting exclusive breastfeeding, providing nutrition education for families, and improving access to nutritious food and adequate sanitation. These approaches have proven successful in reducing stunting prevalence in several countries [4].

The use of digital technology and other innovative approaches in nutrition and health prog has also shown potential to enhance the efficiency and impact of stunting interventions [5]. One effective intervention in prevention and management is the provision of Supplementary Feeding (PMT). PMT is

expected to significantly contribute to meeting the nutritional needs of children, especially those experiencing stunting. Beta carotene, a precursor to vitamin A, is a crucial nutrient [6].

Foods rich in beta carotene, such as carrots and yellow pumpkin, are abundant local sources often underutilized. Carrots contain approximately 8.3 mg of beta carotene per 100 g, while yellow pumpkin contains about 1.1 mg per 100 g [7]. Both foods can be processed into biscuits, a favored product among children that is easy to consume. This research aims to innovate by developing biscuits made from a mixture of carrot flour and yellow pumpkin flour rich in beta carotene, providing numerous health benefits, especially for children experiencing stunting.

2. Research Method

The research method used was true experiment. The research design was a group randomized design (RAK) with three types of treatment and three repetitions. The treatment in this study was the difference in the amount of wheat flour and composite flour added. Formula 1 with the addition of 150 g of wheat flour, 50 g of pumpkin flour and 50 g of carrot flour, formula 2 with the addition of 50 g of wheat flour, 60 g of pumpkin flour and 50 g of carrot flour, and formula 3 with the addition of 50 g of wheat flour, 50 g of pumpkin flour and 150 g of carrot flour.

The tools and materials used in this research are tools and materials for making flour, making biscuits and organoleptic test forms. Pumpkin and carrot flour were made using simple equipment such as a sieve, basin, cutting board, blender and knife. Biscuit making uses tools such as basins, baking sheets, spatulas, mixers, ovens, spoons, digital scales and knives. Biscuit ingredients included wheat flour, pumpkin flour, carrot flour, white sugar, eggs, margarine, vanilla and cornstarch.

Organoleptic test (5 scales) assessment of colour, aroma, taste and texture was conducted by 30 trained panellists who have sensory sensitivity, healthy condition and not colour blind. Chemical tests carried out include beta carotene,

carbohydrate, fat and protein tests. The research data were processed using Microsoft Excel and SPSS. Statistical data analysis using ANOVA test.

3. Results and Discussion

Organoleptic characteristics test of pumpkin carrot biscuits was conducted on colour, aroma, taste and texture attributes. The results of panellists' assessment of pumpkin carrot biscuits based on colour attributes can be seen in the following table:

Table 1. Effect of Wheat Flour Substitution with Composite Flour of Yellow Pumpkin (*Cucurbita moschata* and Carrot (*Daucus carota* L.) on Colour

Treatment	Colour Taste Value
F1 (150 g of wheat flour, 50 g of pumpkin flour and 50 g of carrot flour)	4,13 ± 0,86[a]
F2 (50 g of wheat flour, 150 g of pumpkin flour and 50 g of carrot flour)	3,90 ± 0,71[a]
F3 (50 g of wheat flour, 50 g of pumpkin flour and 150 g of carrot flour)	4,00 ± 0,37[a]

Note: the average value of treatments marked with different letters states that there is a significant difference at the test level <0.05 according to Duncan's test.

The results of the ANOVA statistical test showed that the substitution of wheat flour with pumpkin and carrot composite flour in the three formulations did not have a different effect on the color of beta carotene source pumpkin biscuits.

Table 2. Effect of Wheat Flour Substitution with Composite Flour of Yellow Pumpkin (*Cucurbita moschata* and Carrot (*Daucus carota* L.) on Aroma

Treatment	Aroma Favorability Score
F1 (150 g of wheat flour, 50 g of pumpkin flour and 50 g of carrot flour)	4,03 ± 0,67[a]
F2 (50 g of wheat flour, 150 g of pumpkin flour and 50 g of carrot flour)	3,73 ± 0,64[a]
F3 (50 g of wheat flour, 50 g of pumpkin flour and 150 g of carrot flour)	3,93 ± 0,69[a]

Note: the average value of treatments marked with different letters states that there is a significant difference at the test level <0.05 according to the Duncan test.

