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Effects of Honey Supplementation on Hemoglobin and Blood Pressure in Elderly: A Double-blind RCT in Indonesia

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ABSTRACT

Background: The physiological changes associated with aging often predispose individuals to anemia and cardiovascular dysfunction, prompting interest in natural interventions that may support hematological and vascular health. This study aimed to evaluate the effects of honey supplementation on hemoglobin levels and blood pressure in elderly individuals.

Methods: A double-blind randomized controlled trial was conducted in Makassar, Indonesia, involving 44 participants aged over 60 years. The intervention group received 10 milliliters of pure honey daily for two months, while the control group received standard nutritional counseling. Hemoglobin and blood pressure measurements were collected at baseline and post-intervention.

Result: The results revealed a statistically significant increase in hemoglobin levels in the honey group, with a mean rise of 1.18 grams per deciliter, indicating honey's potential to enhance erythropoiesis and improve hematological status through its antioxidant and anti-inflammatory properties. However, no significant changes were observed in systolic or diastolic blood pressure. This research contributes to the growing field of functional food science by offering empirical evidence on honey's role in elderly care and guiding future integrative health interventions.

Key words: Antioxidant, Blood pressure, Elderly, Functional foods, Hemoglobin, Honey.

INTRODUCTION

Aging is accompanied by physiological transformations that significantly influence the health status of older adults, particularly in hematologic and cardiovascular systems. Among the most prevalent and debilitating conditions in this demographic are anemia and hypertension. Globally, anemia affects a considerable proportion of the elderly. Its prevalence ranges widely, from approximately 2.9% to over 60%, depending on geographic location and population characteristics (Agravat *et al*., 2021; Michalak *et al*., 2020; Yıldız and SARIÇAM, 2022). In Indonesia, comorbidities such as malnutrition and chronic disease contribute further to its burden. The physiological decline in erythropoiesis, along with micronutrient deficiencies, are primary etiological factors (Chueh *et al*., 2020; Encho *et al*., 2023). Hypertension, by contrast, affects up to 80% of the elderly and is closely linked with arterial stiffness, vascular aging and lifestyle risk factors including obesity and physical inactivity (Zulfitri and Husnawati, 2023).

These conditions not only co-occur frequently but may also interact pathophysiologically. Anemia can exacerbate cardiovascular strain by reducing oxygen delivery, while hypertension may impair renal perfusion and erythropoietin production, creating a deleterious feedback loop (Farooq *et al*., 2022; Bazmandegan *et al*., 2023; Li *et al*., 2025). This interconnectedness poses diagnostic and therapeutic challenges, especially in resource-limited settings.

Nutritional approaches offer a promising avenue for intervention (Choudhury and Chaudhary, 2024; Grover and Choudhary, 2017). Evidence shows that nutrient-rich diets can correct hematologic deficits and modulate blood pressure (Oyedeji *et al*., 2024). However, adherence remains a barrier, particularly among elderly individuals with limited education or access to healthcare. Thus, interventions that are culturally acceptable, easy to administer and provide multiple health benefits are highly desirable (Lakehal *et al*., 2025; Steffi and Sreedaya, 2024)

One such intervention is the use of honey. As a functional food, honey is rich in antioxidants, flavonoids, vitamins and minerals (Radja *et al*., 2022). Studies have indicated that honey may improve hemoglobin levels by enhancing iron absorption and stimulating hematopoiesis (Rashmi, 2021). Concurrently, honey's anti-inflammatory and vasodilatory properties may contribute to blood pressure regulation (Olas, 2020). Although a growing body of literature supports honey's individual effects on anemia

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or hypertension, few studies have explored its combined impact.

In Indonesia, the integration of traditional remedies like honey into formal healthcare practices is gaining traction. Studies show that elderly populations, especially in rural areas, often rely on natural remedies due to limited access to modern medical care (Abdullah *et al*., 2023). Honey's compatibility with local health beliefs and its wide availability make it an ideal candidate for nutritional interventions. Its potential to address two interlinked health conditions in one intervention enhances its appeal, especially in public health strategies targeting geriatric populations.

Therefore, this study aims to evaluate the effect of honey supplementation on hemoglobin levels and blood pressure among elderly individuals in Makassar, Indonesia. The novelty of this research lies in its dual-outcome approach, addressing two coexisting conditions with a single, natural intervention. Grounded in both modern clinical methodology and traditional knowledge, the study hypothesizes that daily consumption of honey will improve hemoglobin concentration and modestly reduce blood pressure.

