

Effect of Pumpkin Seed Capsule Supplementation (*Cucurbita moschata*) and a Spiritual-Based Intervention (Tahajjud Prayer) on Fasting Blood Glucose and Cortisol Levels in Prediabetic Patients: A Quasi-Experimental Study

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ABSTRACT

Introduction: This study aimed to evaluate the effect of pumpkin seed (*Cucurbita moschata*) capsule supplementation combined with a spiritual-based stress reduction intervention on fasting blood glucose (FBG) and cortisol levels among prediabetic patients. **Methods:** A quasi-experimental study with a non-randomized pretest-posttest control group design was conducted among 37 prediabetic participants in a primary healthcare setting. The intervention group (n=18) received pumpkin seed capsules (*Cucurbita moschata*) (700 mg, twice daily) and participated in a structured spiritual-based night-time practice (Tahajjud prayer) at least three times per week for 30 days. The control group (n=19) received placebo capsules and health education. FBG was measured using a glucometer, and salivary cortisol levels were assessed using immunoassay. Statistical analyses included Wilcoxon signed-rank and Mann-Whitney tests. **Results:** The intervention group showed a significant reduction in FBG (from 120.06±7.94 mg/dL to 87.72±6.76 mg/dL; p<0.001), compared to the control group (p<0.001), with a significantly greater reduction between groups (p<0.001). Cortisol levels significantly decreased within both groups; however, the between-group difference was not statistically significant (p=0.229). **Conclusions:** The combination of pumpkin seed supplementation (*Cucurbita moschata*) and a spiritual-based intervention significantly improved fasting blood glucose levels in prediabetic patients. Although cortisol levels decreased, the reduction was not significantly different compared to the control group. Due to the simultaneous administration of both interventions, the independent effect of each component cannot be determined. This combined intervention may serve as a complementary strategy for prediabetes management.

Keywords: Blood Glucose, Cucurbita Moschata, Prediabetic State, Spiritual Intervention, Stress Hormone.

INTRODUCTION

Prediabetes is a high-risk metabolic condition characterized by impaired glucose regulation and an increased likelihood of progression to type 2 diabetes mellitus¹. Globally, the prevalence of prediabetes continues to rise, posing a major public health challenge, particularly in low- and middle-income countries^{2,3}. Without early intervention, a substantial proportion of individuals with prediabetes may develop diabetes within a few years^{1,4}.

Beyond metabolic factors, psychological stress plays a critical role in glucose dysregulation. Elevated cortisol levels, a key stress hormone, contribute to insulin resistance and increased blood glucose levels^{5,6}. Chronic stress has also been associated with poor glycemic control and increased risk of metabolic disorders⁷. Therefore, addressing both metabolic and psychological components is essential in prediabetes management.

Non-pharmacological approaches, including dietary modification and behavioral or stress-reduction strategies, have gained increasing attention⁸. Pumpkin seeds (*Cucurbita moschata*) are rich in bioactive compounds such as flavonoids, polyphenols, magnesium, and unsaturated fatty acids, which have been reported

to exhibit hypoglycemic and antioxidant effects⁹⁻¹¹. In addition, functional food interventions have been shown to improve insulin sensitivity and metabolic outcomes¹².

Meanwhile, stress-reduction approaches, including mindfulness and spiritually oriented practices, have demonstrated beneficial effects on cortisol regulation and psychological well-being¹³⁻¹⁵. Previous studies suggest that such interventions may improve endocrine balance and indirectly contribute to glycemic control^{14,15}.

However, evidence on the combined effect of nutritional supplementation and stress-reduction interventions on glycemic control remains limited. Therefore, this study aimed to evaluate the effect of pumpkin seed capsule supplementation combined with a spiritual-based intervention on fasting blood glucose and cortisol levels in prediabetic patients.

