

The effect of pumpkin seed capsules (*Cucurbita moschata*) and Tahajjud prayer on cortisol and triglyceride levels in hypertensive patients

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ABSTRACT

Background: Through neuroendocrine and metabolic pathways, chronic stress and dyslipidemia contribute a major role in the onset and progression of hypertension. While Tahajjud prayer, a type of nocturnal spiritual practice, has been correlated to the regulation of stress-related hormonal responses, pumpkin seeds (*Cucurbita moschata*) are rich in bioactive chemicals that may benefit lipid metabolism. However, evidence on their combined effects is still relatively few.

Objective: The purpose of this study was to assess how Tahajjud prayer and pumpkin seed supplementation affected the levels of triglycerides and cortisol in hypertensive individuals.

Methods: 49 hypertensive patients participated in a quasi-experimental study using a pretest–posttest control group design. Participants were divided into two groups: a control group (n = 25) that received standard antihypertensive medicine, and an intervention group (n = 24) that received pumpkin seed capsules (700 mg twice day) together with Tahajjud prayer (≥3 times/week). For thirty days, the intervention was implemented. The GPO-PAP method was used to detect blood triglyceride levels, and immunoassay was used to measure salivary cortisol levels. Differences within and between groups were examined using the Wilcoxon and Mann-Whitney U tests, with a significance level of $p < 0.05$.

Results: Triglyceride levels in the intervention group were considerably lower than those in the baseline and control groups after 30 days ($p = 0.007$). Additionally, salivary cortisol levels in the intervention group significantly decreased ($p < 0.05$), while levels in the control group stayed constant ($p = 0.312$). Between-group analysis revealed that the intervention group had considerably reduced levels of cortisol and triglycerides.

Conclusion: Among hypertensive patients, the combination of Tahajjud prayer and pumpkin seed supplementation was linked to improvements in cortisol and triglyceride levels. These findings imply that an integrative strategy that incorporates nutritional and spiritual therapy may be beneficial for controlling metabolic and stress-related factors in hypertension. Further randomized controlled trials are needed to confirm these findings.

KEYWORDS

Lipid profile; Blood Pressure; Spiritual Meditation; Stress Hormone; Hypertriglyceridemia.

INTRODUCTION

Hypertension affects over one billion individuals worldwide and remains a leading contributor to cardiovascular morbidity and premature mortality. Despite advances in pharmacological therapy, optimal blood pressure control remains challenging, partly due to the contribution of metabolic disturbances and chronic psychological stress¹.

Emerging evidence highlights the role of the hypothalamic–pituitary–adrenal (HPA) axis and lipid metabolism in the pathophysiology of hypertension. Elevated cortisol levels have been associated with increased vascular resistance and dys-

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lipidemia, including elevated triglycerides. However, conventional antihypertensive treatments primarily target blood pressure and may not adequately address these underlying neuroendocrine and metabolic factors².

Pumpkin seeds (*Cucurbita moschata*) are a natural source of unsaturated fatty acids, antioxidants, and micronutrients such as magnesium and zinc, which have been reported to support cardiovascular and metabolic health. Previous studies suggest that these bioactive compounds may contribute to lipid regulation and modulation of stress-related physiological responses³⁻⁵.

In addition, mind-body and spiritual practices have gained attention for their potential role in stress reduction. Tahajjud prayer, a form of voluntary nocturnal worship, involves structured physical movements and meditative elements that may promote relaxation and improve sleep quality. Such practices have been associated with reduced sympathetic activity and improved psychological well-being^{6,7}.

Although the individual effects of nutritional supplementation and spiritual practices have been explored, limited evidence exists regarding their combined impact on stress-related and metabolic biomarkers in hypertensive patients. Therefore, this study aims to evaluate the combined effects of pumpkin seed supplementation and Tahajjud prayer on cortisol and triglyceride levels

OBJECTIVE

This study aims to evaluate the combined effects of pumpkin seed (*Cucurbita moschata*) supplementation and

Tahajjud prayer on cortisol and triglyceride levels in patients with hypertension.

MATERIAL AND METHOD

Study Design and Setting

This study employed a quasi-experimental pretest-posttest control group design. The study was conducted at the Antang Health Center, Makassar, Indonesia, from April to May 2025.

