

## The Effect of Adding Mocaf Flour (*Modified cassava flour*) and Kepok Banana Peels (*Musa paradisiaca forma typica*) on Vla Pie as Alternative Snack for Hypertension Patients

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### Abstract

Hypertension is a condition when blood pressure is above 140/90 mmHg. One of the causes of hypertension is a lack of calcium and potassium intake. Mocaf flour and kepok banana peels contain calcium and potassium. This study aims to analyze differences in organoleptic characteristics, public acceptability, calcium levels, potassium levels and water content in vla pie with adding mocaf flour and kepok banana peels. The research design used was experimental with a completely randomized design method, the use of wheat flour and mocaf flour, namely F1(50%:50%), F2(35%:65%), F3(20%:80%) and the addition of 50 grams of kepok banana peels in each treatment. The results of the Friedman statistical test showed no differences in aroma, texture and colour, but there was a significant difference in the taste of the Vla pie. The highest hedonic test results were found in F1. The highest calcium content is found in F3. The highest potassium content is found in F1. The water content is not following the pie quality standards in SNI. The conclusion is that vla pie with mocaf flour and kepok banana peels is acceptable to the public.

**Keywords:** Calcium, Kepok Banana Peels, Mocaf Flour, Potassium, Vla Pie

### Introduction

Hypertension is when the systolic blood pressure is above 140 mmHg and the diastolic blood pressure is above 90 mmHg after a re-examination (Unger *et al.*, 2020). The prevalence of hypertension in Indonesia in 2018 has increased since 2013, from 25.8% to 34.1% (Riset Kesehatan Dasar, 2013; Riset Kesehatan Dasar, 2018). It is far from the global target of overcoming non-communicable diseases, namely, to reduce the incidence of hypertension by 25% in 2025 (World Health Organization, 2021). Uncontrolled high blood pressure can cause complications such as heart disease, stroke, kidney disease, retinal damage, nerve disorders, cerebral disorders and peripheral vascular disease (Kemenkes, 2018). Factors that can influence the onset of hypertension include factors that cannot be changed, namely age and gender, as well as factors that can be changed, namely by preventing a deficiency in calcium and potassium intake (Krummel, 2008; US Department of Health and Human Service, 2006).

The use of drugs for the treatment of hypertension is a significant concern in drug selection because of the safety factor of long-term drug use (Wirjowidagdo & Sitanggang, 2002). Therefore, one way to reduce high blood pressure apart from using drugs is to innovate food products that can help lower blood pressure safely. When a person's calcium and potassium intake is low, it can cause blood pressure to rise and vice versa (Damayati, 2020; Putri, 2014). Therefore, it is necessary to innovate food products with attractive shapes that are liked by various age groups, such as vla pie with the addition of mocaf flour and kepok banana peels. This research aims to analyze the effect of adding mocaf flour and kepok banana peels to vla pie as an alternative snack for hypertension patients regarding differences in organoleptic characteristics, public acceptability, calcium content, potassium content and water content in vla pie.

### Methods

This research method is descriptive with a cross-sectional study design. This study was conducted in 4 schools in Surakarta City, namely State Senior High School 4 Surakarta, State Senior High School 5 Surakarta, Al-Abidin Bilingual Boarding School Surakarta, and State Vocational High School 9 Surakarta, which was conducted in July 2023, with inclusion criteria for research subjects in grades X-XI, age 15-18 years, attending school and living in the city of Surakarta. Exclusion criteria for adolescents who use appetite suppressants. Determination of the minimum sample size using the calculation formula of Slovin (1960) is:

$$\begin{aligned}n &= N / (1 + N \times e^2) \\&= 41093 / (1 + 41093 \times 0.12) \\&= 41093 / 411.93 \\&= 99.75 = 100 \text{ respondents}\end{aligned}$$

An estimate of a 15% loss to follow-up is:

$$n = 100 + (100 \times 15\%)$$

= 115 respondents

N: Population size / total population in Surakarta aged 15-19 years of 41093 people

n: Number of samples

e: margin of error (error tolerance) 10% or 0.1 (Badan *et al.*, 2021).