METHODS

Study Design and Participants

Study Design and Participants this study employed a quasi-experimental design with a non-randomized pretest-posttest control group approach. A non-randomized purposive sampling technique was used to select participants based on specific inclusion

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criteria at the Antang Public Health Center. A non-randomized design was chosen due to logistical constraints within the primary healthcare setting and the necessity to select participants willing to adhere to the spiritual intervention protocol. Consequently, allocation concealment was not feasible, introducing a potential risk of selection bias into the study. Participants were allocated into an intervention group (n=18) and a control group (n=19).

Sample Size Justification

The sample size was determined using the Two-sample t-test formula¹⁹. Based on a power of 80% ($1 - \beta = 0.80$), a significance level (α) of 0.05, and estimated variances from previous literature, a minimum of 17 participants per group was required to detect a clinically meaningful difference in blood glucose levels. To account for a potential 20% dropout rate, 21 participants were initially recruited for each group²⁰. Following participant attrition, the final analyzed sample of 37 participants was adequately powered for this study.

Inclusion and Exclusion Criteria

Participants were eligible for inclusion if they met the following criteria: (1) adults aged 30–60 years; (2) diagnosed with prediabetes based on fasting blood glucose levels ranging from 100 to 125 mg/dL; (3) willing to participate in the study for the full duration of 30 days; and (4) able to provide informed consent.

Participants were excluded if they: (1) had a diagnosis of type 2 diabetes mellitus or were currently receiving antidiabetic medication; (2) had chronic illnesses such as cardiovascular disease, renal disease, or endocrine disorders that could affect glucose metabolism; (3) were pregnant or breastfeeding; or (4) were unable to adhere to the intervention protocol.

Intervention

The pumpkin seed capsules used in this study were prepared using pumpkin seed flour manufactured at the Culinary Laboratory of the Faculty of Public Health, Universitas Hasanuddin, following the standardized processing methodology previously described by Syam et al. [18]. Briefly, mature pumpkin (*Cucurbita moschata*) seeds were sourced from a local market in Makassar, South Sulawesi, Indonesia. The seeds were thoroughly washed and cleaned of residual pulp, followed by sun-drying for 7 hours and subsequent oven-drying at 70–75°C for 3 hours. The dried seeds were finely pulverized using a commercial blender and sieved through a 70-mesh screen to obtain a homogenous, fine powder. This prepared powder was then encapsulated into hard gelatin capsules, with each capsule precisely containing 700 mg of pumpkin seed flour. The nutrient profile and safety profile via subchronic toxicity evaluation of this formulation had been firmly verified¹⁸.

During the trial, the intervention group (n=18) received the pumpkin seed capsules at a dose of 700 mg twice daily for a total duration of 30 days. In addition to the nutritional supplementation, participants in this group engaged in a structured spiritual-based night-time behavior modification practice (Tahajjud prayer). Participants received standardized instructions to perform the prayer during the final third of the night (between 01:00 and 04:00 AM) at least three times per week. Adherence to both the capsule consumption and the spiritual intervention was strictly monitored daily via a WhatsApp group and verified through weekly direct home visits using a designated control card

Meanwhile, the control group (n=19) received standard care consisting of placebo capsules and regular health education sessions. To attempt participant blinding, the placebo capsules were designed to be identical

in appearance, weight (700 mg), color, and taste to the active pumpkin seed capsules.

Data Collection

Fasting blood glucose (FBG) levels were measured after 8–12 hours of fasting using a calibrated glucometer. While HbA1c testing provides a superior reflection of long-term glucose regulation over a 2 to 3-month period, FBG was selected as the primary glycemic outcome measure because the intervention duration was strictly limited to 30 days. Salivary cortisol samples were collected using an ELISA Cortisol Kit and analyzed via immunoassay to assess stress-related hormonal changes. Baseline measurements were taken prior to the intervention, and follow-up measurements were obtained after 30 days.

