ORIGINAL ARTICLE

Effect of *Chanaka Yoga* as a dietary supplement in the management of Type II diabetes mellitus patients

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Abstract

Aim: The aim of this study was to evaluate and compare the antidiabetic effect of *Chanaka Yoga* in Type II diabetes mellitus (DM) patients. **Materials and Methods:** Fifty-six patients of Type II DM were registered from the Outpatient Department of Rasa Shastra, Sir Sunderlal Hospital, Banaras Hindu University, Varanasi. Patients were randomly divided into two groups for treatment of two different medicine groups (Group A – *Chanaka Yoga* [10 g 1 time a day]; Group B - Glimepiride treated [1 mg]). The treatment was given for 3 months. Fasting blood sugar, post prandial sugar, hemoglobin A1c, serum glutamic oxaloacetic transaminase, serum glutamic-pyruvic transaminase, serum creatinine, and lipid profile level were estimated biochemically. **Result:** The results were promising and revealed that *Chanaka Yoga* can be a safe, acceptable, and effective alternative to the conventional oral hypoglycemic. **Conclusion:** Holistic principles of *Ayurveda* when used as supplementary for modern drugs in diabetes show its effects on all body symptoms and help minimize them in which modern drug fails. Hence, it is the need of time to support the modern medications with *Ayurvedic* therapy.

Key words: *Chanaka Yoga*, diabetes mellitus, *Prameha*

INTRODUCTION

Ayurveda is the science of life practices by ancient Aryans which is based on Atharvaveda. Ayurvedic literature having various references for the treatment of Prameha (diabetes), there are many formulation and lifestyle was mentioned for its regulation and treatment.

Acharya Vallabhacharya of the 15th century, who wrote "*Vaidya Chintamani*" a classical text, has quoted the formulation *Chanaka Yoga* in the 20th chapter, *Prameha Prakarana*.[1,2] The name of this formulation, such as many *Ayurvedic* polyherbal preparations, is kept according to the major or main ingredient of that formulation. *Chanaka* is a synonym of *Chana* (*Cicer arietinum* Linn.) plant. *Chanaka Yoga* has six commonly available ingredients as mentioned in Table 1.

The best quality of *Chanaka* (Bengal gram) will be selected and a prescribed dose will be immersed overnight in prepared decoction. In the morning, the soaked *Chanaka* will be cooked as per the procedure. Diabetic patients will be advised to take this *Chanaka Yoga* preparation as breakfast.

Diabetes mellitus (DM), a metabolic disorder is the fifth leading cause of death worldwide, accounting for 5.2% of all deaths. Its chronic nature, severity of complications, and the means necessary to control them become diabetes a disease very costly for affected individuals and their families as well as for the health system. Costs directly related to diabetes range from 2.5% to 15% of the annual health budget, depending on their prevalence and the sophistication of the treatment available.[3] Various factors responsible for diabetes burden in India includes genetic predisposition along with lifestyle changes and associated with urbanization and globalization. All these factors contribute to making India as a diabetes hub. In India, diabetes cause among the highest economic burden in the world.[4] Micro- and macro-vascular complications of diabetes lead to increased morbidity and mortality.[5] Almost 50% of undetected diabetic people present with micro- and macro-vascular complications at the time of diagnosis.[6]

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Table 1: Ingredients of *Chanaka Yoga*[1]

Substance	Botanical name	Family	Part used
Chanaka	*Cicer arietinum* Linn	Fabaceae	Seed
Haridra	*Curucuma longa* Linn	Zingiberaceae	Rhizome
Daruharidra	*Berberis aristata* DC.	Berberidaceae	Stem
Haritaki	*Terminalia chebula* Retz.	Combretaceae	Fruit pulp
Bibhitaki	*Terminalia bellirica* Roxb	Combretaceae	Fruit pulp
Amalaki	*Embilica officinalis* Gaerth	Euphorbiaceae	Fruit pulp

MATERIALS AND METHODS

Human Safety Trial

To conduct clinical trial study, patients were registered from the Rasa Shastra outpatient department, Sir Sunderlal Hospital, Institute of Medical Sciences, Banaras Hindu University, Varanasi. Fifty-six patients were selected on the basic criteria of clinical symptoms of DM explained in texts as well as biochemical parameters required in DM II. After the diagnosis of patients was confirmed, patients were randomly divided into four groups for treatment of four different medicine groups (Institutional Ethical Committee No. Dean/2014-15/EC/1182).