MATERIALS AND METHODS

Study design

This study employed a double-blind randomized controlled trial (RCT) design to evaluate the effect of honey supplementation on hemoglobin levels and blood pressure among elderly individuals. The research was conducted at 2 community health centers in Makassar City, namely Karuwisi Community Health Center and Bulurokeng Community Health Center in 2023. Randomization was achieved through a simple allocation process in which participants selected a coded slip from a sealed opaque envelope, prepared in advance by an independent researcher not involved in recruitment or data collection. Allocation concealment was thus maintained until assignment. Blinding was maintained for both the participants and the assessors and the honey was packaged in identical dark bottles to mask group identity.

Population and sampling

The study population consisted of community-dwelling elderly aged over 60 years. A total of 44 participants were recruited through purposive sampling, meeting the inclusion criteria: age above 60, absence of major chronic illnesses (*e.g.*, advanced cancer, renal failure), physician clearance for participation and signed informed consent. The sample size was determined using the formula by Dahlan (2008), with parameters set at $\alpha = 0.05$, 80% power and an expected mean difference in hemoglobin of 1.0 g/dL based on previous pilot data and adjusted for a 20% dropout rate. Ultimately, 22 participants were allocated to each group.

Intervention and control

The intervention group received 10 mL of honey daily at night for a period of two months. The honey used was locally sourced from a physician-managed clinic in Tangerang and reputed for its antibacterial and restorative properties. Participants were instructed to consume the honey directly from a pre-measured container and to avoid heating it before consumption to preserve bioactive compounds. The control group received a single nutritional counseling session without any supplementation. Both groups continued with their usual diet and health routines throughout the study.

Data collection

Baseline and post-intervention data were collected for hemoglobin concentration and blood pressure. Hemoglobin levels were measured using portable hemoglobin meters, which have shown high reliability in geriatric settings (Djuari *et al*., 2023). Blood pressure was measured using automated oscillometric sphygmoma-nometers, as recommended for elderly individuals due to their accuracy in detecting fluctuations, including in atrial fibrillation cases (Park and Choi, 2020). Each blood pressure reading was taken in triplicate at two-minute intervals and the average was used in analyses to minimize measurement variability. Demographic and behavioral data (age, gender, education, marital status, smoking habits, vegetable and fruit consumption) were also collected using structured interviews. Compliance in the intervention group was verified weekly by direct questioning, visual inspection of unused honey and a simple log sheet maintained by participants. Trained enumerators conducted all measurements and interviews, following standardized procedures. Dropouts were defined as individuals who missed honey intake for more than 12 days or were unavailable at post-test.

Dropout and compliance

All 44 participants who were enrolled at the beginning of the study successfully completed the entire intervention period, with no dropouts reported. Self-reported adherence exceeded 95% in the intervention group, with no participants missing more than two consecutive days of supplementation. The high compliance rate was likely due to the simplicity of the supplementation protocol and the cultural familiarity with honey as a traditional health remedy among Indonesian elderly populations (Abdullah *et al*., 2023).

Statistical analysis

Data analysis was conducted using SPSS software. Descriptive statistics were used to profile participant characteristics. Baseline group comparisons were conducted using independent t-tests for continuous variables and chi-square tests for categorical variables. Paired t-tests assessed within-group changes in hemoglobin and blood pressure, while independent t-tests compared outcomes between groups. Effect sizes and 95% confidence intervals were calculated for all main outcomes to enhance interpretability. A significance level of $p<0.05$ was considered statistically meaningful.

Ethical considerations

Ethical approval was obtained from the Ethics Committee of the Faculty of Public Health, Hasanuddin University (No. 6530/UN.14.1/TP.01.02/2023). Participants were informed about the study objectives, procedures and potential risks. Written informed consent was obtained before enrollment. All data were anonymized and used solely for research purposes. Health protocols were strictly observed during data collection

RESULTS AND DISCUSSION

The present study assessed the impact of honey supplementation on hemoglobin levels and blood pressure among the elderly in Makassar. The findings revealed significant effects on hematologic parameters but not on blood pressure (Table 2, Table 3), with all key results reported as mean changes, standard deviations, p-values and 95% confidence intervals. These results, though encouraging in certain respects, must be situated within a broader clinical and biochemical context to fully appreciate their implications.