Statistical Analysis

Data were analyzed using the Statistical Package for the Social Sciences (SPSS). Descriptive statistics were presented as mean $\pm$ standard deviation (SD). Data normality was assessed using the Shapiro-Wilk test. Because the data violated the assumption of normality ($p < 0.05$ for FBG in the intervention group), non-parametric tests were preferred over parametric analyses. Within-group comparisons were performed using the Wilcoxon signed-rank test, while between-group differences were analyzed using the Mann-Whitney U test. Effect sizes ($r = Z / \sqrt{N}$) and 95% confidence intervals (95% CI) were reported alongside p-values to indicate the magnitude of the intervention's impact. A p-value of less than 0.05 was considered statistically significant

RESULTS

The baseline characteristics of the participants are presented in Table 1. There were no significant differences between the intervention and control groups in terms of age, sex distribution, body mass index (BMI), fasting blood glucose, and cortisol levels (all $p > 0.05$), indicating that the two groups were comparable at baseline.

The intervention group showed a significant reduction in fasting blood glucose levels, with a mean decrease of -32.33 ± 7.54 mg/dL ($p < 0.001$). In comparison, the control group experienced a smaller reduction of -14.42 ± 9.25 mg/dL ($p < 0.001$). The between-group comparison using the Mann-Whitney U test showed a statistically significant difference in FBG reduction ($p < 0.001$), demonstrating a large effect size ($r = 0.76$).

The between-group comparison using the Mann-Whitney test showed a statistically significant difference in FBG reduction ($p < 0.001$) (Table 2).

Cortisol levels decreased significantly within both groups. The intervention group showed a reduction of -1.32 ± 1.02 ng/dL ($p < 0.001$), while the control group showed a reduction of -0.90 ± 0.85 ng/dL ($p < 0.001$). However, the difference between groups was not statistically significant ($p = 0.229$, $r = 0.19$). The between-group comparison showed no statistically significant difference ($p = 0.229$) (Table 3).

DISCUSSION

This study demonstrated that the combination of pumpkin seed supplementation (*Cucurbita moschata*) and a spiritual-based intervention significantly reduced fasting blood glucose levels in prediabetic patients. The greater reduction observed in the intervention group suggests a synergistic effect of nutritional and behavioral approaches. The magnitude of the FBG reduction (-32.33 mg/dL) observed in the intervention group is clinically meaningful, as it transitions patients from a prediabetic range toward normal glycemic levels. This substantial change exceeds reductions reported in previous standalone dietary interventions, such as a study by Suwanto and Rahmawati²¹, which recorded a 29.25 mg/dL reduction utilizing pumpkin seed extract alone.

Table 1. Baseline Characteristics of the Participants

Variable	Intervention	Control	p-value
Age	45.3 ± 6.2	46.1 ± 5.8	0.672
Male/Female	7/11	8/11	0.912
BMI	26.8 ± 2.3	27.1 ± 2.5	0.745
FBG	120.06 ± 7.94	116.00 ± 10.28	0.653
Cortisol (ng/dL)	8.12 ± 1.35	7.98 ± 1.41	0.721

Table 2. Fasting Blood Glucose Changes

Group	Pre (Mean ± SD)	Post (Mean ± SD)	95% CI	Change	p-value
Intervention	120.06 ± 7.94	87.72 ± 6.76	84.35 -91.08	-32.33 ± 7.54	<0.001
Control	118.95 ± 8.21	104.53 ± 7.89	95.64 -107.51	-14.42 ± 9.25	<0.001

Table 3. Changes in Cortisol Levels

Group	Pre (Mean ± SD)	Post (Mean ± SD)	95% CI	Mean Change	p-value
Intervention	8.12 ± 1.35	6.80 ± 1.21	1.95-3.20	-1.32 ± 1.02	<0.001
Control	7.98 ± 1.41	7.08 ± 1.33	1.86-2.86	-0.90 ± 0.85	<0.001

However, because the pumpkin seed supplementation and the Tahajjud prayer practice were administered simultaneously, it is impossible to determine which specific component contributed most significantly to the observed reduction in fasting blood glucose.