Inclusion Criteria of Patients

- Patients having symptoms of Type II DM
- Age >30 and <70 years
- Both male and female sexes were included
- 8 h fasting blood sugar >126 and ≤250 mg/dl and 2 h postprandial blood sugar >200 to ≤350 mg/dl.

Exclusion Criteria

- Type I DM
- Type II DM depending on insulin treatment
- Below 30 years and above 70 years patients
- Fasting blood sugar more than 250 mg/dl and postprandial sugar not more than 350 mg/dl
- Patients having long-standing uncontrolled diabetes complication such as nephropathies, retinopathies, and cardiovascular problem
- Patients having endocrinopathies, hormonal imbalance, carcinoma, etc., and other related complication
- Pregnant woman or the woman planning to be pregnant in next 6 months
- Lactating mothers.

Diagnosis of the Patients

Patients were diagnosed on the basis Type II DM symptoms. Diagnosis of patients was done by doing fasting blood sugar, postprandial blood sugar, hemoglobin A1c (HbA1c), Serum creatinine, serum glutamic oxaloacetic transaminase (SGOT), serum glutamic-pyruvic transaminase (SGPT), lipid profile were also done.

Grouping of the Patients

All the 56 patients were registered for the study after clinical and biochemical examination. All the diagnosed patients were divided into two groups (Group A, Group B), Group A: *Chanaka Yoga* group and Group B: Glimepiride (1 mg) treated.

Dose of Trials Drugs

- Group A: *Chanaka Yoga* 10 g 1 time a day before meal (36 subjects)
- Group B: Glimepiride (1 mg) drug was given 2 times a day before meal (20 patients).

Diet schedule: All selected patients were advised to take less amount of food having carbohydrate and fats.

Criteria to Assess the Effect of Trial Drugs

All the selected patients have been advised to come for the follow-up (FU) after every 15 days interval for general examination and estimation of 8-h fasting blood glucose level and 2-h post meal blood glucose level on 1-month interval in three FU for 90 days. Symptomatic relief along with feeling of well-being to the patients was noted every 15 days in six FU. Other biochemical parameters of patient were examined before and after the treatment for the safety of drugs given to the patients and other beneficial effects on the biochemical parameter of diseased patients. Assessments have been done under the two heading as subjective assessments and objective assessments.

Subjective Assessment

In each FU, the patients were assessed for the subjective improvement of the clinical symptoms, i.e., polyurea (PU), polyphagia (PP), polydypsia (PD), exhaustion/tiredness.

Scale of Diabetic Symptoms

Four main symptoms have been taken for the subjective assessment of the patient in each FU. Improvement of the symptoms is completely depended on the metabolic state of the body. All these symptoms graded as (0-3) scale on the basis of severity and duration are as shown in Table 2.

Table 2: Grading of symptoms

Subjective parameters	Scoring			
	0	1	2	3
	Absent	Mild	Moderate	Severe
PU	Normal frequency 1-4 times in a day, 0-2 times at night	Frequency 5-7 times in day, 3-5 times at night	Frequency 8-10 times in day, 6-8 times at night	Frequency>10 times in day, >8 times at night
PD	Normal, 1.5-3 L/day	Increased but can control (3-4 L/day)	Increased frequency without controlled (4-5 L/day)	Increased frequency (>5 L)
PP	Normal meal	Meal 2, light breakfast 2-3/day	Main meal 2, light breakfast 3-5/day	Main meal 2 or 3 light breakfast 3-5/day
Exhaustion/ tiredness	No tiredness	With feeling of tiredness	Routine activity disturbed with feeling of tiredness	Extreme tiredness

PU: Polyurea, PP: Polyphagia, PD: Polydypsia, FU: Follow up

Objective Assessments

Under the objective parameters, biochemical and other findings have been adopted as follows.

- 8 h fasting and 2 h postprandial sugar have done before treatment (BT) (0 day) and on next three FUs (30/60/90 days)
- Glycosylated HbA1c was done BT (0 day) and after treatment (AT) (90 days)
- Lipid profile was done in patients BT (0 day) and AT (90 days)
- Serum creatinine level was done BT (0 day) and AT (90 days)
- SGOT and SGPT were done BT (0 day) and AT (90 days).

In six FU, routine checkup of body vitals such as blood pressure, pulse, respiratory rate, and others such as bowel habits, frequency and consistency of micturition, edema, and pallor were checked.

Statistical Analysis

The collected data were transferred on master chart showing various items/variables in columns and subjects in rows. The analysis of data was done using statistical software SPSS version 16.0.

RESULTS

Subjective Assessment

Initially, in Group A, 38.9% cases have mild PU, 11.1% cases have moderate PU while 19.4% cases have severe PU, but after giving treatment, 69.4% cases have no PU symptom while 30.6% cases have mild PU at FU 3.