The results of ANOVA statistical test showed that the substitution of wheat flour with pumpkin and carrot composite flour in the three formulations

did not have a different effect on the aroma of pumpkin biscuits as a source of beta carotene.

Table 3. Effect of Wheat Flour Substitution with Composite Flour of Yellow Pumpkin (*Cucurbita moschata*)and Carrot (*Daucus carota* L.) on Taste

Treatment	Taste Value
F1 (150 g of wheat flour, 50 g of pumpkin flour and 50 g of carrot flour)	4,13 ± 0,90[b]
F2 (50 g of wheat flour, 150 g of pumpkin flour and 50 g of carrot flour)	3,70 ± 0,88[a]
F3 (50 g of wheat flour, 50 g of pumpkin flour and 150 g of carrot flour)	3,87 ± 0,63[a]

Note: the average value of treatments marked with different letters states that there is a significant difference at the test level <0.05 according to the Duncan test.

The results of ANOVA statistical test showed that the substitution of wheat flour with pumpkin and carrot composite flour in formula 2 (50 g of wheat flour, 150 g of pumpkin flour and 50 g of carrot flour) and formula 3 (50 g of wheat flour, 50 g of pumpkin flour and 150 g of carrot flour) did not give a significantly different effect on the taste of beta carotene source pumpkin carrot biscuits. While the substitution of wheat flour with pumpkin and carrot composite flour in formula 1 (150 g of wheat flour, 50 g of pumpkin flour and 50 g of carrot flour) gave a significantly different effect on the taste of beta carotene source pumpkin carrot biscuits.

Table 4 Effect of Wheat Flour Substitution with Composite Flour of Pumpkin (*Cucurbita moschata*) and Carrot (*Daucus carota* L.) on Texture

Treatment	Taste Value
F1 (150 g of wheat flour, 50 g of pumpkin flour and 50 g of carrot flour)	3,97 ± 0,81[a]
F2 (50 g of wheat flour, 150 g of pumpkin flour and 50 g of carrot flour)	3,83 ± 0,83[a]
F3 (50 g of wheat flour, 50 g of pumpkin flour and 150 g of carrot flour)	3,97 ± 0,72[a]

Note: the average value of treatments marked with different letters states that there is a significant difference at the test level <0.05 according to the Duncan test.

The results of ANOVA statistical test showed that the substitution of wheat flour with pumpkin and carrot composite flour in the three formulations did not have a different effect on the texture of beta carotene source pumpkin biscuits. Pumpkin and carrot composite flour biscuit formulation that is most preferred by panellists in terms

of color, aroma, taste and texture is F1 biscuit with a balance of 150 g of wheat flour, 50 g of pumpkin flour and 50 g of carrot flour, followed by F2 and F3.

Figure 1. Pumpkin Carrot Biscuits

The nutritional content test includes beta carotene, carbohydrate, protein and fat content tests which were carried out 3 times. The results of testing the nutritional content of pumpkin carrot biscuits can be seen in the following table:

Table 5. Effect of Wheat Flour Substitution with Composite Flour of Yellow Pumpkin (*Cucurbita moschata*) and Carrot (*Daucus carota* L.) on Nutritional Content

Nutrient Content	Treatment		
	F1	F2	F3
Beta Carotene (mg)	12,83	20,35	30,97
Carbohydrate (gr)	16,45	7,91	7,45
Protein (gr)	6,98	3,55	3,22
Fat (gr)	11,05	8,35	8,89

Table 5 shows that the higher the amount of carrot flour added to the biscuits, the higher the beta carotene content. The beta carotene content in F3 biscuits has the highest value of 30.97 mg per 100 g of biscuits, F2 as much as 20.35 mg and F1 as much as 12.83 mg.