Pumpkin seeds contain bioactive compounds such as flavonoids, polyphenols, and micronutrients that may enhance insulin secretion and improve glucose metabolism⁹⁻¹¹. Experimental and clinical studies have reported that pumpkin seed extract exhibits hypoglycemic and antioxidant properties, which contribute to improved metabolic outcomes^{10,11}. Additionally, dietary interventions rich in plant-based compounds have been shown to improve insulin sensitivity and reduce oxidative stress¹².

The reduction in cortisol levels observed in both groups suggests that factors beyond the intervention may contribute to stress reduction¹³⁻¹⁵. The lack of a significant difference between the groups may be attributed to the "Hawthorne Effect," wherein routine monitoring and intensive interaction between researchers and control group participants inadvertently provided a sense of care, thereby lowering their baseline anxiety and cortisol levels. Furthermore, the 30-day intervention period may be insufficient to capture distinct long-term neuroendocrine adaptations between the groups.

These findings highlight the importance of integrating nutritional and stress-management strategies in prediabetes care. Large-scale studies, such as the Diabetes Prevention Program, have demonstrated that combined lifestyle interventions are highly effective in reducing the incidence of type 2 diabetes^{16,17}. Therefore, a holistic approach that addresses both physiological and psychological factors may provide greater benefits in managing prediabetes.

LIMITATIONS OF THE STUDY

This study has several limitations that should be acknowledged. First, the quasi-experimental, non-randomized design utilizing purposive sampling introduces a potential risk of selection bias. Second, because participants were recruited from a single primary healthcare center and shared similar cultural and religious backgrounds, the findings may have limited generalizability to broader or more diverse populations. Third, important confounding variables that could significantly affect blood glucose and cortisol levels—such as detailed daily dietary intake, physical activity, weight change, medication use, and strict adherence to the intervention—were not adequately monitored or controlled. Fourth, glycemic control was assessed solely using fasting blood glucose due to the short 30-day intervention timeframe; future studies should incorporate HbA1c testing to evaluate long-term glucose regulation. Finally, the simultaneous administration of the combined

interventions represents a major limitation, as the independent effects of the nutritional and spiritual components cannot be isolated. Future multi-center randomized controlled trials with larger cohorts, extended durations, and rigorous monitoring of dietary and lifestyle habits are highly recommended to further validate these preliminary outcomes.

CONCLUSIONS

In conclusion, pumpkin seed capsule supplementation combined with a spiritual-based intervention significantly improves fasting blood glucose levels in prediabetic patients. Although cortisol levels decreased, no significant difference was observed between groups. Importantly, due to the simultaneous application of both treatments, the distinct contribution of each intervention component remains undetermined. This approach may be considered as a complementary strategy in prediabetes management.

REFERENCES

1. Tabák AG, Herder C, Rathmann W, Brunner EJ, Kivimäki M. Prediabetes: a high-risk state for diabetes development. *Lancet* 2012;379(9833):2279–2290. [https://doi.org/10.1016/S0140-6736\(12\)60283-9](https://doi.org/10.1016/S0140-6736(12)60283-9)
2. International Diabetes Federation. IDF diabetes atlas. 10th ed. Brussels: International Diabetes Federation; 2021.
3. Saeedi P, Petersohn I, Salpea P, Malanda B, Karuranga S, Unwin N, et al. Global and regional diabetes prevalence estimates for 2019 and projections for 2030 and 2045. *Diabetes Res Clin Pract* 2019;157:107843. <https://doi.org/10.1016/j.diabres.2019.107843>
4. Perreault L, Pan Q, Mather KJ, Watson KE, Hamman RF, Kahn SE, et al. Effect of regression from prediabetes to normal glucose regulation on long-term reduction in diabetes risk. *Lancet* 2012;379(9833):2243–2251. [https://doi.org/10.1016/S0140-6736\(12\)60525-X](https://doi.org/10.1016/S0140-6736(12)60525-X)
5. Hackett RA, Steptoe A. Type 2 diabetes mellitus and psychological stress—a modifiable risk factor. *Nat Rev Endocrinol* 2017;13(9):547–560. <https://doi.org/10.1038/nrendo.2017.64>
6. Joseph JJ, Golden SH. Cortisol dysregulation: the bidirectional link between stress, depression, and type 2 diabetes mellitus. *Ann N Y Acad Sci* 2017;1391(1):20–34. <https://doi.org/10.1111/nyas.13217>
7. Surwit RS, Schneider MS, Feinglos MN. Stress and diabetes mellitus. *Diabetes Care* 2002;25(4):659–661. <https://doi.org/10.2337/diacare.15.10.1413>
8. Esposito K, Giugliano D. Diet and inflammation: a link to metabolic and cardiovascular diseases. *Eur Heart J* 2006;27(1):15–20. <https://doi.org/10.1093/eurheartj/ehi605>