This change in severity grade was found statistically highly significant. In Group B, 60% cases have mild PU, 10% cases have moderate PU while 0% cases have severe PU, but after giving treatment, 65.0% cases have no PU symptom while 35% cases have mild PU at FU 3.

This change in severity grade was found statistically highly significant. The intergroup comparison of PU between Group A and B was not statistically significant BT as well as every FU (Table 3).

This change in severity grade was found statistically highly significant. Initially, in Group A, 38.9% cases have mild PP, 30.6% cases have moderate PP while 0% cases have severe PP, but after giving treatment, 80.6% cases have no PP symptom while 19.4% cases have mild PP at FU 3.

This change in severity grade was found statistically highly significant. In Group B, 35% cases have mild PP, 35% cases have moderate PP while 0% cases have severe PP, but after giving treatment, 65.0% cases have no PP symptom while 35% cases have mild PP at FU 3.

This change in severity grade was found statistically highly significant. The intergroup comparison of PP between Group A and B was not statistically significant BT as well as every FU.

This change in severity grade was found statistically highly significant (Table 4).

Initially, in Group A, 6% cases have mild PD, 4% cases have moderate PD while 7% cases have severe PD, but after giving treatment, 80.6% cases have no PD symptom while 19.4% cases have mild PD at FU 3.

This change in severity grade was found statistically highly significant. In group B, 7% cases have mild PD, 2% cases have moderate PD while 0% cases have severe PD, but after giving treatment, 77.4% cases have no PD symptom while 22.6% cases have mild PD at FU 3.

This change in severity grade was found statistically not significant. The intergroup comparison of PD between

Group A and B was not statistically significant BT as well as every FU (Table 5).

Initially, in Group A, 14% cases have mild exhaustion/tiredness, 4% cases have moderate exhaustion/tiredness while 7% cases have severe exhaustion/tiredness, but after giving treatment, 80.6% cases have no exhaustion/tiredness symptom while 19.4% cases have mild exhaustion/tiredness at FU 3.

This change in severity grade was found statistically highly significant. In Group B, 10% cases have mild exhaustion/tiredness, 7% cases have moderate exhaustion/tiredness while 0% cases have severe exhaustion/tiredness, but after giving treatment, 55.0% cases have no exhaustion/tiredness symptom while 45.0% cases have mild exhaustion/tiredness at FU 3.

This change in severity grade was found statistically highly significant.

The intergroup comparison of exhaustion/tiredness between Group A and B was not statistically significant BT as well as every FU (Table 6).

Effect of interventions on fasting blood glucose and postprandial blood glucose in different FU among study groups [Figures 1 and 2].

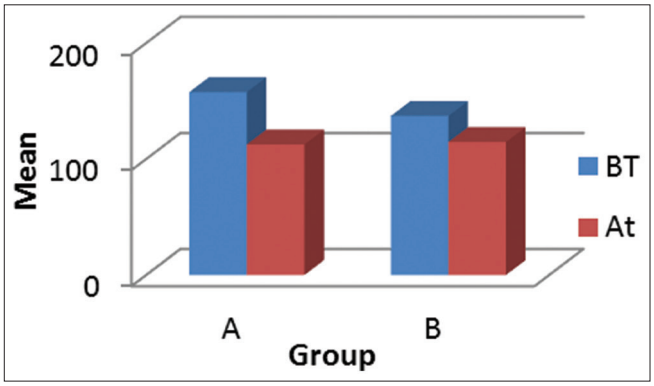

Figure 1: Fasting blood glucose level

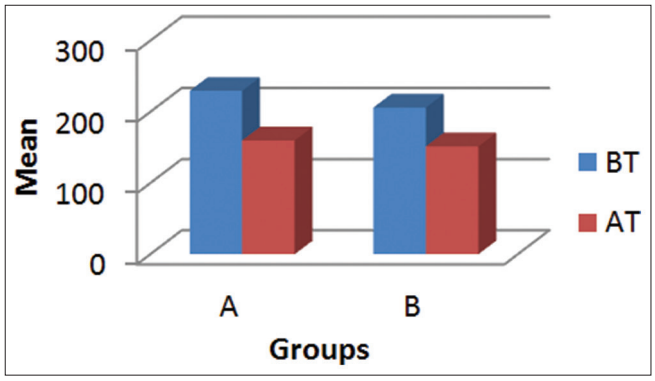

Figure 2: Postprandial blood glucose

The comparison done with respect to the mean fasting and mean postprandial blood glucose level showed that all groups showed improvement after intervention has given. The decrease in mean fasting blood sugar AT as compared to initial in Group A and B was 45.18 and 22.50, respectively, and this difference was statistically highly significant in Group A and B. Decrease in mean post prandial blood sugar AT as compared to initial in Group A and B was 69.73 and 54.65, respectively. Difference AT was statistically highly significant in Group A and B (Table 7).