Honey has long been recognized for its nutritive and therapeutic potential. This study reinforces the growing body of literature suggesting that honey's health effects are mediated largely through its bioactive components such as flavonoids, polyphenols and enzymatic antioxidants. These compounds have been shown to exert a protective effect against oxidative stress, which is a central factor in the degradation of red blood cells and a contributor to age-related anemia (Scepankova *et al*., 2024; Baltić *et al*., 2023;

Table 1: Characteristics of respondents in the intervention and control groups.

Characteristics	Intervention (n=22)		Control (n=22)	
	n	%	n	%
Gender				
Male	10	45.5	3	13.6
Female	12	54.5	19	86.4
Age				
Young-old (60-69)	12	54.5	13	59.1
Middle-old (70-79)	4	18.2	7	31.8
Old-old (≥80)	6	27.3	2	9.1
Education				
Bachelor	1	4.5	1	4.5
Diploma	1	4.5	0	0
high school	2	9.1	7	31.8
Junior high school	3	13.6	3	13.6
Elementary school	9	40.9	8	36.4
Never went to school	6	27.3	3	13.6
Work				
Housewives	9	40.9	16	72.7
Work	2	9.1	5	22.7
Retired	11	50.0	1	4.5
Marital status				
Married	9	40.9	9	40.9
Widowed	12	54.5	13	59.1
Divorced	1	4.5	0	0
Smoking status				
Yes	3	13.6	0	0
No	19	86.4	22	100
Eat vegetables				
Every day	6	27.3	16	72.7
3-6 days/week	4	18.2	4	18.2
<3 days/week	5	22.7	0	0
Never	7	31.8	2	9.1
Eat fruit				
Every day	2	9.1	8	36.4
3-6 days/week	7	31.8	5	22.7
<3 days/week	3	13.6	8	36.4
Never	10	45.5	1	4.5

Hunter *et al*., 2021). The data here align with Ayandiran *et al*. (2023), who demonstrated that antioxidant-rich honey can attenuate hematologic toxicity in animal models. Additionally, Ribeiro *et al*. (2022) proposed that honey can enhance iron absorption, potentially explaining the observed increase in hemoglobin concentrations. Our effect size for hemoglobin improvement (Cohen's d = 0.89) suggests a large clinical effect in this population.

A total of 44 elderly individuals participated in the study and were equally divided between the intervention group (n=22) and control group (n=22). The majority of participants were female, aged between 60 and 75 years. Most participants had only completed elementary education and were married or widowed. Smoking prevalence was low across both groups, while fruit and vegetable consumption varied. Specifically, the intervention group reported slightly higher vegetable intake compared to the control group (Table 1). No statistically significant baseline differences were observed between groups for any measured variable (all p>0.05).

At baseline, mean hemoglobin levels in the intervention group were slightly lower than those in the control group. Similarly, systolic and diastolic blood pressure readings showed modest differences but were not statistically significant between groups. After two months of daily honey supplementation, the intervention group showed a statistically significant increase in hemoglobin levels. The mean increase was 1.18 g/dL (95% CI: 0.92-1.44, p<0.001), confirming the hypothesis that honey positively affects hemoglobin concentration (Graph 1). In contrast, the control group experienced a non-significant decline in hemoglobin levels over the same period (mean change: -0.21 g/dL, 95% CI: -0.43 to 0.01, p = 0.057) (Table 2).

Although there was a modest reduction in systolic blood pressure (mean decrease: -6.5 mmHg, 95% CI: -17.7 to 4.7, p = 0.250) in the intervention group, the change was not statistically significant. (Graph 2) Diastolic pressure showed minimal variation across both groups (mean change: +3.0 mmHg, 95% CI: -2.8 to 8.7, p = 0.301). (Graph 3) The control group did not exhibit notable changes in either systolic or diastolic blood pressure (Table 3).

Table 2: Effect of honey administration on blood pressure and hemoglobin levels in the elderly in the intervention group and control group.

