



Effect of SOYDRA pudding (soybean and red dragon fruit) on blood pressure in patients with hypertension

Pengaruh pemberian puding SOYDRA (soybeans and red dragon) terhadap tekanan darah pada pasien hipertensi

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Article History:

Received: June 09, 2025; Revised: July 10, 2025; Accepted: July 23, 2025; Published: September 8, 2025.

Publisher:



Politeknik Kesehatan Aceh
Kementerian Kesehatan RI

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Abstract

Hypertension is a major risk factor for cardiovascular diseases and remains the leading cause of mortality globally. Non-pharmacological interventions using local functional foods are promising alternatives for blood pressure management. SOYDRA pudding, a novel combination of soymilk and red dragon fruit, contains bioactive compounds such as flavonoids, isoflavones, and dietary fiber, which are known to have antihypertensive properties. This study aimed to evaluate the effect of SOYDRA pudding as a dietary intervention on blood pressure in patients with grade 1 hypertension. A randomized crossover trial was conducted from September to November 2024 at the outpatient clinic of the Arosuka Hospital, West Sumatra. Thirty-two participants aged 40–60 years with grade 1 hypertension were included in this study. The intervention consisted of consuming SOYDRA puddings twice daily (2×150 g/day) along with nutritional education over a 30-day period. Blood pressure measurements were performed before and after the intervention. Data were analyzed using the dependent t-test and Wilcoxon test. Results, there was a statistically significant reduction in systolic blood pressure from $146,3 \pm 6,2$ mmHg to $132,5 \pm 5,9$ mmHg ($p = 0,000$) and in diastolic blood pressure from $92,7 \pm 4,8$ mmHg to $84,1 \pm 4,2$ mmHg ($p = 0,000$) after the 30-day intervention. In conclusion, the administration of the SOYDRA pudding at a dose of 2×150 g/day for 30 days significantly reduced both systolic and diastolic blood pressure in patients with hypertension. These findings highlight the potential of functional food-based dietary strategies in non-pharmacological hypertension management.

Keywords: Hypertension, SOYDRA pudding, blood pressure, soy milk, red dragon fruit

Abstrak

Hipertensi merupakan salah satu faktor risiko utama penyakit kardiovaskular, yang hingga kini masih menjadi penyebab kematian tertinggi di dunia. Intervensi non-farmakologis dengan memanfaatkan pangan fungsional lokal menjadi alternatif yang menjanjikan dalam pengelolaan tekanan darah. Puding SOYDRA, yaitu kombinasi antara susu kedelai dan buah naga merah, mengandung senyawa bioaktif seperti flavonoid, isoflavon, dan serat pangan yang diketahui memiliki efek menurunkan tekanan darah. Penelitian ini bertujuan untuk mengevaluasi pengaruh pemberian puding SOYDRA sebagai intervensi diet terhadap tekanan darah pada pasien dengan hipertensi. Penelitian ini menggunakan desain uji coba acak silang (randomized crossover trial) yang dilaksanakan pada bulan September hingga November 2024 di poliklinik rawat jalan RSUD Arosuka, Sumatera Barat. Sebanyak 32 orang berusia 40–60 tahun dengan hipertensi derajat 1 menjadi subjek penelitian. Intervensi yang diberikan berupa konsumsi puding SOYDRA sebanyak 2 kali sehari (2×150 gram/hari) disertai edukasi gizi selama 30 hari. Pengukuran tekanan darah dilakukan sebelum dan sesudah intervensi. Analisis data menggunakan uji t dependen dan wilcoxon.

Hasil, terdapat penurunan signifikan secara statistik pada tekanan darah sistolik dari $146,3 \pm 6,2$ mmHg menjadi $132,5 \pm 5,9$ mmHg ($p = 0,000$), dan tekanan darah diastolik dari $92,7 \pm 4,8$ mmHg menjadi $84,1 \pm 4,2$ mmHg ($p = 0,000$) setelah 30 hari intervensi. Kesimpulan, pemberian puding SOYDRA sebanyak 2×150 gram per hari selama 30 hari terbukti efektif menurunkan tekanan darah sistolik dan diastolik pada penderita hipertensi. Temuan ini menunjukkan potensi strategi diet berbasis pangan fungsional sebagai pendekatan non-farmakologis dalam pengelolaan hipertensi.