The comparison done with respect to the mean HbA1c showed that all groups showed improvement after intervention has given. AT, we found that there is slight decline in mean HbA1c in Group A and B which is statistically highly significant (Table 3 and Figure 4).

Effect of interventions on SGOT and SGPT in different FU among study groups [Figures 4 and 5].

The comparison done with respect to mean SGOT and mean SGPT showed that all groups showed improvement after intervention has given. There is statistically significant decrease in mean SGOT AT when compared to initial in Group A through, not in Group B. We found decline in mean SGPT level AT and showed significant in Groups A and B. The intergroup comparison also showed no significant difference AT (Table 9).

The decrease in mean serum creatinine AT as compared to initial in Group A and B, respectively, and this was

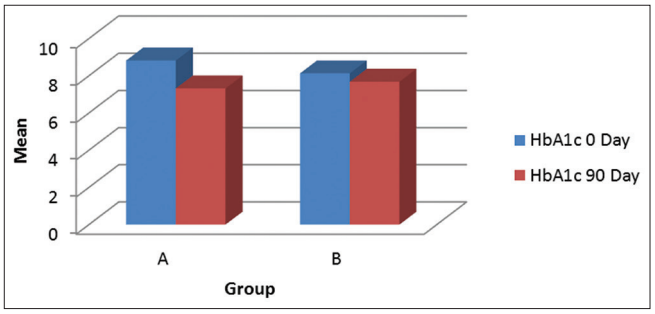

Figure 3: Hemoglobin A1c level before and after trial in various study groups

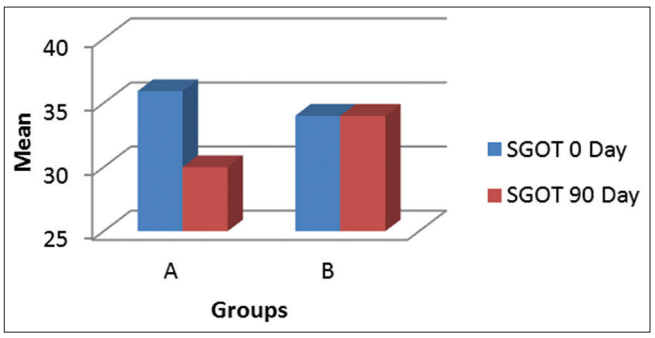

Figure 4: Serum glutamic oxaloacetic transaminase level

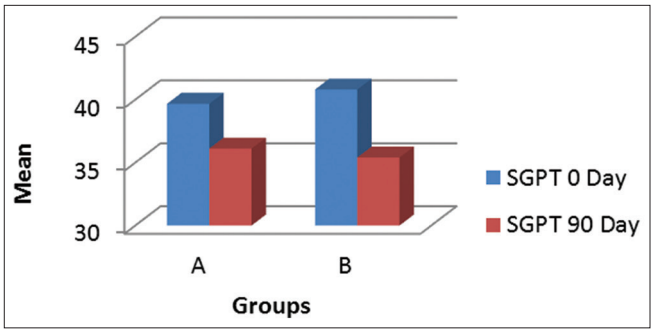

Figure 5: Serum glutamic pyruvic transaminase level

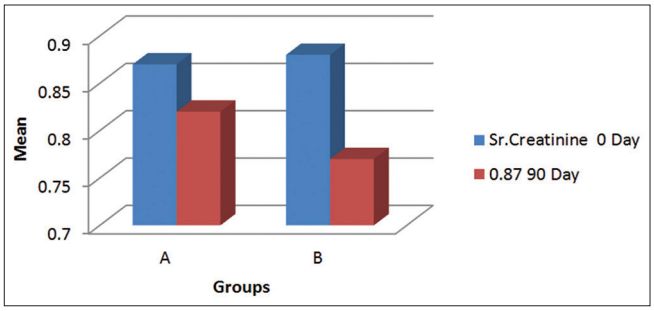

Figure 6: Serum creatinine level before and after trial in various study groups

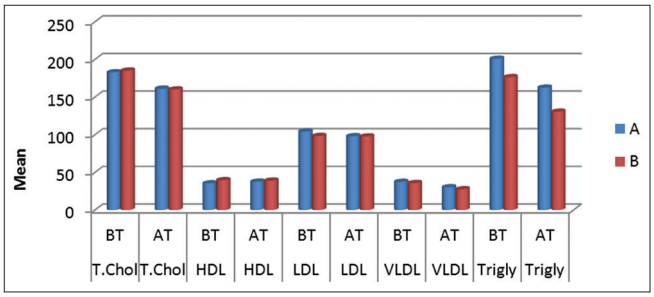

Figure 7: Effect of trial treatment on lipid profile before trial and after follow-ups in various study groups

statistically highly significant in Group B while Group A showed significant difference (Table 10 and Figure 6).