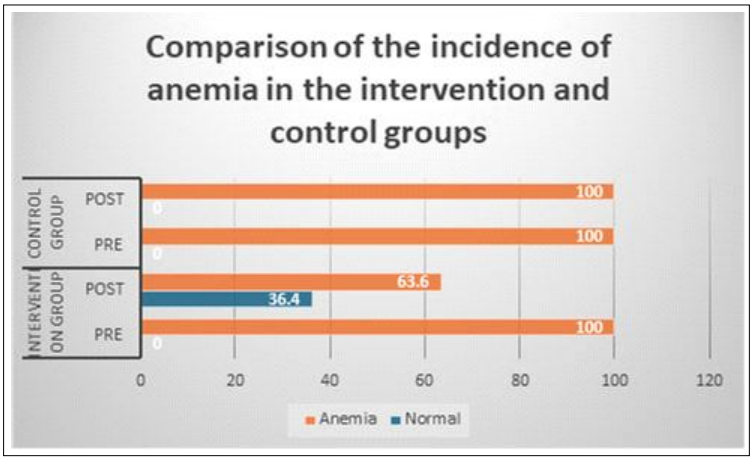
Parameter	Intervention group				Control group			
	Pre	Post	Difference	P value*	Pre	Post	Difference	P value*
Systolic BP (mmHg)	160±21.73	153.50±19.85	6.5±1.88	0.250	157.18±24.13	153.59±9.1	3.59±15.03	0.492
Diastolic BP (mmHg)	85.40±8.93	88.36±9.29	2.96±0.36	0.301	89.41±12.22	89.54±12.54	0.13±0.32	0.943
Haemoglobin (g/dL)	10.55±0.98	11.73±1.45	1.18±0.47	0.000	10.18±1.15	9.97±0.84	0.21±0.31	0.057

*Paired T-Test.

Table 3: Effect of honey on blood pressure and hemoglobin levels in the elderly before and after intervention.

Parameter	Pre intervention				Post intervention			
	Intervention group	Control group	Difference	P value*	Intervention group	Control group	Difference	P value*
Systolic BP (mmHg)	160±21.73	157.18±24.13	2.82±2.4	0.662	153.50±19.85	153.59±9.1	0.09±10.75	0.985
Diastolic BP (mmHg)	85.40±8.93	89.41±12.22	4.01±3.29	0.223	88.36±9.29	89.54±12.54	1.18±3.25	0.724
Haemoglobin (g/dL)	10.55±0.98	10.18±1.15	0.37±0,.17	0.267	11.73±1.45	9.97±0.84	1.4±0.61	<0.001

*Independent T-Test.



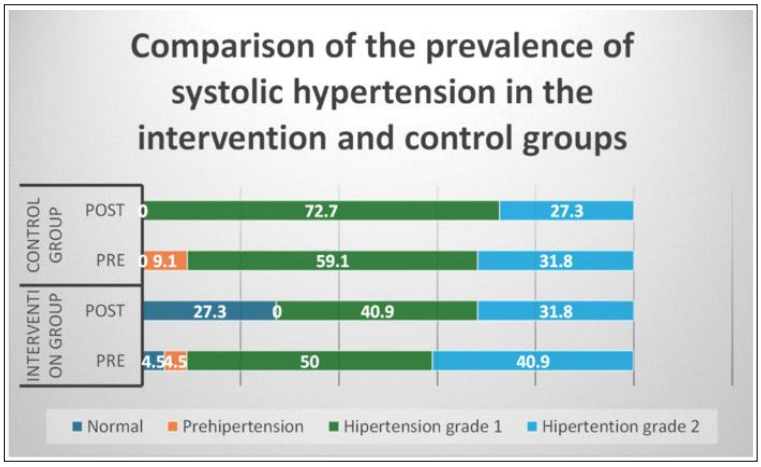
Graph 1: Hemoglobin of anemia in the intervention group and control group, before and after the intervention.

In this study, participants in the honey group exhibited a significant mean increase in hemoglobin of 1.18 g/dL, an effect consistent with previous trials and biochemical understanding. This improvement is clinically relevant, as even modest elevations in hemoglobin can enhance oxygen-carrying capacity and overall vitality in older adults. Honey's antioxidant and anti-inflammatory properties likely contributed to this outcome by minimizing red blood cell lysis and promoting erythropoiesis. This is supported by the hypothesis that glucose oxidase and phenolic compounds in honey contribute to reducing oxidative injury while modulating inflammatory markers (Ribeiro *et al*., 2022).