The Number of respondents for each school using the formula according to Sugiyono (2007) is  $n = (x / N) N_1$

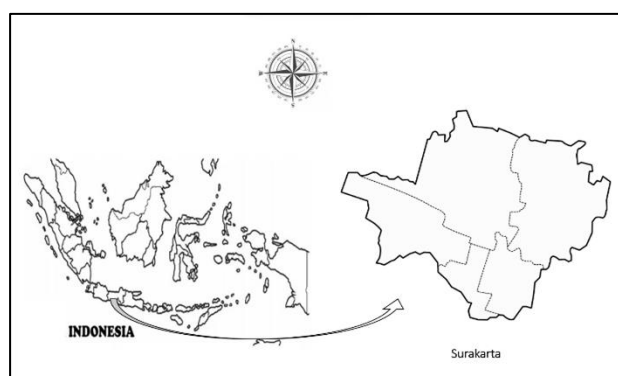
n = Number of desired samples per stratum

N = Total population of teenagers in the School

X = Total population in each stratum

N<sub>1</sub> = Sample

Based on the formula, the number of respondents from each school is State Senior High School 4 Surakarta =  $1134/4876 \times 115 = 26.7 = 27$  respondents, State Senior High School 5 Surakarta =  $1054/4876 \times 115 = 24.8 = 25$  respondents, Al-Abidin Bilingual Boarding School Surakarta =  $1054/4876 \times 115 = 26.1 = 27$  respondents, State Vocational High School 9 Surakarta =  $1581/4876 \times 115 = 37.2 = 38$  respondents. The total sample size is 117 adolescents.



**Figure 1.** Location of research in Surakarta City at four schools, State Senior High School 4 Surakarta (7°33'22.4"S 110°48'07.7"E), State Senior High School 5 Surakarta (7°33'00.8"S 110°49'50.3"E), Al-Abidin Bilingual Boarding School Surakarta (7°32'16.8"S 110°48'22.7"E), and State Vocational High School 9 Surakarta (7°32'05.0"S 110°48'15.5"E)

This study has received ethical approval from the Health Research Ethics Committee (KEPK) of the Faculty of Medicine, Sebelas Maret University, with the number 95/UN27.06.11/KEP/EC/2023. The data were primary, including body weight using a weight scale, height using a micrometer, and waist circumference using a midline to determine BMI/U and RFM values. Statistical tests to determine the relationship between variables used the Person Product Moment test if the data is normally distributed. If the data is not normally distributed, use the *Spearman rank* test.

## Results and Discussions

The research results in **Table 1** show that women dominate the characteristics of the gender research subjects compared to men, which is due to the higher number of female students than men. Based on BMI-for-age, most subjects were in the normal category, with 76 (65%) people, while the lowest was fewer than 10 (8.5%). In the percentage category of body fat using RFM, most samples were found at the height of 46 (39.3) people.

**Table 1.** Characteristics and distribution of samples based on variables studied

Category	n	%
<b>Gender type</b>		
Male	40	34.2
Female	77	65.8
<b>BMI-FOR-AGE</b>		
Poor nutrition	10	8.5
Normal nutrition	76	65.0
Overnutrition	20	17.1
Obesity	11	9.4
<b>Body Fat Percentage (RFM)</b>		
Fitness	34	29.1
Average	37	31.6
Obese	46	39.3

**Table 2** shows the frequency distribution of body mass index according to age (IMT/U) and per cent body fat using RFM. The respondents' IMT/U had a mean value of 3.27, a median of 3.00, a standard deviation of 0.75, a minimum value of 2.00, and a maximum value of 5.00. The respondents' per cent body fat with RFM had a mean value of 1.39, a median of 1.00, a standard deviation of 0.49, a minimum value of 1.00, and a maximum value of 2.00.