9. Makni M, Fetoui H, Gargouri NK, Garoui EM, Jaber H, Makni J, et al. Hypoglycemic and antioxidant effects of pumpkin seed extract in alloxan-induced diabetic rats. *J Diabetes Complications* 2011;25(5):331–338. <https://doi.org/10.5897/AJPP11.635>
10. Yadav M, Jain S, Tomar R, Prasad GBKS, Yadav H. Medicinal and biological potential of pumpkin: an updated review. *Nutr Res Rev* 2010;23(2):184–190. <https://doi.org/10.1017/s0954422410000107>
11. Adams GG, Imran S, Wang S, Mohammad A, Kok MS, Gray DA, et al. The hypoglycaemic effect of pumpkin seeds and pumpkin seed oil. *Food Chem* 2014;147:71–79. <https://doi.org/10.1080/10408398.2011.635816>
12. Schwingshackl L, Chaimani A, Hoffmann G, Schwedhelm C, Boeing H. Impact of different dietary approaches on glycemic control: a systematic review and network meta-analysis. *BMJ* 2017;356:j1113. <https://doi.org/10.1186/s13643-017-0455-1>
13. Pascoe MC, Thompson DR, Ski CF. Mindfulness mediates the physiological markers of stress: systematic review and meta-analysis. *Psychoneuroendocrinology* 2017;95:156–178. <https://doi.org/10.1016/j.psychires.2017.08.004>
14. Black DS, Slavich GM. Mindfulness meditation and the immune system: a systematic review of randomized controlled trials. *Ann N Y Acad Sci* 2016;1373(1):13–24. <https://doi.org/10.1111/nyas.12998>
15. Koenig HG. Religion, spirituality, and health: the research and clinical implications. *ISRN Psychiatry* 2012;2012:278730. <https://doi.org/10.5402/2012/278730>
16. Knowler WC, Barrett-Connor E, Fowler SE, Hamman RF, Lachin JM, Walker EA, et al. Reduction in the incidence of type 2 diabetes with lifestyle intervention or metformin. *N Engl J Med* 2002;346(6):393–403. <https://doi.org/10.1056/nejmoa012512>
17. Tuomilehto J, Lindström J, Eriksson JG, Valle TT, Hämäläinen H, Ilanne-Parikka P, et al. Prevention of type 2 diabetes mellitus by changes in lifestyle among subjects with impaired glucose tolerance. *N Engl J Med* 2001;344(18):1343–1350. <https://doi.org/10.1056/nejm200105033441801>
18. Syam A, Zainal, Wahiduddin, Cangara MH, Kurniati Y, Hasfiah NA. Nutrient content and toxicity of pumpkin seed flour. *Food Res* 2023;7. [https://doi.org/10.26656/fr.2017.7\(6\).069](https://doi.org/10.26656/fr.2017.7(6).069)
19. Neyman J, Pearson ES. The testing of statistical hypotheses in relation to probabilities a priori. *Mathematical Proceedings of the Cambridge Philosophical Society* 1933;29(4):492–510.
20. Bowling A. *Research Methods in Health: Investigating Health and Health Services*. 2nd ed. Berkshire: Open University Press; 2002.
21. Suwanto S, Rahmawati R. *Aktivitas hipoglikemik diet pakan ekstrak biji labu kuning (Cucurbita moschata Duch)*. Indonesia; 2019.

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