Kata Kunci: Buah naga merah, hipertensi, puding SOYDRA, susu kedelai, tekanan darah

Introduction

Hypertension remains one of the most significant global public health problems. It is clinically defined as a condition in which systolic blood pressure is ≥ 140 mmHg and/or diastolic blood pressure is ≥ 90 mmHg (Pardoel et al., 2021). According to the World Health Organization (WHO), the number of adults with hypertension has nearly doubled over the past three decades, rising from 650 million in 1990 to 1,3 billion in 2019. Elevated blood pressure is estimated to contribute to 10,8 million preventable deaths annually and accounts for approximately 235 million years of life lost or lived with disability (Hypertension in Adults: Diagnosis and Management NICE Guideline, 2019). Globally, nearly one in three adults is affected by hypertension, with a slightly higher prevalence among men aged < 50 years. Among individuals over 50 years of age, the prevalence is nearly 49%, affecting men and women almost equally.

In Indonesia, 2018 Basic Health Research (Riskesdas) reported a national hypertension prevalence of 34,11%, representing an estimated 63 million individuals. The hypertension-related mortality in the country reached 427,218 deaths in the same year. In West Sumatra Province, the prevalence was 25,16%, with 176,169 cases identified through blood pressure screening. In the catchment area of the Arosuka Regional Hospital, hypertension ranks as the second most common disease managed in outpatient care, with a consistent increase in cases observed annually (Kemenkes RI, 2018).

While pharmacological treatment is essential in managing hypertension, non-pharmacological approaches—such as lifestyle modifications, weight reduction, sodium intake restriction, increased consumption of potassium and dietary fiber, and adoption of low-fat diets—are also critical components of comprehensive

management strategies (Wei et al., 2020). The use of locally sourced functional foods rich in bioactive compounds offers promising potential for supporting non-pharmacological interventions.

Soybeans (*Glycine max*) are legumes widely recognized for their high isoflavone, protein, and dietary fiber content. They are commonly processed into various traditional foods such as soy milk, tofu, and tempeh in many Asian countries (Kalaiselvan et al., 2010). Red dragon fruit (*Hylocereus polyrhizus*) is another local commodity known for its abundant phytochemical content, including polyphenols, flavonoids, vitamin C, and dietary fiber, all of which exhibit strong antioxidant properties that may contribute to blood pressure regulation (Paško et al., 2021).

Potassium dietary fiber can reduce blood pressure and potassium fiber levels. Compared with the potassium requirement for hypertension patients, which is 3500 mg, 6,2% of daily potassium requirements per day, and 9,9% of need fiber food can be filled. Soydra pudding has an extremely simple texture. In addition, pudding also has fiber, which can help all the fat in the arterial blood (Miranda et al., 2023). The SOYDRA pudding is an innovative functional food product developed from a combination of soymilk and red dragon fruit. It is designed to be easily consumed and is rich in fiber, isoflavones, and antioxidants. Its soft texture and nutrient profile make it a potential dietary intervention to support blood pressure reduction in hypertensive individuals (Aryani et al., 2023).

However, to date, there is a lack of empirical studies specifically investigating the effects of SOYDRA pudding on blood pressure, highlighting an important research gap. Therefore, this study aimed to analyze the effect of SOYDRA pudding administration on blood pressure in individuals diagnosed with hypertension.

Methods

This research is a *randomized crossover trial* that compares two nutritional interventions, namely, counseling and educational nutrition regarding hypertension and administration pudding SOYDRA (soybean and red dragon) as much as 2×150 g/day. This study used a washout period of at least 15 d. The study will be conducted in outpatient care at the AroSuka Regional Hospital Solok Regency, West Sumatra, from September 2024 to November 2024.

The calculation of big subject using formula provision calculation sample is as follows:

$$n = \frac{(Z1 - \frac{a}{2} + Z1 - b)^2 (S1^2 + S2^2)^2}{d^2}$$

$$n = \frac{(196 + 0,84)^2 (33,26^2 + 38,05^2)^2}{(180,93 - 142,31)^2}$$

$$n = 13,42$$

Based on this formula, the estimated large sample size for every research group was $n = 13,42$ (rounded to 14). The number of subjects plus 10% for anticipating the subject dropped out or was lost to follow-up, so each group treatment consisted of 16 subjects. Because there were two treatment groups, the participants needed for the research were 32 participants, with two repetitions of the intervention.