**Tabel 2.** Frequency Distribution of Body Mass Index Respondents by Age and Percent Body Fat Using Relative Fat Mass

	Mean	Median	Std. Deviation	Minimum	Maximum
IMT/U	3.27	3.00	0.75	2.00	5.00
RFM	1.39	1.00	0.49	1.00	2.00

**Table 3** shows the correlation test results between variables using the Spearman rank test. Then, the results obtained for the relationship between BMI-for-age and body fat percentage show, among other things, that there is a significant relationship with the result ( $p=0.000$ ,  $r=0.628^{**}$ ) where the value of  $p<0.05$  indicates that the higher a person's BMI-for-age value, the higher the value of the body fat per cent; otherwise, the smaller the BMI-for-age value, the lower the per cent of body fat. This research succeeded in observing the relationship between both.

The results of this study are in line with previous studies, which stated that there was a relationship between body fat percentage and BMI (Akindele *et al.*, 2016). The study conducted by Naulia *et al.* (2023) showed a significant relationship between BMI and body fat percentage ( $p<0.05$ ) with a positive direction. Another study with the same variable found a correlation between BMI and body fat percentage ( $p = 0.000$ ) with a sample size of 115 people meeting the productive age criteria (15–64 years), a study conducted in Semarang (Susantini, 2021). Similarly, a study conducted on medical students at Diponegoro University resulted in a positive correlation between BMI and individual body fat percentage, with an average fat content of 72.5% in the sample (Archilona *et al.*, 2016).

To the author, this is the first study to address the relationship between BMI and RFM. The study results show that there is a relationship between BMI/U and RFM. The results of this study are in line with previous studies, which stated that there was a relationship between BMI and the per cent body fat of adult women estimated by BIA (Misra *et al.*, 2019). Other supporting studies show that RFM has high accuracy in estimating body fat percentage (Paek *et al.*, 2019). RFM predicts the proportion of body fat more accurately (Woolcott & Bergman, 2018), so it can easily estimate adiposity in individuals (Corrêa *et al.*, 2021). RFM is a simple-to-calculate, sex-specific obesity indicator more closely approximates whole-body fat percentage than BMI (Suthahar *et al.*, 2023). The reference explains that separately, RFM is more accurate in predicting per cent fat than BMI in obese individuals (Paek *et al.*, 2019).

Obesity is the accumulation of excess fat that can be detrimental to health. Obesity results from an imbalance between energy consumed and energy spent (Jehan *et al.*, 2020). Increased consumption of high-energy foods such as fat and sugar can lead to an increase in body fat percentage (WHO, 2021). The gradual and periodic measurement of anthropometry is one of the methods of preventing obesity. Anthropometric measurement methods include the calculation of age-based body mass index (BMI-for-age), upper arm circumference (LILA), neck circle, waist-to-arm circle comparison (RLPP), and skin fold thickness (SKF), bioelectric impedance analysis (BIA) and double-energy x-ray absorption (DXA) (Supariasa *et al.*, 2016).

The advantage of RFM in measuring body fat percentage is that it is a simple, inexpensive, and non-invasive technique (Corrêa *et al.*, 2021). Thus, its use is more popular. It is known that BMI is correlated with body fat mass (Jeong *et al.*, 2023). One study determined that the body mass index (BMI) correlates strongly with the body fat mass determined by the bioelectrical impedance analysis (BIA) method. Still, the BIA method is superior to the BMI method in determining body mass composition (Wiranata & Inayah, 2020).

A study stated that a person who followed nutrition counselling experienced a decrease in the percentage of overweight women's body fat and obesity among Pilates gym participants (Ranitadewi *et al.*, 2018). Therefore, it is essential to note the importance of keeping the body mass index according to age in adolescents within the normal range. BMI-for-age is closely linked to total body fat levels, so it can trigger the onset of obesity, which may trigger various fatal diseases. Teenagers who are obese or overweight can be prevented by performing routine measurements of BMI-for-age and body fat percentage.