The comparison done with respect to mean values of total cholesterol, high-density lipoprotein (HDL), low-density lipoprotein (LDL), very LDL (VLDL), and triglyceride showed that all groups showed improvement after intervention has given. In Group A and B, statistically significant decline in mean total cholesterol was observed. In case of mean HDL, it was observed that Group A showed increase in mean value while Group B has decreased mean HDL after given intervention. There is decrease in mean LDL AT but not statistically significant result. Intergroup comparison showed not significant result at BT and AT. There is marked decline in mean VLDL in Group A and B which was statistically significant. The intergroup comparison of mean VLDL was not statistically significant at BT as well as AT. Decrease in mean triglyceride after given intervention as compared to BT in Group A and B showed statistically highly significant difference (Table 11 and Figure 7).

DISCUSSION

Clinical Assessment According to Subjective Parameters

In each FU, the patients were assessed for the subjective improvement of the clinical symptoms, i.e., PU, PP, PD, exhaustion/tiredness. The comparison done with respect to the all clinical symptoms showed that all groups having improved results after intervention have given. *Chanaka Yoga,* i.e., Group A, showed statistically highly significant result in symptom PU. Group A, i.e., *Chanaka Yoga,* has good result in controlling the PP symptom. All groups showed improvement in PD symptom in diabetes with statistically not significant results. *Chanaka Yoga,* i.e., Group C showed better control on PD and tiredness symptom. Furthermore, Group A has statistically significant results.

Clinical Assessment Based on Objective Parameters

"Nothing exists in the world that given the appropriate conditions and situations cannot be used for a therapeutical scope."[7]

Vagbhata had also given importance to *Bhrista Chanaka*. According to him "Pramehi should take condiments prepared from fried *Chanaka*."[8] The hypoglycemic and hypolipidemic effects of all ingredients in this formulation were already reported. As per the previous researchers, each of the ingredients of *Chanaka Yoga* has been proven scientifically to be very effective in the management of DM.

The glycemic index (GI) is a measure of the effects of carbohydrates on blood sugar levels. While modifying diet for prevention of diabetes, due importance should be given to the GI of popular and staple food items for not only to provide adequate calories, proteins, fibers, etc., but also to prevent postprandial hyperglycemia. Bengal gram (*Cicer arietinum*) or channa dal contains 64% carbohydrates with GI 33-42, protein 22%, fiber 13.6 g/100 g, and gives 327 kcal/100 g. Therefore, the food items with low-GI diet are ideally suited as staples in Type II DM's provided these could quantitatively replace rice and wheat products in daily diet as the main energy sources. This will ensure adequate calories, satiety, and at the same time control postprandial hyperglycemia.[9] The increased level of fat in blood and body results in decreased action of insulin. Hence, the low fatty diet in the form of *Bhrista Chanaka* may promote the proper functioning of insulin. After roasting (*Bhrista*) the carbohydrate and fat content of *Chanaka* are reduced while at the same time, protein and energy content get increased. Hence, *Bhrista Chanaka* is useful in reducing the blood glucose level in diabetes.[10]

Increased antioxidant and inhibitory potential of sprouted Bengal gram (*Cicer arietin*) against α-glucosidase and

α-amylase (key enzymes linked to Type II diabetes) make them desirable for dietary management/prevention of diabetes.[11] Methanolic extract of Bengal gram exhibited significant antihyperglycemic activity along with antioxidant properties.[12] According to Mathur *et al*., the hypocholesterolemic action of Bengal gram has been confirmed in experimental rat studies.[13]