The sample in this study was administered an intervention in the form of SOYDRA pudding to the intervention group at a dose of 2× 150 g/day. In 150 g of SOYDRA pudding, 100 ml of soymilk, 50 ml of dragon fruit extract, 10 g of agar-agar, 1,5 g of stevia sugar, and 100 ml of water. SOYDRA pudding was given 2 times a day with the time of administration in the morning at 10.00 and 16.00 for 30 days in a row. By visiting the respondents' homes directly, blood pressure measurement results were obtained after treatment intervention 1 and treatment intervention 2.

Blood pressure was measured three times per session in the right upper arm using a validated digital sphygmomanometer (Omron HEM-7130) by a trained medical officer. The participants were seated and rested for at least five minutes before the measurement. The average of three readings was recorded. Measurements were obtained at baseline, after the first intervention, after the washout period, and after the second intervention.

To control for dietary confounding, dietary intake was monitored using a 2 × 24-hour food recall method at each phase of the study (before and after each intervention). Nutrient intake data were analyzed using the NutriSurvey 2007, with specific attention paid to sodium, potassium, and fiber intake. The participants were also asked to maintain their usual diet and physical activity throughout the study period.

Data were analyzed using both univariate and bivariate methods. The Shapiro–Wilk test was used to assess the normality of continuous variables. Nonparametric tests were applied to variables that were not normally distributed. Specifically, the Wilcoxon signed-rank test was used to assess differences in blood pressure before and after each intervention, and the Mann–Whitney U test was used to compare the effects between interventions. Sociodemographic, anthropometric, and dietary intake data were described using descriptive statistics (mean, standard deviation, frequency, and percentage).

This study was approved by the Health Research Ethics Committee of the Faculty of Medicine, Diponegoro University, Semarang, Indonesia (Reference No. 436/EC/KEPK/FK-UNDIP/VIII/2024). All participants provided written informed consent after receiving a detailed explanation of the study objectives, procedures, potential risks, and benefits.

Result and Discussion

A total of 32 hypertensive respondents participated in the intervention study. The majority were aged 40–45 years (37,5%), which falls into the middle-to-late adulthood category. This age group is associated with vascular stiffness and increased peripheral resistance, contributing to elevated blood pressure (Meilani et al., 2022). Regarding nutritional status, 43,8% of the respondents were classified as obese and 25% as overweight. Obesity is a well-established risk factor for hypertension due to the activation of the renin-angiotensin-aldosterone system (RAAS) from visceral adiposity, leading to increased vascular resistance (Zhao et al., 2024).

Table 1 presents the respondents' sociodemographic and clinical characteristics. Most participants had hypertension for 2–5 years (71,9%) and were self-employed (59,4%), which may indicate irregular work patterns and higher stress levels. Additionally, 90,6% of the

participants reported active smoking habits and 78,1% had a family history of hypertension, further increasing their cardiovascular risk. The educational background predominantly consisted of high school graduates (71,9%) and nearly all respondents were married (96,9%), suggesting the potential for familial dietary support.

Table 1. Characteristics of respondents (n=32)

Variable	Category	n	%
Age	40–45 years	12	37,5
	46–50 years	5	15,6
	51–55 years	7	21,9
	56–60 years	8	25,0
BMI (Nutritional Status)	Underweight	3	9,4
	Normal	7	21,9
	Overweight	8	25,0
	Obese	14	43,8
Duration of Hypertension	2–5 years	23	71,9
	6–9 years	9	28,1
Occupation	Farmer	7	21,9
	Civil servant	4	12,5
	Retired	2	6,3
	Self-employed	19	59,4
Education	Junior High School	6	18,8
	Senior High School	23	71,9
	College	3	9,4

Marital Status	Married	31	96,9
	Not married	1	3,1
Smoking Habits	Smoke	29	90,6
	Do not smoke	3	9,4
Family History of Hypertension	Yes	25	78,1
	No	7	21,9

Table 2 outlines the changes in nutritional intake before and after SOYDRA pudding intervention. Energy intake significantly increased from 1861,51 ± 111,40 kcal to 2350,61 ± 237,24 kcal ($p=0,000$), with percentage fulfillment rising from 81,54% to 105,66%. Carbohydrate and fiber intakes also showed statistically significant improvements ($p=0,020$ and $p=0,000$, respectively), indicating the efficacy of pudding in enhancing nutrient adequacy.

