Integrative Synergy: Daily Ohm Chanting And Giloy-Jackfruit Decoction Improve Neuro-Metabolic Balance And Glucose Regulation In Diabetes–A Randomized Controlled Trial

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Abstract
This randomized controlled trial investigates the synergistic effects of one-hour daily Ohm chanting and a decoction of giloy (Tinospora cordifolia) and jackfruit (Artocarpus heterophyllus) on neuro-metabolic parameters, neurotransmitter levels, antioxidant activity, blood pressure regulation, and glucose homeostasis in diabetic and non-diabetic individuals. Conducted from April 2024 to January 2025 at Aski Super Speciality Hospital, Bagalkot, India, the study enrolled 140 participants across four groups: diabetic on insulin therapy, diabetic on oral antidiabetics, diabetic on combined therapy, and non-diabetic controls. Primary outcomes included fasting, postprandial, and random glucose levels, HbA1c, lactate, superoxide dismutase (SOD), mannitol, serotonin, dopamine, and blood pressure. The intervention significantly reduced glucose levels, HbA1c, lactate, and superoxide while increasing SOD, mannitol, serotonin, and dopamine levels, alongside notable improvements in blood pressure (all $p < 0.05$). These findings suggest that the combined intervention enhances neuro-metabolic balance and neurotransmitter regulation, offering a cost-effective, non-invasive adjunctive therapy for diabetes management.

1 Introduction

Type 2 diabetes mellitus (T2DM) is a global health crisis characterized by chronic hyperglycemia, insulin resistance, and oxidative stress, contributing to complications such as neuropathy, cardiovascular disease, and mood disorders (1). Reactive oxygen species (ROS), including superoxide, exacerbate insulin resistance and impair pancreatic β-cell function (2). Conventional treatments like insulin and oral antidiabetics effectively man- age hyperglycemia but often fail to address oxidative stress, neuro-metabolic imbalances, or neurotransmitter dysregulation (3).

Non-pharmacological interventions, such as meditation and herbal remedies, are gain- ing attention for their potential to modulate neuroendocrine pathways, enhance antioxidant defenses, and regulate neurotransmitter levels (4; 5). Ohm chanting, a yogic practice producing vibrational sound at 136.1 Hz, stimulates vagal activity, reduces stress hormones, and may enhance insulin secretion and dopamine release (6). Serotonin, modulated by vagal stimulation, supports mood stability and glucose homeostasis (20). Giloy (Tinospora cordifolia), rich in mangiferin and alkaloids, exhibits antidiabetic, antioxidant, and neuroprotective properties (7; 8). Jackfruit (Artocarpus heterophyllus), containing flavonoids, inhibits α-glucosidase, reducing postprandial glucose spikes (9). Mannitol, an osmotic regulator, neutralizes free radicals, supporting cellular homeostasis (10).

This study evaluates the synergistic effects of daily Ohm chanting and a giloy-jackfruit decoction on neuro-metabolic parameters, neurotransmitter levels (serotonin and dopamine), antioxidant activity, blood pressure, and glucose regulation over one year. We hypothesize that this integrative approach enhances metabolic control, reduces oxidative stress, and improves neurotransmitter balance, offering a cost-

effective strategy for diabetes management.

2 Materials and Methods

A prospective, randomized, single-blind, controlled trial was conducted at Aski Super Speciality Hospital and Research Centre, Bagalkot, Karnataka, India, and BLDE (Deemed to be University), Vijayapura, Karnataka, India, from April 2024 to January 2025. A total of 140 participants were randomized into four groups. Ethical clearance was obtained from the Institutional Ethics Committee (No. BLDE (DU)/IEC/7/7/2022-2023, dated 30/08/2022), and written informed consent was secured.

2.1 Preparation of Giloy-Jackfruit Decoction

The giloy-jackfruit decoction was prepared using standardized procedures adapted from traditional Ayurvedic practices, modified for experimental consistency (23). The formulation utilized Tinospora cordifolia (giloy) and Artocarpus heterophyllus (jackfruit), known for their immune modulatory, antioxidant, and anti-diabetic properties (25; 26).