Organoleptic testing of pumpkin carrot biscuits on 4 attributes namely colour, aroma, taste and texture was conducted by 30 trained panellists. Based on the colour attribute, it can be seen that F1 biscuits are light brown, F2 biscuits are brown and F3 biscuits are dark brown. The difference in colour occurred due to the effect of the addition of different carrot flour ingredients in the 3 formulas. The more carrot flour added will produce a darker biscuit colour. This occurs because of the beta carotene content which is an orange pigment. In line with Cahyadi's research in 2017 which states that the higher the beta carotene content, the lower the brightness level because the colour will be more orange, while the lower the beta carotene content, the brighter the yellow colour of the product will be [8]. In addition to the beta carotene content, the addition of carrot flour in making biscuits

also causes a Maillard reaction which has an impact on the brightness value of the product.

According to the aroma characteristics, F3 biscuits have a stronger aroma than F1 and F2 biscuits. The distinctive aroma detected is due to the presence of terpenoids and volatile compounds usually found in carrot [9]. The results of the assessment of flavour attributes showed that F1 biscuits were the sweetest compared to F2 and F3. F2 biscuits had a slightly bitter sweet flavour, while F3 biscuits had a slightly sour sweet flavour. The bitter taste in F2 biscuits was caused by the addition of more pumpkin flour which tends to have a bitter taste [10].

The three biscuit formulations showed no significant difference in texture. The results of the panellists' assessment showed that the texture of pumpkin carrot biscuits was quite dense and not easily crushed. The densest biscuit texture was found in F3 biscuits. This is due to the addition of carrot flour which is rich in fibre. According to Damayanti (2020), the higher the fibre content in food products, the harder and denser the texture [11].

Consuming 50 g of F1 biscuits alone can meet the needs of beta carotene in a day, when compared to the daily requirement of beta carotene, which is 6 - 15 mg per day. Referring to the standard nutritional claims according to the FDA, consuming F3 biscuits with a composition of 50 g of wheat flour, 50 g of pumpkin flour, and 150 g of carrot flour is qualified as a good source of beta carotene antioxidants. In accordance with the requirement that at least 10% of the RDI for vitamin A must be present in the form of beta carotene per serving. In addition, the nutritional content of F3 biscuits also contained lower carbohydrate and fat than F1, but the lowest protein content compared to F1 and F2.

Efforts to increase vitamin A are recommended by WHO, even nationally, in the form of using strategies that are in line with Vitamin A supplementation through efforts to consume a variety of foods and carry out food fortification [12]. According to SNI. 01.2973.1993 Biscuit is a dry food product made by baking dough containing basic ingredients of flour, fat and raising agents with or without the addition of other additional food ingredients. Biscuits in general have a high carbohydrate and fat content. The energy content in 100 g of biscuits is approximately 400-500 kcal. Nowadays, biscuits are not only a food source of energy, but also a source of other nutrients that the body really needs. When making biscuits, various food ingredients can be added which contain lots of vitamins, minerals and dietary fibber which are beneficial for health [13].

This research is in line with Dewi's research which found that there were significant differences in the aroma of cookies ($p<0.05$), Dewi's research also revealed that consumer acceptance of food is also determined by the aroma of the food. Aroma is also influenced by the composition of the ingredients used in a food product [14]. Aroma is a sensation caused by a material mixing with the surrounding air, depending on the quality of the aroma of the material. The higher the quality of the aroma, the wider its range for mixing with the surrounding air. The human sense of smell varies in terms of shape and sensitivity to scent recognition [15].

4. Conclusion

Organoleptic test results of carrot pumpkin composite flour biscuits in 3 types of formulations showed no significant difference in aroma and texture, but gave a significantly different effect on colour and taste preferences. The results of the nutritional content test analysis showed that there were significant differences between F1, F2 and F3 biscuits. Biscuit F3 has the highest beta carotene content of 30.97 mg. Biscuit F3 with a balance of 50 g of wheat flour, 50 g of pumpkin flour and 150 g of carrot flour is the best formulation judging from its organoleptic characteristics with the highest beta carotene content compared to F1 and F2. The conclusion of this study is that the substitution of wheat flour with composite flour of pumpkin (*Cucurbita moschata*) and carrot (*Daucus carota* L.) affects the nutritional content (beta carotene, carbohydrates, protein and fat) of biscuits.