Decreased glucose level by enhancing insulin sensitivity was observed with *Emblica officinalis* fruit juice in streptozotocin (STZ)-induced diabetic rats.[14] Curcumin, the polyphenolic concentrated compound in *Curcuma longa* showed antidiabetic effects partly due to a reduction in hepatic glucose production in isolated mice hepatocytes.[15] Curcumin found in *C. longa* showed pancreatic islet regeneration with improved insulin synthesis and secretion.[16] Berberine alkaloid found in *Berberis aristata* reduces blood sugar by inhibiting absorption of sugars from the intestine and enhances production of insulin in human.[17] Root bark powder of *B. aristata* stimulates pancreas to secret insulin in human.[18] Berberine alkaloid found in *B. aristata* stem promotes regeneration and functional recovery of β-cells in diabetic induced rats.[19] Currently, HbA1c test has been recommended for screening and diagnosis of diabetes.[20] The use of A1c may offer some advantages such as sampling at convenient time, no need for overnight fasting or availability of 75 g glucose, and providing a measure of hyperglycemia over a prolonged duration, which are the major limitations of fasting plasma glucose or the oral glucose tolerance test. In addition, the result is unaffected and has a low biological variability and better preanalytic stability.[21]

Antirenal lesion effect of curcumin, the polyphenolic concentrated compound in *C. longa,* has been proved in STZ-induced diabetic rats.[22] Furthermore, significantly attenuated both renal dysfunction and oxidative stress are observed in

Table 3: Effect on PU symptom in different FU among study groups

Groups	Grade	PU FU of patients *N* (%)				Within the group comparison Friedman test
		BT	FU_1	FU_2	FU_3	
Group A	0	11 (30.6)	19 (58.8)	19 (52.8)	25 (69.4)	χ^2=58.263 *P*<0.001
	1	14 (38.9)	10 (27.8)	10 (27.8)	11 (30.6)	
	2	4 (11.1)	7 (19.4)	7 (19.4)	0 (0)	
	3	7 (19.4)	0 (0)	0 (0)	0 (0)	
Group B	0	6 (30.0)	11 (55.0)	13 (65.0)	13 (65.0)	χ^2=21.194 *P*<0.001
	1	12 (60.0)	7 (35.0)	7 (35.0)	7 (35.0)	
	2	2 (10.0)	2 (10.0)	0 (0)	0 (0)	
	3	0 (0)	0 (0)	0 (0)	0 (0)	
Between Group A and B comparison		χ^2=5.139 *P*=0.162	χ^2=0.946 *P*=0.623	χ^2=4.446 *P*=0.108	χ^2=0.116 *P*=0.772	

PU: Polyurea, FU: Follow up

Table 4: Effect on PP symptom in different FUs among study groups

Groups	Grade	PP FU of patients *N* (%)				Within the group comparison Friedman test
		BT	FU_1	FU_2	FU_3	
Group A	0	11 (30.6)	19 (52.8)	25 (69.4)	29 (80.6)	χ^2=60.517 *P*<0.001
	1	14 (38.9)	17 (47.2)	11 (30.6)	7 (19.4)	
	2	11 (30.6)	0 (0)	0 (0)	0 (0)	
	3	0 (0)	0 (0)	0 (0)	0 (0)	
Group B	0	6 (30.0)	11 (55.0)	11 (55.0)	13 (65.0)	χ^2=31.636 *P*<0.001
	1	7 (35.0)	7 (35.0)	9 (45.0)	7 (35.0)	
	2	7 (35.0)	2 (10.0)	0 (0)	0 (0)	
	3	0 (0)	0 (0)	0 (0)	0 (0)	
Between Group A and B comparison		χ^2=0.132 *P*=0.936	χ^2=4.060 *P*=0.131	χ^2=1.168 *P*=0.280	χ^2=1.659 *P*=0.198	

FU: Follow up, PP: Polyphagia

Table 5: Effect on PD symptom in different FUs among study groups

Groups	Grade	PD FU of patients *N* (%)				Within the group comparison Friedman test
		BT	FU_1	FU_2	FU_3	
Group A	0	19 (52.8)	19 (52.8)	25 (69.4)	29 (80.6)	χ^2=45.980 *P*<0.001
	1	6 (16.7)	10 (27.8)	11 (30.6)	7 (19.4)	
	2	4 (11.1)	7 (19.4)	0 (0)	0 (0)	
	3	7 (19.4)	0 (0)	0 (0)	0 (0)	
Group B	0	11 (55.0)	11 (55.0)	11 (55.0)	13 (65.0)	χ^2=8.000 *P*=0.046
	1	7 (35.0)	9 (45.0)	9 (45.0)	7 (35.0)	
	2	2 (10.0)	0 (0)	0 (0)	0 (0)	
	3	0 (0)	0 (0)	0 (0)	0 (0)	
Between Group A and B comparison		χ^2=5.777 *P*=0.123	χ^2=5.025 *P*=0.081	χ^2=1.168 *P*=0.280	χ^2=1.659 *P*=0.198	