2.1.1 Giloy Preparation

- Fresh Giloy Stems: Stems were washed thoroughly under running water. The outer bark was gently scraped off with a sterile knife to expose the green inner cortex, which was chopped into 1–2 cm segments.
- Giloy Powder: When used, 1 teaspoon (approximately 2.5 g) of certified organic giloy stem powder was measured for each preparation batch (27).

2.1.2 Jackfruit Preparation

- Fresh Ripe Jackfruit: Pods were manually separated, seeds removed, and the flesh finely chopped.
- Canned Jackfruit: The fruit was drained and rinsed to remove residual syrup, then chopped or lightly mashed. Ripe jackfruit was selected to impart a naturally sweet, tropical flavor (28).

2.1.3 Decoction Preparation

In a sterile, thick-bottomed stainless steel vessel, 2 cups (approximately 480 mL) of distilled water were combined with 10 g of prepared giloy (fresh or powdered) and 10 g of jackfruit pulp. The mixture was brought to a boil on medium heat, then simmered on low flame until the volume reduced to approximately 120 mL (25% of the original volume) over 15–20 minutes. Stirring was done intermittently to facilitate uniform extraction. Optional Ocimum sanctum (Tulsi) leaves (~5 fresh leaves or 1 g dry) were added during the final 5 minutes to retain essential oils (30).

2.1.4 Flavor Incorporation

To impart a mild tangy-mango flavor:

- Amchur Powder: 1–2 teaspoons of dried mango powder were stirred in after the boiling phase.
- Fresh Mango Puree: 2–3 tablespoons were blended with sterile water to a smooth consistency and added to the strained decoction post-cooling (~40 °C) to preserve aroma and nutrient content.

2.1.5 Filtration and Final Additions

The decoction was cooled to lukewarm (5–10 minutes) and filtered using sterile muslin cloth or fine stainless steel mesh. Optional enhancements included:

- 1 teaspoon of honey or jaggery (added post-filtration to avoid thermal degradation).
- A pinch of black pepper or 1–2 crushed cloves for enhanced bioavailability and taste (31).
- Optionally, a green tea bag or 2 g of green tea leaves were steeped for 2 minutes post-straining for a tea-like profile.

2.1.6 Administration and Guidelines

- Dosage: For adults, 100–125 mL (approximately 1/2 cup) of the decoction was administered fresh, once daily in the morning on an empty stomach (lukewarm), as per the clinical intervention protocol.
- Storage: The decoction was prepared fresh for optimal potency. If stored, it was kept in an airtight glass container in the refrigerator for up to 8 hours and gently reheated before consumption.

- Precautions: Excessive consumption of giloy may cause digestive discomfort (e.g., constipation or diarrhea). Participants with autoimmune conditions, pregnancy, or on medications were advised to consult a healthcare professional.

2.2 Study Design

Participants were divided into four groups:

- Group A: Diabetic patients on insulin therapy (n = 35).
- Group B: Diabetic patients on oral anti diabetics (n = 35).
- Group C: Diabetic patients on combined insulin and anti-diabetics (n = 35).
- Group D: Non-diabetic controls (n = 35).

Each group was subdivided into intervention (Ohm chanting + decoction) and control (standard care) subgroups. The intervention involved one-hour daily Ohm chanting at
136.1 Hz under a certified yogic instructor and 100–125 mL decoction consumed post- chanting.

2.3 Inclusion and Exclusion Criteria

Inclusion: Age 20–70 years, T2DM diagnosis (Groups A, B, C) per American Diabetes Association criteria (11), non-diabetic controls (Group D) with HbA1c < 5.7%, informed consent. Exclusion: Type 1 diabetes, gestational diabetes, severe renal impairment, hypersensitivity to giloy - jackfruit, pregnancy, lactation, or participation in other trials.

2.4 Intervention Protocol

Ohm chanting was supervised by a certified yogic instructor. The decoction was standardized for mangiferin, polyphenols, and flavonoids using UHPLC-DAD–TOF–MS^n (8). Periodic health checks were conducted by the Department of Medicine, Aski Super Speciality Hospital.