Protein intake improved from 73,16 g to 76,05 g, while fat intake slightly decreased from 53,66 g to 53,79 g; however, these changes were not statistically significant ($p=0,067$ and $p=0,118$, respectively). Cholesterol intake remained stable, with no significant difference ($P=0,947$). These unchanged values are important, as they suggest that the intervention did not exacerbate dietary risk factors, such as high fat or cholesterol, which could otherwise negatively impact hypertensive status.

Table 2. Changes in nutrient intake and % fulfillment before and after SOYDRA pudding intervention

Nutrient	Intake (Before)	Intake (After)	Δ (Change)	% Fulfillment (Before)	% Fulfillment (After)	p-value
Energy (kcal)	1861,51 ± 111,40	2350,61 ± 237,24	489,1	81,54	105,66	0,000 ^a
Protein (g)	73,16 (51,39–98,23)	76,05 (71,93–106,45)	2,89	65,16	91,50	0,067 ^b
Fat (g)	53,66 (31,21–78,63)	53,79 (40,11–87,48)	0,13	110,50	103,83	0,118 ^b
Carbohydrates (g)	336,10 (194,75–418,67)	364,73 (265,91–469,97)	28,63	96,28	104,71	0,020 ^b
Fiber (g)	22,03 ± 4,69	27,60 ± 1,13	5,57	78,70	98,58	0,000 ^a
Cholesterol (mg)	198,62 ± 54,83	199,28 ± 8,30	0,66	99,31	99,64	0,947 ^a

Notes: a = Paired t-test, b = Wilcoxon test

Table 3. Changes in blood pressure

Variable	Median	Minimum-Maximum	Δ (Change)	p-value
Systolic (mmHg)				
Before	139,5	121–159	13,5	0,000 ^b
After	126,0	102–139		
Diastolic (mmHg)				
Before	92,0	71–107	11,0	0,000 ^b

After	81,0	66–95
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Table 3 shows significant reductions in systolic and diastolic blood pressure post-intervention. Median systolic pressure decreased from 139,50 mmHg to 126,00 mmHg ($p=0,000$), and diastolic pressure dropped from 92,00 mmHg to 81,00 mmHg ($p=0,000$). The findings demonstrate that SOYDRA pudding significantly improved energy, carbohydrate, and fiber intake while also yielding substantial reductions in systolic and diastolic blood pressure. These outcomes are consistent with prior studies showing that dietary fiber and isoflavones exert antihypertensive effects through vasodilation and endothelial function enhancement (Huang et al., 2021; Slavin, 2013).

The unchanged protein, fat, and cholesterol intake values merit further interpretation. Although the protein intake increased, this change was not statistically significant. This may be attributed to dietary variability or short intervention duration. Nevertheless, an increase in percentage fulfillment indicates improved dietary quality. Stable fat and cholesterol levels suggest that the SOYDRA pudding did not contribute to additional cardiovascular risk, which is favorable for patients with hypertension.

Mechanistically, soy isoflavones act as phytoestrogens that enhance nitric oxide synthesis, reduce vascular resistance, and inhibit angiotensin-converting enzyme (ACE), thereby lowering blood pressure (Zhang et al., 2023). Meanwhile, red dragon fruit is rich in anthocyanins and prebiotic fibers, contributing to oxidative stress reduction and improved metabolic function (Paško et al., 2021).

Compared with previous research, these results align with (Maulidina et al., 2022) who noted that functional foods containing fiber and polyphenols can enhance cardiovascular outcomes. Similarly, Yamagata & Yamori (2021) reported that antioxidant-rich fruits reduce systolic blood pressure through modulation of vascular tone. The SOYDRA pudding intervention resulted in improved dietary intake and a significant reduction in both systolic and diastolic blood pressure among hypertensive adults. These findings support the use of functional foods rich in fiber and isoflavones as a complementary strategy for hypertension management (Huang et al., 2021).