## Conclusions

The study was conducted on adolescents in Surakarta City at State Senior High School 4 Surakarta, State Senior High School 5 Surakarta, Al-Abidin Bilingual Boarding School Surakarta, and State Vocational High School 9 Surakarta with a total sample of 117 people where the majority of the sample was female with a percentage of 65.8%. Based on the results of the Rank Spearman test conducted, the data showed a significant solid relationship with a positive direction between body mass index according to age (IMT/U) and per cent body fat using Relative Fat Mass (RFM) ( $p=0.000$ ). The results showed that the higher a person's body mass index, the higher the body fat percentage. Therefore, excessive fat accumulation can lead to obesity and hurt health. The results of this study are expected to be a scientific reference in school nutrition programs to determine the nutritional status and percentage of body fat in students using IMT/U and RFM, which are conducted periodically.

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## References

- Akindele MO, Phillips JS and Igumbor EU (2016). The Relationship between Body Fat Percentage and Body Mass Index in Overweight and Obese Individuals in an Urban African Setting. *Journal of Public Health in Africa*, 7(1), pp.: 15–19. doi: 10.4081/jphia.2016.515.
- Archilona ZY, Nugroho KH and Puruhita N (2016). Hubungan Antara Indeks Massa Tubuh (IMT) Dengan Kadar Lemak Total (Studi Kasus Pada Mahasiswa Kedokteran Undip). *Jurnal Kedokteran Dipenogoro*, 5(2), pp.: 122–131.
- Badan Pusat Statistik Kota Surakarta (2021). *Jumlah Penduduk Menurut Kelompok Umur Dan Jenis Kelamin (Jiwa), 2020-2021*. Available at: <https://surakartakota.bps.go.id/indicator/12/319/1/jumlah-penduduk-menurut-kelompok-umur-dan-jenis-kelamin.html>.
- Corrêa CR, Formolo NPS, Dezanetti T, Speretta GFF and Nunes EA (2021). Relative Fat Mass Is a Better Tool to Diagnose High Adiposity When Compared to Body Mass Index in Young Male Adults: A Cross-Section Study. *Clinical Nutrition ESPEN*, 41, pp.: 225–233. doi: 10.1016/j.clnesp.2020.12.009.
- Hardinsyah and Supriasa I (2017). *Ilmu Gizi Teori Dan Aplikasinya*. Jakarta: EGC.
- Jebeile H, Kelly AS, O'Malley G and Baur LA (2022). Obesity in Children and Adolescents: Epidemiology, Causes, Assessment, and Management. *The Lancet Diabetes and Endocrinology*, 10(5), pp.: 351–365. doi: 10.1016/S2213-8587(22)00047-X.
- Jehan S, Zizi F, Pandi-Perumal SR, McFarlane SI, Jean-Louis G and K Myers A (2020). Energy Imbalance: Obesity, Associated Comorbidities, Prevention, Management and Public Health Implications. *Advances in Obesity, Weight Management & Control*, 10(5), pp.: 146–161. doi: 10.15406/aowmc.2020.10.00321.
- Jeong SM, Lee DH, Rezende LFM and Giovannucci EL (2023). Different Correlation of Body Mass Index with Body Fatness and Obesity-Related Biomarker According to Age, Sex and Race-Ethnicity. *Scientific Reports*, 13(1), pp.: 1–11. doi: 10.1038/s41598-023-30527-w.
- Kansra AR, Lakkunarajah S and Jay MS (2021). Childhood and Adolescent Obesity: A Review. *Frontiers in Pediatrics*, 8(January), pp.: 1–16. doi: 10.3389/fped.2020.581461.
- Limbong MNA and Malinti E (2023). Tubuh Dan Lemak Viseral Pda Mahaiswa Fakultas Ilmu Keperawatan. *Nutrix Journal*, 7(288), pp.: 43–49.
- Lin X and Li H (2021). Obesity: Epidemiology, Pathophysiology, and Therapeutics. *Frontiers in Endocrinology*, 12(September), pp.: 1–9. doi: 10.3389/fendo.2021.706978.
- Misra P, Singh AK, Archana S, Lohiya A and Kant S (2019). Relationship between Body Mass Index and Percentage of Body Fat, Estimated by Bio-Electrical Impedance among Adult Females in a Rural Community of North India: A Cross-Sectional Study. *Journal of postgraduate medicine*, 65(3), pp.: 134–140. doi: 10.4103/jpgm.JPGM\_218\_18.
- Paek JK, Kim J, Kim K and Lee SY (2019). Usefulness of Relative Fat Mass in Estimating Body Adiposity in Korean Adult Population. *Endocrine Journal*, 66(8), pp.: 723–729. doi: 10.1507/endocrj.EJ19-0064.