Participants

A total of 49 patients diagnosed with primary hypertension, aged 39–63 years, were recruited using purposive sampling. Inclusion criteria were: (1) Muslim patients, (2) diagnosed with primary hypertension, and (3) willingness to participate in the study protocol. Exclusion criteria included: (1) history of severe comorbidities (e.g., stroke or coronary heart disease), (2) known allergy to pumpkin seeds, and (3) current use of lipid-lowering supplements. Participants were allocated into an intervention group (n = 24) and a control group (n = 25). Due to the nature of the intervention, randomization was not performed.

Sample

The sample size calculation in this study was performed using the two-sample t-test sample size formula for comparing two means (Neyman & Pearson, 1933)¹⁰. The required sample size was calculated as follows:

Triglyceride:	Cortisol:
$n = \frac{2(Z_{\alpha} + Z_{\beta})^2 \sigma^2}{d^2}$	$n = \frac{2(Z_{\alpha} + Z_{\beta})^2 \sigma^2}{d^2}$
$n = \frac{2(1.96 + 0.84)^2 \frac{(0.23^2 + 0.14^2)}{2}}{0.26^2}$	$n = \frac{2(1.96 + 0.84)^2 \frac{(1.68^2 + 2.29^2)}{2}}{1.7^2}$
$n = \frac{2(1.96 + 0.84)^2 \frac{(0.0529 + 0.0196)}{2}}{0.0676}$	$n = \frac{2(1.96 + 0.84)^2 \frac{(2.8224 + 5.2441)}{2}}{2.89}$
$n = \frac{2(1.96 + 0.84)^2 \cdot 0.03625}{0.0676}$	$n = \frac{2(1.96 + 0.84)^2 \cdot 4.03325}{2.89}$
$n = \frac{2 \times 7.84 \times 0.03625}{0.0676}$	$n = \frac{2 \times 7.84 \times 4.03325}{2.89}$
$n = \frac{0.5684}{0.0676} = 8.40$	$n = \frac{63.24136}{2.89} = 21.88$
$= 8$	$n = 22$

Figure 1. Sample Size Calculation

Description:

n = Sample size per group

Z = Z value for the significance level ($= 0,05$ corresponding to 1,96)

Z = Z value for the desired statistical power ($= 0,80$ corresponding to 0,84)

σ = Standard deviation of the intervention group

d = Minimum mean difference considered clinically of statistically significant between the intervention group and the control group.

Based on the above calculation, the required sample size for each group was determined by adding a 20% allowance for potential dropout (K,-H.Lee, 2008)¹¹. After rounding, the required sample size was 27 participants in the control group. Therefore, the total sample size was 54 participants with hypertension, representing the minimum required sample for the study.

cortisol levels were measured using a commercially available enzyme-linked immunosorbent assay (ELISA) kit, following the manufacturer's instructions.

Statistical Analysis

Data were analyzed using SPSS software Version 26. Descriptive statistics were used to summarize participant characteristics. As the data were not normally distributed, non-parametric tests were applied. The Wilcoxon signed-rank test was used to assess within-group differences, while the Mann-Whitney U test was used for between-group comparisons. A p -value of ≤ 0.05 was considered statistically significant.

Ethical Considerations

This study was conducted in accordance with the Declaration of Helsinki and was approved by the Health Research Ethics Committee of the Faculty of Public Health, Hasanuddin

Table 1. Sample Size Calculation Based on Variable Outcomes

Variable	Standard deviation (σ)	Variance (σ^2)	Mean difference (d)	Mean Variance
Triglyceride Levels ⁸	Group 1 = 0.23	Group 1 = 0.0529	0.26	$\sigma^2 = \frac{(0.0529+0.0196)}{2} = 0.03625$
	Group 2 = 0.14	Group 2 = 0.0196		
Cortisol Levels ⁹	Group 1 = 1.68	Group 1 = 2.8224	1.7	$\sigma^2 = \frac{(2.8224+5.2441)}{2} = 4.03325$
	Group 2 = 2.29	Group 2 = 5.2441		

Intervention

The intervention group received pumpkin seed (*Cucurbita moschata*) capsules at a dose of 700 mg, administered twice daily for 30 consecutive days. In addition, participants were instructed to perform Tahajjud prayer at least three times per-week between 01:00 and 04:00 AM. Each session consisted of a minimum of two rakaat, following common practice, without strict regulation of duration. The control group received standard antihypertensive therapy consisting of amlodipine 5 mg once daily. No additional nutritional or structured spiritual interventions were provided to this group. Adherence to the intervention protocol was monitored through daily reminders via WhatsApp, self-reported control cards, and weekly in-person evaluations.