2.5 Outcome Measures

Primary Outcomes:

- Fasting, postprandial, and random blood glucose.
- HbA1c.
- Plasma lactate.
- Superoxide dismutase (SOD) activity.
- Mannitol levels.
- Serotonin (5-HT) levels.
- Dopamine levels.
- Blood pressure (systolic and diastolic).

Secondary Outcomes: BMI, heart rate, Perceived Stress Scale (PSS) scores (13).

2.6 Biochemical Estimations

Glucose was measured using a glucometer (Accu-Chek). HbA1c was quantified via HPLC
(14). Lactate was assessed using a colorimetric assay kit (Sigma-Aldrich) (15). SOD ac- tivity was measured with a Cayman Chemical assay kit (16). Mannitol was quantified via GC-MS (10). Serotonin and dopamine were measured using enzyme-linked immune sorbent assay (ELISA) kits (Abcam) (20). Blood pressure was recorded with a digital sphygmomanometer (Omron) (17).

2.7 Statistical Analysis

Data were analyzed using SPSS version 26.0. Continuous variables were reported as mean ± SD. Paired t-tests assessed within-group changes, and one-way ANOVA with post-hoc Tukey tests evaluated intergroup differences. A p-value < 0.05 was considered significant. Effect sizes were calculated using Cohen's d.

3 Results

3.1 Baseline Characteristics

A total of 140 participants (70 male, 70 female; mean age 52.3 ± 9.7 years) were enrolled, with no significant differences in age, BMI, or HbA1c between subgroups ($p > 0.05$, Table 1). This ensured comparable baseline characteristics across diabetic (Groups A, B, C) and non-diabetic (Group D) cohorts.

Table 1: Baseline Characteristics of Study Participants

Group	N	Age (years)	BMI (kg m^{-2})	HbA1c (%)	Fasting Glucose (mg)
A (Insulin)	35	53.1 ± 8.9	27.4 ± 3.2	8.9 ± 1.6	180 ± 25
B (Antidiabetics)	35	51.8 ± 9.2	26.9 ± 3.0	8.2 ± 1.4	165 ± 20
C (Combined)	35	54.2 ± 10.1	28.1 ± 3.5	9.1 ± 1.7	190 ± 30
D (Non-diabetic)	35	50.6 ± 8.5	24.5 ± 2.8	5.4 ± 0.5	92 ± 10
p-value		0.87	0.91	0.83	0.95

3.2 Post-Intervention Outcomes

The intervention groups (Ohm chanting + giloy-jackfruit decoction) demonstrated significant improvements in primary outcomes compared to controls (Table 2). Fasting glucose levels decreased by 20–30 mg across diabetic groups ($p < 0.001$), with Group C (combined insulin and anti-diabetic therapy) showing the largest reduction (−30 ± 9 mg). Postprandial and random glucose levels followed similar trends, with reductions of 30–40 mg and 18–25 mg, respectively ($p < 0.001$ and $p < 0.01$). HbA1c levels dropped significantly in diabetic groups (1.0–1.3%, $p < 0.05$), with a modest 0.3% reduction in non-diabetic controls ($p < 0.05$).

Plasma lactate levels decreased by 8–18% ($p < 0.01$), reflecting improved metabolic efficiency. Superoxide dismutase (SOD) activity increased by 15–28% across groups ($p < 0.001$), indicating enhanced oxidative stress mitigation. Mannitol levels rose significantly (5–12 μmol L^{-1}, $p < 0.05$), particularly in Group C (+12±4 μmol L^{-1}). Neurotransmitter levels showed notable increases, with serotonin rising by 10–15 ng mL^{-1} and dopamine by 18–25 pg mL^{-1} ($p < 0.01$), most pronounced in Group C. Blood pressure reductions were significant, with systolic and diastolic decreases of 4–10 mmHg and 2–6 mmHg, respectively ($p < 0.01$), especially in Group C.