PD: Polydypsia, FU: Follow up

Table 6: Effect of interventions on exhaustion/tiredness in different FU among study groups

Groups	Grade	Exhaustion/tiredness FU of patients *N* (%)				Within the group comparison Friedman test
		BT	FU_1	FU_2	FU_3	
Group A	0	11 (30.6)	19 (52.8)	25 (69.4)	29 (80.6)	χ^2=62.723 *P*<0.001
	1	14 (38.9)	10 (27.8)	11 (30.6)	7 (19.4)	
	2	4 (11.1)	7 (19.4)	0 (0)	0 (0)	
	3	7 (19.4)	0 (0)	0 (0)	0 (0)	
Group B	0	3 (15.0)	6 (30.0)	11 (55.0)	11 (55.0)	χ^2=35.509 *P*<0.001
	1	10 (50.0)	7 (35.0)	7 (35.0)	9 (45.0)	
	2	7 (35.0)	7 (35.0)	2 (10.0)	0 (0)	
	3	0 (0)	0 (0)	0 (0)	0 (0)	
Between Group A and B comparison		χ^2=9.239 *P* 0.026	χ^2=2.960 *P*=0.228	χ^2=4.096 *P*=0.129	χ^2=4.114 *P*=0.043	

FU: Follow up

Table 7: Effect of interventions on fasting blood glucose and postprandial blood glucose level BT and AT

Groups	Mean±SD			
	Fasting blood sugar		Postprandial blood sugar	
	BT	AT	BT	AT
Group A	157.74±24.45	112.55±12.38*	229.52±37.90	159.78±18.99**
Group B	137.10±10.67	114.60±7.60	206.10±32.57	151.45±20.47*

Values are statistically significant at *P<0.05, **P<0.001. BT: Before treatment, AT: After treatment

Table 8: Effect of interventions on HbA1c BT and AT

Groups	FU of HbA1c (Mean±SD)	
	BT	AT
Group A	8.82±1.20*	7.32±0.64**
Group B	8.13±0.96	7.68±0.66**

Values are statistically significant at *P<0.05, **P<0.001.
BT: Before treatment, AT: After treatment, FU: Follow up, HbA1c: Hemoglobin A1c

STZ-induced diabetic rats.[23] Diabetes is a common secondary cause of hyperlipidemia, particularly if glycemic control is poor.[24] The insulin resistance/metabolic syndromes also include a compensatory increase in plasma concentrations of insulin and dyslipidemia including increased plasma concentrations of triglycerides and diminished concentrations of HDL-C.[25] Antihyperlipidemic activity of dry powder of *E. officinalis* has been proved in 35-55 age group of humans.[26] Curcumin, the polyphenolic-concentrated

Table 9: Effect of interventions on SGOT and SGPT BT and AT

Groups	Mean±SD			
	SGOT		SGPT	
	BT	AT	BT	AT
Group A	35.92±12.01	30.00±7.30**	39.67±15.21	36.11±12.33
Group B	34.00±10.23	34.00±5.02*	40.80±9.98	35.40±7.18

Values are statistically significant at *P<0.05, **P<0.001. BT: Before treatment, AT: After treatment, SD: Standard deviation, SGOT: Serum glutamic oxaloacetic transaminase, SGPT: Serum glutamic-pyruvic transaminase

Table 10: Effect of interventions on serum creatinine BT and AT

Groups	Serum creatinine (Mean±SD)	
	BT	AT
Group A	0.87±0.15	0.82±0.15**
Group B	0.88±0.11	0.77±0.09*

Values are statistically significant at *P<0.05, **P<0.001.
BT: Before treatment, AT: After treatment, SD: Standard deviation

compound in *C. longa* showed hypolipidemic effect in Type II diabetes in diabetic-induced mice.[27] Berberine alkaloid found in *B. aristata* lowers elevated blood total cholesterol, LDL cholesterol (LDL-C), triglycerides, and atherogenic apolipoproteins.[28] Antidiabetic activity methanolic extract and chloroform extract of *Terminalia chebula* reduced the blood sugar level in normal and alloxan diabetic rats significantly.[29,30] *T. chebula* fruit and seeds also exhibited dose-dependent reduction in blood glucose of STZ-induced diabetic rats, both in short-term and long-term study.[31,32] Ethanolic extract of the *Terminalia belerica* fruit (250 mg/twice daily/1 week) exhibited significant hypoglycemic activity in alloxan diabetic albino rats.[33] Latha P.C.R *et al*. (2010) investigated that hexane, ethyl acetate, and methanolic extracts of *T. belerica* fruit at the doses of 200, 300, and 400 mg/kg, p.o. for 60 days to STZ-induced diabetic rats significantly ($P < 0.05$) increased the plasma insulin, C-peptide and glucose tolerance levels, body weight, serum total protein. The effect was more pronounced in the methanol extract treated rats. In addition, the plant extracts significantly decreased the serum levels of total cholesterol, triglycerides, LDL-C, urea, uric acid, and creatinine in diabetic rats.[34]