Outcome Measures

Primary outcomes included changes in triglyceride and salivary cortisol levels measured at baseline and after the 30-day intervention period. Serum triglyceride levels were analyzed using the enzymatic colorimetric method (GPO-PAP). Salivary

University (Protocol No. 24625042152; Approval No. 1178/UN4.14.1/TP.01.02/2025).

All participants received a detailed explanation of the study procedures and provided written informed consent prior to participation.

RESULT**Respondent Characteristics**

Table 2 shows a total of 49 participants were included in this study, consisting of 24 individuals in the intervention group and 25 in the control group. Based on age distribution, the majority of participants were within the 45–54 years age group. There was no significant difference in age distribution between the intervention and control groups ($p = 0.424$), indicating comparability between groups.

In terms of gender, most participants were female (71.4%). The proportion of males and females was comparable between the two groups, with no statistically significant difference ($p = 0.588$).

Table 2. Respondent characteristics based on groups

Characteristics	Groups				Total (n=49)	%	p-value
	Intervention (n=24)		Control (n=25)				
	(n)	%	(n)	%			
Age							
35-44	9	37.5	7	28.0	16	32.7	0.424
45-54	9	37.5	14	56.0	23	46.9	
≥ 55	6	25.0	4	16.0	10	20.4	
Gender							
Male	6	25.0	8	32.0	14	28.6	0.588
Female	18	75.0	17	68.0	35	71.4	
Employment Status							
Employed	9	37.5	8	32.0	17	34.7	0.686
Unemployed	15	62.5	17	68.0	32	65.3	
Nutritional Status							
Underweight	0	0.0	1	4.0	1	2.0	0.729
Normal	7	29.2	10	40.0	17	34.7	
Overweight	4	16.7	4	16.0	8	16.3	
Obesity Class 1	10	41.7	7	28.0	17	34.7	
Obesity Class 2	3	12.5	3	12.0	6	12.2	

* Chi-Square Test.

Regarding employment status, the majority of participants were unemployed, predominantly housewives (65.3%). There was no significant difference in employment status between the intervention and control groups ($p = 0.686$).

Nutritional status was distributed across categories, with the highest proportions observed in the normal and obesity class I groups (each 34.7%). No significant difference in nutritional status was found between the two groups ($p = 0.729$). Overall, baseline characteristics were comparable between the intervention and control groups, suggesting that the groups were relatively homogeneous prior to the intervention. No significant differences were observed in baseline characteristics, indicating minimal risk of selection bias.

Univariate Analysis

Table 3 shows the baseline distribution of triglyceride levels in both the intervention and control groups was predomi-

nantly within the borderline hypertriglyceridemia category (150–199 mg/dL). There was no statistically significant difference between groups at baseline ($p > 0.05$), indicating comparable initial metabolic profiles.

Following the 30-day intervention, the proportion of participants classified within the normal triglyceride range increased in both groups. The intervention group showed a higher proportion of individuals shifting to the normal category compared to the control group. However, a small proportion of participants in the intervention group remained in the high triglyceride category.

Regarding salivary cortisol levels, most participants in both groups were within the normal range at baseline. Post-intervention, the categorical distribution of cortisol levels remained relatively stable, with no substantial shifts observed between categories in either group.