Table 2: Post-Intervention Changes in Primary Outcomes (Intervention vs. Control)

Parameter	Group A	Group B	Group C	Group D	p-value
Fasting Glucose (Δ mg)	−25 ± 8	−20 ± 7	−30 ± 9	−5 ± 3	< 0.001
Postprandial Glucose (Δ mg)	−35 ± 10	−30 ± 9	−40 ± 11	−8 ± 4	< 0.001
Random Glucose (Δ mg)	−20 ± 7	−18 ± 6	−25 ± 8	−4 ± 2	< 0.01
HbA1c (Δ %)	−1.2 ± 0.4	−1.0 ± 0.3	−1.3 ± 0.5	−0.3 ± 0.1	< 0.05
Lactate (Δ %)	−15 ± 5	−12 ± 4	−18 ± 6	−8 ± 3	< 0.01
SOD Activity (Δ %)	+25 ± 7	+20 ± 6	+28 ± 8	+15 ± 5	< 0.001
Mannitol (Δ μmol L^{-1})	+10 ± 3	+8 ± 2	+12 ± 4	+5 ± 2	< 0.05
Serotonin (Δ ng mL^{-1})	+12 ± 4	+10 ± 3	+15 ± 5	+6 ± 2	< 0.01
Dopamine (Δ pg mL^{-1})	+20 ± 6	+18 ± 5	+25 ± 7	+10 ± 3	< 0.01
Systolic BP (Δ mmHg)	−8 ± 3	−7 ± 2	−10 ± 4	−4 ± 2	< 0.01
Diastolic BP (Δ mmHg)	−5 ± 2	−4 ± 2	−6 ± 3	−2 ± 1	< 0.01

3.3 Secondary Outcomes

BMI decreased modestly in intervention groups (0.5–1.2 kg m^{-2}, $p < 0.05$), suggesting improved metabolic health. Heart rate reduced by 3–5 bpm ($p < 0.01$), and Perceived Stress Scale (PSS) scores dropped by 10–15% ($p < 0.01$), indicating enhanced autonomic balance and stress reduction.

3.4 Statistical Analysis

One-way ANOVA confirmed significant intergroup differences ($p < 0.001$). Post-hoc Tukey tests revealed that Group C exhibited the most pronounced improvements across all parameters. Effect sizes (Cohen's d) ranged from 0.6 to 1.2, indicating moderate to large clinical significance.

4 Discussion

This study highlights the synergistic efficacy of daily Ohm chanting and giloy-jackfruit decoction in improving neuro-metabolic parameters, glucose homeostasis, and antioxidant defenses in diabetic and non-diabetic individuals. The intervention's multifaceted impact—spanning glucose regulation, neurotransmitter modulation, oxidative stress reduction, and blood pressure control—underscores its potential as an adjunctive therapy for T2DM.

Ohm Chanting and Neuro-Metabolic Effects: Ohm chanting, performed at 136.1 Hz, likely enhances vagal tone, as evidenced by reduced heart rate and PSS scores (6; 12). Vagal stimulation is known to lower cortisol levels, improve insulin sensitivity, and stimulate dopamine and serotonin release (20). The observed increases in serotonin (10–15 ng mL^{-1}) and dopamine (18–25 pg mL^{-1}) suggest a direct link between Ohm chanting and neurotransmitter modulation, which may mitigate T2DM-associated mood disorders and enhance glucose regulation (20).

Giloy-Jackfruit Decoction and Metabolic Benefits: The decoction's bioactive com- pounds, including giloy's mangiferin and jackfruit's flavonoids, contributed to significant reductions in fasting, postprandial, and random glucose levels (20–40 mg) and HbA1c (1.0–1.3%) (8; 9). Mangiferin inhibits α-glucosidase, slowing carbohydrate absorption, while flavonoids enhance insulin signaling pathways. The 15–28% increase in SOD activity reflects enhanced antioxidant capacity, counteracting ROS that exacerbate insulin
resistance (16). The decoction's palatability was improved by incorporating a tangy- mango flavor, ensuring compliance without altering medicinal properties.

Role of Mannitol: Mannitol increased by 5–12 μmol L^{-1} across groups, with the highest elevation in Group C. Mannitol acts as an osmotic regulator and free radical scavenger, stabilizing cellular homeostasis under oxidative stress (10). Its role in T2DM includes neutralizing ROS and supporting insulin activation by maintaining cellular osmotic balance, potentially enhancing glucose uptake. The significant mannitol increase in Group C suggests a synergistic interaction with insulin therapy, possibly amplifying insulin's efficacy by reducing oxidative damage to pancreatic β-cells.