Chanaka Yoga is a nutraceutical preparation prescribed for the treatment of urinary disorders including DM mentioned in ancient Ayurvedic treatise, i.e., Vaidya Chintamani. Based on this reference, the present work has been carried out to reveal its efficacy in the management of Type II DM. The formula *Chanaka Yoga* contains Chana and decoction made with equal proportion of ingredients, namely, Haldi, Daruhaldi, Haritaki, Bibhitaki, and Amalaki. The Chana which is processed with above-cited decoction was administered to 36 DM patients (Group A), to find out the impact of administering indigenous fiber rich therapeutic dietary supplement on blood glucose levels. *Chanaka Yoga* was given during breakfast in the form of semisolid for 90 days without disturbing the daily dietary pattern of the selected diabetic patients. In present study, as per the observation of HbA1c value in both the groups, the *Chanaka Yoga* treated Group A has shown a significant reduction of HbA1c with comparing to Group B treated with glimepiride. As per the results, the postprandial blood sugar is significantly reduced in the *Chanaka Yoga*-treated group. Whereas fasting blood sugar is reduced in both the groups almost equal and with significant findings.

As per the findings of liver function test, the mean HDL was observed that Group A showed increase in mean value while Group B had decreased mean HDL after given intervention which is the positive outcome of the medicine. As per the findings in mean LDL AT, there was no statistically significant result. As per the findings marked, decline in mean VLDL in Group A and B was statistically significant. The intergroup comparison of mean VLDL was not statistically significant at BT as well as AT. It is also found that statistically significant decrease in mean SGOT AT when compared to initial in Group A through, not in Group B. The intergroup comparison of mean SGOT was not significant BT, however, significant AT. The mean SGPT level AT and showed significant in Groups A and B. The intergroup comparison also showed no significant difference AT. This result shows highly significant decline in mean total cholesterol after the intervention was given to the subject.

Decrease in mean triglyceride after intervention as compared to BT in Group A and B was 38.43 and 45.90, respectively, which shows statistically highly significant difference. Intergroup comparison of mean triglyceride was statistically significant AT.

The decrease in mean serum creatinine AT as compared to initial in Group A and B, respectively, and this was statistically highly significant in Group B while Group A showed a significant difference.

CONCLUSION

An *Ayurvedic* herbal formulation, *Chanaka Yoga* is more beneficial for diabetic patients with respect to subjective and objective parameters. Food article beneficial in Madhumeha, especially *Chanaka* improves digestive power and restores

Table 11: Effect of interventions on lipid profile BT and AT

Groups	Lipid profile (Mean±SD)											
	Total cholesterol		HDL		LDL		VLDL		Triglyceride			
	BT	AT	BT	AT	BT	AT	BT	AT	BT	AT	BT	AT
Group A	182.84±45.68	161.11±26.21**	35.47±7.44	37.67±2.74**	104.27±37.36	97.97±19.01**	37.41±20.90	30.27±11.86**	200.88±66.81	162.45±51.40**		
Group B	185.10±28.28	160.10±13.65**	39.61±10.32	37.99±5.71	98.26±15.60	97.68±7.81	35.83±8.80	27.53±3.81	176.50±38.99	130.60±30.51*		

Values are statistically significant at *P<0.05, **P<0.001. SD: Standard deviation, BT: Before treatment, AT: After treatment, HDL: High-density lipoprotein, LDL: Low-density lipoprotein, VLDL: Very low-density lipoprotein

the normal physiology of body tissues. The use of food items which are Kapha-Vatahara is an important underlying principle in the prevention of Madhumeha. The *Chanaka Yoga* was found very safe and free from any side effect or adverse effect. Holistic principles of *Ayurveda* when used as supplementary for modern drugs in diabetes show its effects on all bodily symptoms and help minimize them in which modern drug fails. Hence, it is the need of time to support the modern medications with *Ayurvedic* therapy. This study proves that specific diet maintains the normalcy of blood glucose level. People at risk should be educated about this scientific fact and advised to follow it at the earliest, for better prevention of Madhumeha (DM).

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