Table 3. Distribution of Changes in Blood Pressure, Triglycerides, and Cortisol Categories in the Intervention and Control Groups

Variabel	Intervention				Control			
	Pre		Post		Pre		Post	
	n=24	%	n=24	%	n=25	%	n=25	%
Triglyceride Levels								
Normal (<150)	5	20.8	12	50.0	0	0.0	5	20.0
Borderline (150-199)	17	70.8	10	41.7	21	84.0	17	68.0
High (200-499)	2	8.3	2	8.3	4	16.0	3	12.0
Morning Cortisol Levels (07.00-09.00)								
Low (<1,0 ng/mL)	0	0.0	1	4.2	1	4.0	1	4.0
Normal (1,0–7,5 ng/mL)	24	100.0	23	95.8	23	92.0	24	96.0
High (>7,5 ng/mL)	0	0.0	0	0.0	1	4.0	0	0.0

Compliance with Intervention

1) Compliance with Therapy Consumption

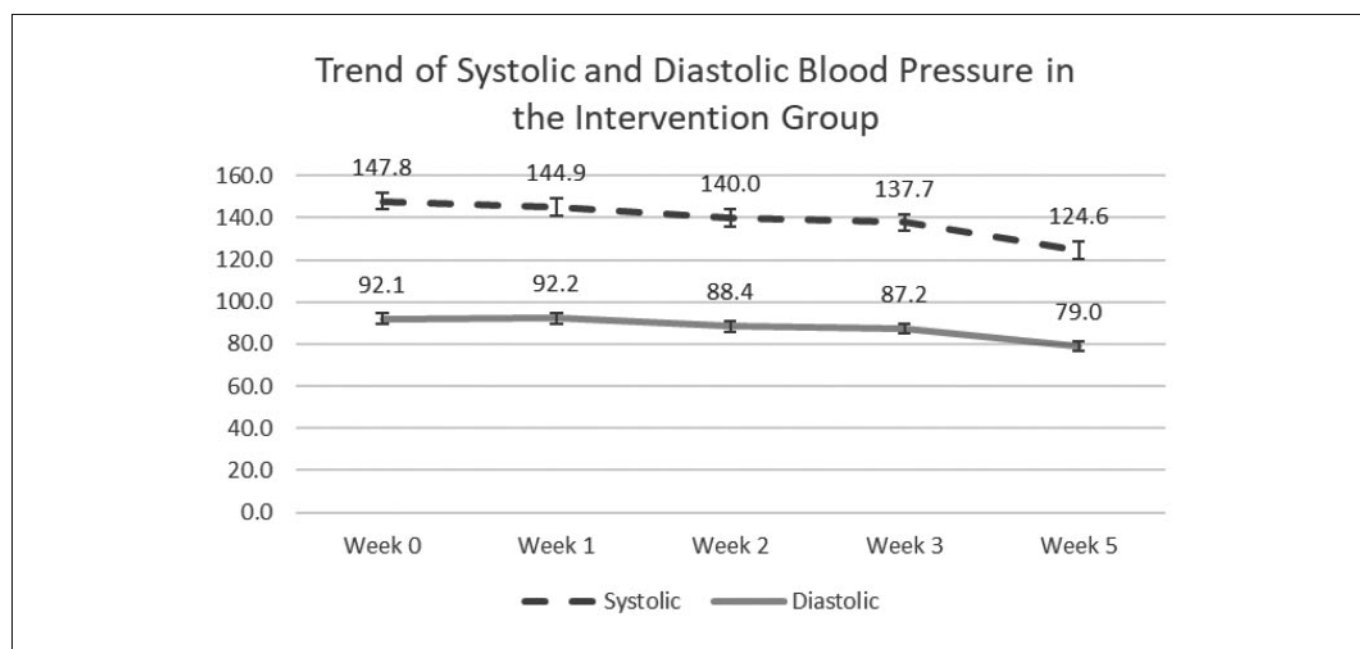
In the intervention group, all participants (n = 24, 100%) were compliant with pumpkin seed capsule consumption. In the control group, 21 participants (84.0%) were compliant with amlodipine therapy, while 4 participants (16.0%) were classified as non-compliant.

2) Compliance with Tahajjud Prayer

All participants in the intervention group (n = 24, 100%) met the minimum compliance criteria for performing Tahajjud prayer (≥ 3 times per week). No participants were categorized as non-compliant..

3) Blood Pressure Monitoring

Figure 2 illustrates the trends in systolic and diastolic blood pressure in the intervention group over the 5-week observa-

**Figure 2.** Trends in Systolic and Diastolic Blood Pressure (Intervention Group)

tion period. Mean systolic blood pressure decreased from 147.8 mmHg at baseline (Week 0) to 124.6 mmHg at Week 5. Similarly, mean diastolic blood pressure declined from 92.1 mmHg to 79.0 mmHg over the same period. A consistent downward trend in both systolic and diastolic blood pressure was observed across the monitoring weeks.