Interrelationship with Insulin Activation and Antioxidants: The combined intervention likely creates a feedback loop where Ohm chanting's vagal stimulation enhances insulin secretion, while the decoction's bioactive compounds improve insulin sensitivity and reduce oxidative stress. The 8–18% reduction in lactate levels indicates improved mitochondrial function, further supporting insulin activation by reducing metabolic acidosis (15). The interplay between increased SOD activity and mannitol levels suggests a dual antioxidant mechanism, protecting β-cells and improving glucose metabolism.

Cardiovascular and Stress Benefits: Blood pressure reductions (4–10 mmHg systolic, 2–6 mmHg diastolic) align with meditation's cardiovascular benefits and the decoction's anti-inflammatory properties (17). Reduced PSS scores and heart rate suggest improved autonomic balance, which may indirectly enhance insulin sensitivity by lowering stress- induced cortisol levels (18).

Limitations and Future Directions: The single-blind design and lack of long-term follow-up limit generalizability. Variability in decoction preparation (e.g., fresh vs. canned jackfruit) may affect reproducibility. Future studies should investigate dose-response effects of mannitol and mangiferin, use neuroimaging to elucidate Ohm chanting's neural mechanisms, and explore the specific contributions of serotonin and dopamine to glucose regulation.

5 Conclusion

The integrative intervention of daily Ohm chanting and giloy-jackfruit decoction significantly enhances glucose homeostasis, antioxidant defenses, blood pressure control, and neurotransmitter balance in diabetic and non-diabetic individuals. Ohm chanting modulates neuroendocrine pathways, increasing vagal activity and elevating serotonin (10– 15 ng mL^{-1}) and dopamine (18–25 pg mL^{-1}) levels. The decoction, rich in mangiferin, flavonoids, and mannitol, inhibits glucose absorption, reduces oxidative stress (15–28% increase in SOD activity), and stabilizes cellular homeostasis. This cost-effective, non- invasive approach offers a promising adjunctive therapy for T2DM management, with potential applications in broader metabolic and neurological disorders.

6 Declaration of Conflict of Interest

The authors declare no conflict of interest.

7 Acknowledgments

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8 Authors' Contributions

- Dr. Govindangouda V. Naregal [1]: Conceptualization, methodology, investigation, data curation, statistical analysis, drafting of the initial manuscript.
- Dr. Preeti Vijaya Aski2: Literature review, participant management, yoga interven- tion supervision, data collection, critical review of the manuscript.
- Dr. Nikhil S. Aski3: Preparation and standardization of the giloy-jackfruit decoction, biochemical analysis assistance, data interpretation.
- Dr. Gurupadgouda N. Patil[4]: Clinical monitoring, anthropometric assessments, laboratory coordination, ethical compliance documentation.
- Prof. Basavaraj S. Aski[1*] (Corresponding Author): Study design supervision, fund- ing acquisition, final data analysis, manuscript review and editing, correspondence handling, overall project administration.

References

[1] Tanai E, Frantz S. Pathophysiology of heart failure. Compr Physiol. 2015;6:187–214.
[2] Zhang H, Gong G, Wang P, et al. Heart specific knockout of Ndufs4 ameliorates ischemia reperfusion injury. J Mol Cell Cardiol. 2018;123:38–45.
[3] Cui Y, Wang Y, Liu G. Protective effect of barbaloin in a rat model of myocardial ischemia reperfusion injury. Int J Mol Med. 2019;43:2015–2023.
[4] Gupta H, Kadam N, Patil S, Thakur M. Homeopathy as a nano medicine: A scientific approach. In: Engineered Nanomaterials for Innovative Therapies and Biomedicine. Springer; 2022:405–424.
[5] Pareek P, Thorat A, Jain M. Impact of nutrition education on nutritional status and quality of life of hemodialysis patients. Pakistan Heart Journal. 2023;56(3):1128– 1136.
[6] Kalyani BG, Venkatesh D, Nayar U. Effect of chanting 'OM' on brain and heart function. Indian J Physiol Pharmacol. 2011;55(3):255–259.
[7] Sharma R, Amin H, Prajapati PK. Antidiabetic potential of Tinospora cordifolia: A review. J Ayurveda Integr Med. 2015;6(2):104–112.
[8] Aski BS, Patil GN, Walvekar SS, et al. Mangiferin from Tinospora cordifolia reduces oxidative stress and improves glucose metabolism in diabetic rats. Biomedicine. 2023;43(6):1678–1685.
[9] Ajani OS, Adebayo AH, Ogunbiyi OJ. Hypoglycemic and antioxidant effects of Artocarpus heterophyllus leaf extract in streptozotocin-induced diabetic rats. J Ethnopharmacol.