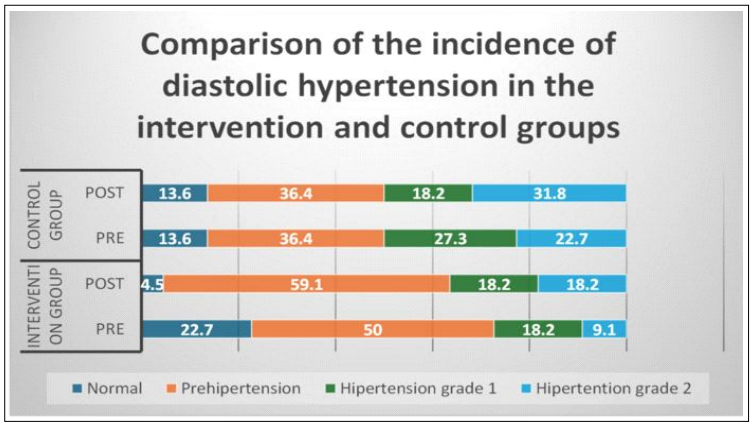
By contrast, the study did not observe a significant reduction in blood pressure, despite honey's theoretical capacity to modulate vascular function. According to Hunter *et al*. (2021) and Sitthisak *et al*. (2025), honey's bioactives may enhance nitric oxide availability and suppress ACE activity, mechanisms that should lead to vasodilation and thus lower blood pressure. However, our findings suggest that either the dose or duration of intervention was insufficient to elicit measurable cardiovascular effects.

Moreover, recent studies provide a more nuanced view. While Azman *et al*. (2023) and Šeremet *et al*. (2023) confirmed the theoretical antihypertensive pathways through which honey operates, clinical trials yield inconsistent results. Boulaares and Derouiche (2021), for instance, found improvements in cardiovascular biomarkers only when honey was paired with garlic or onion extracts, implying a possible synergistic effect necessary for clinical significance. Our study, using honey as a standalone intervention, thus offers insight into its limitations when not combined with complementary compounds. Future research could test such combinations in elderly populations to determine if synergy produces more consistent blood pressure reductions.

The complexity of dietary interventions in geriatric populations further complicates straightforward conclusions. As Vijewardane *et al*. (2023) argued, short-term studies are rarely sufficient to capture the longitudinal impacts of dietary modifications. Our two-month intervention, though methodologically rigorous, may not have provided ample time to influence vascular remodeling or chronic inflammatory



Graph 2: Incidence of hypertension based on systolic blood pressure in the intervention group and control group, before and after the intervention.



Graph 3: Incidence of hypertension based on diastolic blood pressure in the intervention group and control group, before and after the intervention.

profiles relevant to blood pressure regulation. Coelho *et al*. (2021) and Napier *et al*. (2021) also highlight how habitual diet, cultural dietary norms and educational background influence the responsiveness to nutritional interventions.

Furthermore, comorbidities in the elderly, as noted by Xu *et al*. (2023; 2024), create highly individualized nutritional requirements. A one-size-fits-all approach-such as uniform honey dosing-may not address the multifaceted metabolic and vascular challenges present in this age group. Adherence is another crucial issue. As Jeyalakshmi *et al*. (2024) note, short-term compliance with dietary interventions can be low, especially if perceptible benefits are not immediate or if the intervention lacks behavioral reinforcement components. This raises the possibility that inconsistent intake or psychological factors affected outcomes in the blood pressure domain. Including behavioral support, dietary counseling and culturally adapted reminders could enhance adherence in future trials.

CONCLUSION

This study demonstrates that honey supplementation significantly improves hemoglobin levels among elderly individuals, highlighting its potential as a natural adjunct therapy for anemia management in aging populations. Although the intervention did not yield statistically significant changes in blood pressure, the observed trends and biological plausibility suggest that longer duration or synergistic approaches may be required to manifest measurable cardiovascular benefits. The study contributes to geriatric nutrition science by validating the hematological efficacy of honey and reinforces the relevance of functional foods in preventive healthcare.

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Informed consent

All respondents involved in this study have agreed to participate in the study by signing an informed consent. This study has received ethical approval as explained in the research method.

Conflict of interest

The authors declare that there are no conflicts of interest regarding the publication of this article. No funding or sponsorship influenced the design of the study, data collection, analysis, decision to publish, or preparation of the manuscript.

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