Figure 3 illustrates the trends in systolic and diastolic blood pressure in the control group over the 5-week observation period. Mean systolic blood pressure remained relatively stable during the first three weeks (149.8–150.5 mmHg), followed by a decrease in Weeks 4–5, reaching 130.4 mmHg at the end of the monitoring period. A similar pattern was observed for diastolic blood pressure, which remained around 92 mmHg initially and decreased to 83.8 mmHg by Week 5. Both sys-

tolic and diastolic blood pressure showed a downward trend over time in the control group.

Bivariate Analysis

Table 4 presents the comparison of triglyceride levels before and after the intervention in both groups. At baseline, triglyceride levels were comparable between the intervention and control groups, with no statistically significant difference ($p = 0.242$), indicating a similar initial metabolic profile.

Following the 30-day intervention, both groups demonstrated a reduction in triglyceride levels. However, the magnitude of reduction was greater in the intervention group, as reflected by a larger shift in median values and a wider interquartile range to-

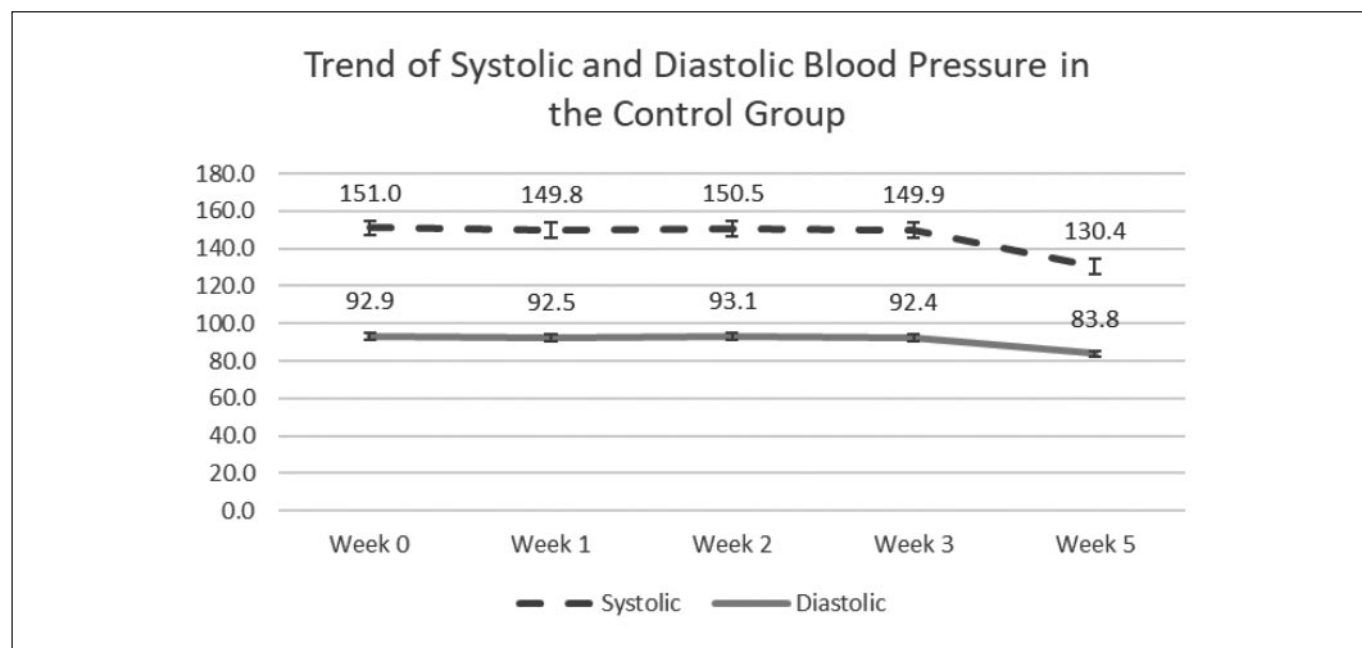


Figure 3. Trends in Systolic and Diastolic Blood Pressure (Control Group)