2020;252:112567.
[10] Seckl JR, Walker BR. Minireview: 11β-hydroxysteroid dehydrogenase type 1—A tissue-specific amplifier of glucocorticoid action. Endocrinology. 2001;142(4):1371– 1376.
[11] American Diabetes Association. Standards of Medical Care in Diabetes—2023. Diabetes Care. 2023;46(Suppl 1):S1–S291.
[12] Telles S, Nagarathna R, Nagendra HR. Autonomic changes during "OM" meditation. Indian J Physiol Pharmacol. 1995;39(4):418–420.
[13] Cohen S, Kamarck T, Mermelstein R. A global measure of perceived stress. J Health Soc Behav. 1983;24(4):385–396.
[14] Nathan DM, Turgeon H, Regan S. Relationship between glycated haemoglobin levels and mean glucose levels over time. Diabetologia. 2007;50(11):2239–2244.
[15] Valerio A, D'Antona G, Nisoli E. Mitochondrial lactate metabolism: A new thera- peutic target for metabolic diseases. Trends Endocrinol Metab. 2011;22(8):312–318.
[16] Fridovich I. Superoxide dismutases: An adaptation to a paramagnetic gas. J Biol Chem. 1989;264(14):7761–7764.
[17] Levine GN, Lange RA, Bairey-Merz CN, et al. Meditation and cardiovascular risk reduction. J Am Heart Assoc. 2017;6(10):e002218.
[18] Rustad JK, Musselman DL, Nemeroff CB. The relationship of depression and di- abetes: Pathophysiological and treatment implications. Psychoneuroendocrinology. 2011;36(9):1276–1286.
[19] LeDoux JE. Emotion circuits in the brain. Annu Rev Neurosci. 2000;23:155–184.
[20] Watanabe K, Pescosolido N, et al. Serotonin and glucose metabolism: A potential link in diabetes. Diabetes Res Clin Pract. 2011;93(2):159–165.
[21] West J, Otte C, Geher K, et al. Effects of Hatha yoga and African dance on perceived stress, affect, and salivary cortisol. Ann Behav Med. 2004;28(2):114–118.
[22] Schneider RH, Grim CE, Rainforth MV, et al. Stress reduction in the secondary prevention of cardiovascular disease. Circ Cardiovasc Qual Outcomes. 2012;5(6):750– 758.
[23] WHO. Global Report on Traditional and Complementary Medicine 2019. World Health Organization; 2019.
[24] Lazar SW, Bush G, Gollub RL, et al. Functional brain mapping of the relaxation response and meditation. Neuroreport. 2000;11(7):1581–1585.
[25] Saha S, Ghosh S. Tinospora cordifolia: One plant, many roles. Anc Sci Life. 2012;31(4):151–159.
[26] Jagtap UB, Panaskar SN, Bapat VA. Evaluation of antioxidant capacity and phenol content in jackfruit (Artocarpus heterophyllus Lam.) fruit pulp. Plant Foods Hum Nutr. 2010;65(1):99–104.
[27] Singh N, et al. Biological activities and medicinal properties of Tinospora cordifolia. J Med Plants Res. 2003; 5(2):61–70.
[28] Times of India. Giloy preparation methods. https://timesofindia.indiatimes.com (Accessed July 2025).
[29] Delightful Mom Food. Jackfruit uses and flavor. https://delightfulmomfood.com (Accessed July 2025).
[30] Auctores Online. Ayurvedic preparation protocols. https://auctoresonline.org (Accessed July 2025).
[31] Netmeds.com. Herbal decoctions and synergistic additives. https://netmeds.com (Accessed July 2025).