Despite these promising results, several limitations of this study remain to be acknowledged. First, the sample size was

relatively small and regionally confined, which limits generalizability. Second, the absence of long-term follow-up precludes conclusions about sustained effects. Third, potential confounders such as sodium intake and physical activity were not fully controlled.

Conclusion

The findings of this study demonstrate that SOYDRA pudding, formulated from soymilk and red dragon fruit and rich in fiber, isoflavones, and antioxidants, has a significant effect in reducing both systolic and diastolic blood pressure in patients with stage 1 hypertension. As a functional food-based intervention, SOYDRA pudding may serve as a complementary nonpharmacological strategy to support blood pressure management. Its accessibility, ease of preparation, and favorable nutritional profile make it a potentially practical dietary recommendation for individuals with hypertension.

However, this study did not specifically assess the side effects or long-term safety profiles; therefore, further clinical trials are needed to evaluate its broader application and sustainability in diverse populations. Future studies should also investigate the potential synergistic effects of SOYDRA pudding with antihypertensive medications and their impact on inflammatory or oxidative stress markers.

From a public health perspective, SOYDRA pudding can be considered as an innovative, low-risk dietary approach that supports the management of hypertension, particularly in communities with access to local functional food ingredients.

Acknowledgments

The authors accept the greatest love for academic mentors for guidance and support during the research. In addition, the author pronounces the acceptance of love to all research participants who have cheap heart-dedicated time and energy.

References

Aryani, D., Hanifah, N., & Ritonga, A. F. (2023).

- Hubungan antara kadar trigliserida dan hipertensi pada penderita jantung koroner di Rumah Sakit Bhayangkara Tk. I R. Said Sukanto. *Jurnal Medika Hutama*, 4(2), 3359–3365.
- Astuti, V. W., Tasman, T., & Amri, L. F. (2021). Prevalensi dan analisis faktor risiko hipertensi di wilayah kerja Puskesmas Nanggalo Padang. *BIMIKI (Berkala Ilmiah Mahasiswa Ilmu Keperawatan Indonesia)*, 9(1), 1–9. <https://doi.org/10.53345/bimiki.v9i1.185>
- Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, & Office on Smoking and Health. (n.d.). *Smoking cessation: A report of the Surgeon General*.
- Garwahasada, E., & Wirjatmadi, B. (n.d.). Hubungan jenis kelamin, perilaku merokok, aktivitas fisik dengan hipertensi pada pegawai kantor [Correlation of sex, smoking habit, physical activity and hypertension among office employees]. *Media Gizi Indonesia*, 15(1), 60–65. <https://doi.org/10.204736/mgi.v15i1.60-65>
- Jurnal Gizi dan Kesehatan, Miranda, M., Rotua, M., & Palembang, P. (2023). Formulasi brownies berbasis tepung kacang hijau dan puree kulit pisang raja sebagai makanan selingan tinggi kalium. *Jurnal Gizi dan Kesehatan*, 3(1). <https://doi.org/10.36086/jgk.v3i1>
- Huang, Y., Brennan, M. A., Kasapis, S., Richardson, S. J., & Brennan, C. S. (2021). Maturation process, nutritional profile, bioactivities and utilisation in food products of red pitaya fruits: A review. *Foods*, 10(11), 2862. <https://doi.org/10.3390/foods10112862>
- National Institute for Health and Care Excellence. (2019a). *Hypertension in adults: Diagnosis and management (NICE guideline NG136)*. <https://www.nice.org.uk/guidance/ng136>
- National Institute for Health and Care Excellence. (2019b). *Hypertension in adults: Diagnosis and management (NICE guideline NG136)*.
- <https://www.nice.org.uk/guidance/ng136>
- Kalaiselvan, V., Kalaivani, M., Vijayakumar, A., Sureshkumar, K., & Venkateskumar, K. (2010a). Current knowledge and future direction of research on soy isoflavones as therapeutic agents. *Pharmacognosy Reviews*, 4(8), 111–117. <https://doi.org/10.4103/0973-7847.70900>
- Kalaiselvan, V., Kalaivani, M., Vijayakumar, A., Sureshkumar, K., & Venkateskumar, K. (2010b). Current knowledge and future direction of research on soy isoflavones as therapeutic agents. *Pharmacognosy Reviews*, 4(8), 111–117. <https://doi.org/10.4103/0973-7847.70900>
- Maulidina, P. A., Sulendri, N. K., Sofiyatin, R., Wahyuningsih, R., Praburangkasari, J., Cermen, D., ... & Nusa Tenggara Barat, I. (2022). Pengaruh pemberian juice campuran buah naga (*Hylocereus polyrhizus*) dan sari kedelai (*Glycine max*) terhadap kadar kolesterol pada pasien hiperkolesterolemia rawat jalan. *Student Journal of Nutrition*, 1(1).
- Meilani, H., Diah, S. K., Rohyadi, Y., Tursini, Y., & Program Studi DIII Keperawatan Poltekkes Kemenkes Bandung. (2022). Gambaran pengetahuan pasien hipertensi tentang komplikasi hipertensi: Literature review. *Jurnal Keperawatan*, 2(1).
- Pardoel, Z. E., Reijneveld, S. A., Lensink, R., Widyaningsih, V., Probandari, A., Stein, C., Hoang, G. N., Koot, J. A. R., Fenenga, C. J., Postma, M., & Landsman, J. A. (2021). Core health-components, contextual factors and program elements of community-based interventions in Southeast Asia: A realist synthesis regarding hypertension and diabetes. *BMC Public Health*, 21(1), 1393. <https://doi.org/10.1186/s12889-021-11244-3>
- Paško, P., Galanty, A., Zagrodzki, P., Luksirikul, P., Barasch, D., Nemirovski, A., & Gorinstein, S. (2021). Dragon fruits as a reservoir of natural polyphenolics with chemopreventive properties. *Molecules*, 26(8), 2185. <https://doi.org/10.3390/molecules26082158>