Table 4. The Effect of Consuming Pumpkin Seed Capsules and Tahajjud Prayer (Intervention Group) and Amlodipine Consumption (Control Group) on Triglyceride Levels in Hypertensive Patients

Groups	n	Pre-Test		Post-Test		p-value ^a
		Median (IQR)	Mean ± SD	Median (IQR)	Mean ± SD	
Intervention	24	176 (164–187)	171.42 ± 45.73	148 (124–162)	143.5 ± 34.95	0.000
Control	25	185 (166–198)	186.44 ± 34.01	168 (150–182)	172.52 ± 33.3	0.000
p-value ^b		0.242		0.007		

^a Wilcoxon Signed Ranks Test (within-group pre-post test).

^b Mann-Whitney U Test (between-group comparison pre-test and post-test).

ward lower levels. Within-group analysis confirmed that the decrease in triglyceride levels was statistically significant in both the intervention and control groups ($p < 0.001$).

Between-group comparison after the intervention showed a statistically significant difference ($p = 0.007$), suggesting that the reduction in triglyceride levels was more pronounced in the intervention group compared to the control group.

Table 5 presents the comparison of salivary cortisol levels before and after the intervention in both groups. At baseline, cortisol levels were comparable between the intervention and control groups, with no statistically significant difference ($p = 0.051$), although slightly higher values were observed in the intervention group.

Following the 30-day intervention, a reduction in cortisol levels was observed in both groups. However, a statistically significant decrease was only identified in the intervention group based on within-group analysis ($p < 0.001$), whereas the control group showed no significant change ($p = 0.312$).

Despite this within-group reduction, post-intervention comparison between groups did not demonstrate a statistically significant difference ($p = 0.509$), indicating that final cortisol levels were relatively similar across groups. Overall, the intervention group exhibited a greater magnitude of reduction in cortisol levels compared to the control group, although this difference was not statistically significant in the between-group analysis.

DISCUSSION

Effect of Pumpkin Seed Supplementation and Tahajjud Prayer on Triglyceride Levels

Triglycerides represent a major lipid component involved in energy storage; however, elevated levels are strongly associated with increased cardiovascular risk, particularly among patients with hypertension. Hypertriglyceridemia contributes to atherosclerosis, increased peripheral vascular resistance,

and activation of neurohormonal pathways that sustain elevated blood pressure^{12,13}.

In the present study, baseline triglyceride levels were comparable between the intervention and control groups, indicating similar initial metabolic conditions. This comparability supports the internal validity of the study and allows for a more reliable assessment of post-intervention changes¹⁴.

Following the 30-day intervention, triglyceride levels decreased significantly in both groups. However, the pattern of response differed according to baseline metabolic status. Participants in the intervention group with borderline triglyceride levels demonstrated a greater tendency toward reduction, whereas those with higher baseline levels showed minimal change. This finding suggests that the intervention may be more effective in individuals with moderate metabolic disturbances rather than those with more severe dyslipidemia¹⁵.

Interestingly, a reduction in triglyceride levels was also observed in the control group receiving amlodipine. This indicates that standard pharmacological therapy may contribute indirectly to improvements in lipid profiles, or that other factors, such as baseline variability or lifestyle conditions, may influence triglyceride changes¹⁶. Therefore, the present study was unable to identify a single dominant factor responsible for the observed reductions, particularly given the combined nature of the intervention and the heterogeneity of participant responses.

From a physiological perspective, the observed reduction in triglyceride levels in the intervention group may be associated with the bioactive components of pumpkin seeds, including unsaturated fatty acids such as linoleic and oleic acids. These compounds have been reported to influence lipid metabolism and may contribute to reduced triglyceride synthesis and improved lipid profiles. Previous studies have similarly demonstrated the lipid-lowering potential of pumpkin seed consumption, supporting its role as a complementary nutritional approach^{17,18,15}.