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6. Reference

[1] Kemenkes RI. SSGI. Balitbangkes RI. 2022.

[2] Lestari E, Siregar A, Hidayat AK, Yusuf AA. Stunting and its association with education and cognitive outcomes in adulthood: A longitudinal study in Indonesia. 2024. *PLoS ONE* 19(5): e0295380. https://doi.org/10.1371/journal.pone.0295380. 2024.

[3] Hoddinott, J., et al. The global investment framework for nutrition: A tool for translating aspirations into action. *The Lancet* ,395(10217), 1280-1281. doi:10.1016/S0140-6736(20)30794-3. 2020.

[4] Aguayo, V. M., et al. Complementary feeding interventions have a small but significant impact on linear and ponderal growth of children in low- and middle-income countries: A systematic review and meta-analysis. The *Journal of Nutrition*,149(5), 824-835. doi:10.1093/jn/nxy308. 2019.

[5] De-Regil, L. M., et al. Use of Digital Technology to Improve the Effectiveness of Nutrition Interventions in Low- and Middle-Income Countries: Protocol for a Scoping Review. *JMIR Research Protocols*, 10 (2), e25953. doi:10.2196/25953. 2021.

[6] Fiedor, J., et al. The potential role of carotenoids as antioxidants in human health and disease. *Nutrients*,1(10), 2024. doi:10.3390/nu11102524. 2024.

[7] USDA Food Data Central. Beta carotene content of selected foods. Available at: https://fdc.nal.usda.gov/fdc-app.html. 2019.

[8] Cahyadi, K. Effect of Spray Drying and Foam-mat Drying Methods on the Physicochemical Characteristics of Instant Powder Drinks Blend of Pumpkin and Carrot. Mini Thesis. Universitas Katolik Soegijapranata Semarang. 2017.

[9] Chodijah, C. Herawati, N., & Ali, A. Utilisation of Carrot (*Daucus carota* L) in Ice Cream Making with the Addition of Kasturi Orange. *Sagu*,18(1), 25-38. 2019.

[10] Sugitha, I. M., Harsojuwono, B. A., & Yoga, I. W. Determination of Pumpkin (*Cucurbita moschata*) Biscuit Formula as Dietary Food For Patients With Diabetes Mellitus. *Media Ilmiah Teknologi Pangan*, 2(2), 98–105. 2015.

[11] Damayanti, S., Bintoro, V. P., & Setiani, B. E. Effect of Composite Flour Addition of Wheat, Bran and Red Bean on the Physical Properties of Cookies. *Journal of Nutrition College*, 9(3), 180-186. 2020.

[12] Gunawas, N. O., Abadi, E., & Mowwuta, H. I. Daya Terima Biskuit Wortel dengan Penambahan Tepung Kelor pada Anak Balita di Wilayah Kerja Puskesmas Perumnas. *Jurnal Kesehatan Masyarakat Celebes*, *2*(03), 15-25. 2021.

[13] Nasional BS. Mutu dan cara uji biskuit (SNI 01-2973-1992). BSN, Jakarta. 1992.

[14] Astarina, L. D. *Pengaruh Substitusi Tepung Wortel Pada Pembuatan Biskuit Ditinjau Dari Kadar B-Karoten, Sifat Organoleptik Dan Daya Terima* (Doctoral dissertation, Universitas Muhammadiyah Surakarta). 2010.

[15] Mayangsari, R., & Rasmiati, K. Effect Of Supplementation of F100 Biscuits Modified With Moringa Oleifera Flour Substitution on Nutritional Status of Under-Five Children With Malnutrition in Kendari City Indonesia. *Public Health of Indonesia*, *6*(1), 28-34. 2020.