- Powell-Wiley TM, Poirier P, Burke LE, Després JP, Gordon-Larsen P, Lavie CJ, Lear SA, Ndumele CE, *et al.* (2021). Obesity and Cardiovascular Disease A Scientific Statement From the American Heart Association. *Circulation*, 143(21), pp.: E984–E1010. doi: 10.1161/CIR.0000000000000973.
- Puspitasari DI, Widiyaningsih EN and Soviana E (2019). *Peranan Gizi Dalam Siklus Hidup Manusia*. Surakarta: Muhammadiyah University Press.
- Ranitadewi IN, Syaqui A and Wijayanti HS (2018). Pengaruh Pemberian Konseling Gizi Terhadap Persen Lemak Tubuh Wanita Overweight Dan Obesitas Peserta Senam Pilates. *Journal of Nutrition College*, 7(3), pp.: 123. doi: 10.14710/jnc.v7i3.22271.
- Riskesdas K (2018). *Laporan Provinsi Jawa Tengah Riskesdas*. Jakarta: Badan Penelitian dan Pengembangan Kesehatan.
- Slovin MJ (1960). *Sampling*. New York: Simon and Schuster Inc.
- Supriasa I, Bakri B and Fajar I (2016). *Penilaian Status Gizi*. Edisi Revi. Jakarta: Penerbit Buku Kedokteran EGC.
- Susantini P (2021). Hubungan Indeks Masa Tubuh (IMT) Dengan Persen Lemak Tubuh, Dan Lemak Viscelar Di Kota Semarang. *Jurnal Gizi*, 10(1), pp.: 51. doi: 10.26714/jg.10.1.2021.51-59.
- Suthahar N, Wang K, Zwartkruis VW, Bakker SJL, Inzucchi SE, Meems LMG, Eijgenraam TR, Ahmadizar F, *et al.* (2023). Associations of Relative Fat Mass, a New Index of Adiposity, with Type-2 Diabetes in the General Population. *European Journal of Internal Medicine*, (October 2022). doi: 10.1016/j.ejim.2022.12.024.
- WHO (2021). *Obesity and Overweight*. World Health Organization. Available at: <https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight>.
- Wiranata Y and Inayah I (2020). Perbandingan Penghitungan Massa Tubuh Dengan Menggunakan Metode Indeks Massa Tubuh (IMT) Dan Bioelectrical Impedance Analysis (BIA). *Jurnal Manajemen Kesehatan Yayasan RS.Dr. Soetomo*, 6(1), pp.: 43. doi: 10.29241/jmk.v6i1.280.
- Woolcott OO and Bergman RN (2018). Relative Fat Mass (RFM) as a New Estimator of Whole-Body Fat Percentage — A Cross-Sectional Study in American Adult Individuals. *Scientific Reports*, 8(1), pp.: 1–11. doi: 10.1038/s41598-018-29362-1.
- Woolcott OO and Seuring T (2022). Prevalence Trends in Obesity Defined by the Relative Fat Mass (RFM) Index among Adults in the United States: 1999–2018. *Metabolism*, 128, pp.: 155027. doi: 10.1016/j.metabol.2021.155027.
- Yao A (2013). Screening for and Management of Obesity in Adults: U.S. Preventive Services Task Force Recommendation Statement: A Policy Review. *Annals of Medicine and Surgery*, 2(1), pp.: 18–21. doi: 10.1016/S2049-0801(13)70022-0.