Table 5. The Effect of Consuming Pumpkin Seed Capsules and Tahajjud Prayer (Intervention Group) and Consuming Amlodipine (Control Group) on Cortisol Levels in Hypertensive Patients

Groups	n	Pre-Test		Post-Test		p-value ^a
		Median (IQR)	Mean $\pm$ SD	Median (IQR)	Mean $\pm$ SD	
Intervention	24	2.95 (2.66–5.03)	3.74 $\pm$ 1.8	2.19 (1.63–2.61)	2.38 $\pm$ 1.09	0.000
Control	25	2.55 (1.58–3.37)	2.9 $\pm$ 1.8	2.33 (1.58–3.33)	2.66 $\pm$ 1.37	0.312
p-value^b		0.051		0.509		

^a Wilcoxon Signed Ranks Test (within-group pre–post test).

^b Mann–Whitney U Test (between-group comparison pre-test and post-test).

Effect of Pumpkin Seed Supplementation and Tahajjud Prayer on Cortisol Levels

Cortisol is a key hormone involved in the physiological response to stress, regulated through the hypothalamic–pituitary–adrenal (HPA) axis. Chronic dysregulation of cortisol has been associated with hypertension through mechanisms such as increased vascular sensitivity and fluid retention¹⁹.

In this study, baseline cortisol levels were relatively comparable between groups. After the intervention, a significant reduction in cortisol levels was observed in the intervention group, whereas no significant change was detected in the control group. However, the difference in post-intervention cortisol levels between groups was not statistically significant, indicating that the overall hormonal outcomes were relatively similar at the end of the study period.

Importantly, the interpretation of cortisol levels should be approached with caution. Elevated cortisol does not necessarily indicate a pathological condition, as it plays a critical role in normal physiological processes, including circadian rhythm regulation, energy mobilization, and adaptation to daily stressors^{20,21}. Therefore, the observed reduction in cortisol levels in the intervention group may reflect a modulation of stress-related physiological responses rather than a simple “improvement” in hormonal status.

The observed changes may be associated with the combined influence of nutritional and behavioral factors. Tahajjud prayer, as a structured nocturnal spiritual practice, may contribute to relaxation and stress regulation, potentially influencing autonomic balance and HPA axis activity. At the same time, nutritional factors from pumpkin seed supplementation may also play a supportive role. However, due to the combined design of the intervention, it was not possible to determine the relative contribution or dominant effect of each component^{21,22}.

Role of Respondent Characteristics

The baseline characteristics of participants, including age, gender, employment status, and nutritional status, were relatively comparable between groups, minimizing the potential for selection bias.

However, the relatively high proportion of overweight and obese individuals in both groups may have influenced the metabolic response to the intervention. Obesity is closely associated with dyslipidemia, insulin resistance, and increased sympathetic activity, which may attenuate the magnitude of response to both pharmacological and non-pharmacological interventions^{15,23}.

In addition, the predominance of female participants and individuals with lower occupational activity provides important contextual insight into the study population. These characteristics may be associated with specific lifestyle patterns, in-

cluding lower physical activity and varying levels of psychosocial stress, which could influence both triglyceride and cortisol dynamics.

Implications and Study Limitations

The findings of this study suggest that an integrative approach combining nutritional supplementation and spiritual practice may contribute to improvements in metabolic and stress-related parameters in hypertensive patients. However, several limitations should be considered.

First, the study design did not allow for the identification of the individual effects of pumpkin seed supplementation and Tahajjud prayer, limiting the ability to determine a dominant contributing factor. Second, the variability in baseline metabolic status appears to influence the effectiveness of the intervention, particularly in individuals with higher triglyceride levels. Third, the relatively short duration of the intervention may not be sufficient to produce substantial changes in all participants.

Future studies employing randomized controlled designs and multi-arm interventions are needed to further clarify the specific mechanisms and optimize the application of integrative approaches in hypertension management.

CONCLUSION

The combined intervention of pumpkin seed (*Cucurbita moschata*) supplementation and Tahajjud prayer was associated with a greater reduction in triglyceride levels compared to standard therapy, particularly among participants with borderline baseline levels. This finding suggests that the intervention may be more effective in individuals with moderate metabolic disturbances.

In contrast, although a significant reduction in cortisol levels was observed within the intervention group, no significant difference was found between groups at the end of the study, indicating that the overall effect on cortisol remains inconclusive.

These findings highlight the potential role of integrative approaches combining nutritional and spiritual interventions as complementary strategies in the management of metabolic and stress-related factors in hypertension. Further studies with more rigorous designs are required to clarify the individual contributions and long-term effects of such interventions.

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