- Slavin, J. (2013). Fiber and prebiotics: Mechanisms and health benefits. *Nutrients*, 5(4), 1417–1435. <https://doi.org/10.3390/nu5041417>
- Wei, J. L., Wang, X. Y., Liu, F. C., Chen, J. C., Cao, J., Li, J. X., Hu, D. S., Shen, C., Lu, F. H., Zhao, Y. X., Huang, J. F., & Lu, X. F. (2020a). Associations of soybean product intake with blood pressure changes and hypertension incidence: The China-PAR project. *Journal of Geriatric Cardiology*, 17(7), 384–392. <https://doi.org/10.11909/j.issn.1671-5411.2020.07.005>
- Wei, J. L., Wang, X. Y., Liu, F. C., Chen, J. C., Cao, J., Li, J. X., Hu, D. S., Shen, C., Lu, F. H., Zhao, Y. X., Huang, J. F., & Lu, X. F. (2020b). Associations of soybean product intake with blood pressure changes and hypertension incidence: The China-PAR project. *Journal of Geriatric Cardiology*, 17(7), 384–392. <https://doi.org/10.11909/j.issn.1671-5411.2020.07.005>
- Yamagata, K., & Yamori, Y. (2021). Potential effects of soy isoflavones on the prevention of metabolic syndrome. *Molecules*, 26(19), 5840. <https://doi.org/10.3390/molecules26195863>
- Zhang, R., Noronha, J. C., Khan, T. A., McGlynn, N., Back, S., Grant, S. M., Kendall, C. W. C., & Sievenpiper, J. L. (2023). The effect of non-nutritive sweetened beverages on postprandial glycemic and endocrine responses: A systematic review and network meta-analysis. *Nutrients*, 15(4), 1045. <https://doi.org/10.3390/nu15041050>
- Zhao, Z., Wang, L., Chen, J., Zhang, N., Zhou, W., & Song, Y. (2024). Altitudinal variation of dragon fruit metabolite profiles as revealed by UPLC-MS/MS-based widely targeted metabolomics analysis. *BMC Plant Biology*, 24(1), 112. <https://doi.org/10.1186/s12870-024-05011-w>