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Clinical Evaluation Of Vamana Karma In The Management Of Prediabetes

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ABSTRACT

Objective: Prediabetes is an intermediate state of hyperglycemia considered to be an at risk state, with high chances of developing diabetes. Since modern drugs have their own restrictions and peoples looking toward Ayurveda for their health care services. Both the preventive and curative measures were described in Ayurveda for Madhumehi (diabetic people). Panchkarma therapy (bio-purification procedures) is a unique concept of Ayurveda. **Vamana is one of the important panchkarma therapies helpful in controlling blood sugar levels in patients with prediabetes.** ***The purpose of the present work to establish vamana as a preventive measure for prediabetic peoples.***

Study design: A Comparative clinical study with 60 prediabetes patients (30-60 yrs. age, fasting plasma glucose and postprandial level of 100-125 mg/dL and 140-199 mg/dL respectively with HbA_1C ranging 5.7-6.4). Group I (n= 30) patients were advised for Vamana therapy by Madanaphala Yoga. Group II (Control group, n=30) patients were treated with modern drug (Metformin, 500 mg, O.D.).

Results: After three month of vamana procedure fasting and postprandial blood sugar was fall by 11.47 and 20.02% respectively. While, standard drug treatment reduces the fasting and postprandial blood sugar by 10.86 and 18.17% respectively.

Interpretation and conclusion: The vamana with Madanaphala Yoga can be used as preventive measure in prediabetes.

Keywords: Madhumeha, Prameha, Panchakarma, Vamana Karma, Prediabetes, Type-2 DM

Introduction

The term prediabetes or "intermediate hyperglycaemia" is a strong risk factor of diabetes mellitus. The criteria for diagnosis of prediabetes includes impaired fasting glucose (IFG) [fasting plasma glucose (FPG) of 6.1-6.9 mmol/L (110 to 125 mg/dL)] and impaired glucose tolerance (IGT) [2 h plasma glucose of 7.8-11.0 mmol/L (140-200 mg/dL) after ingestion of 75 g of oral glucose] (1). It is a transit stage from where a person can revert back to normal or develop into diabetes. The risk for develop into diabetes of 5%–10% in a year and more than 25% in 3-5 year (2). More than 470 million people will have in prediabetes stage till 2030 (3). Prediabetes is may related with the insulin resistance and β-cell dysfunction. Prediabetics are more prone to develop Type-2 Diabetes mellitus and related macro-microvascular complications (4).

Ayurveda, the science of life, described prameha which is considered equivalent to different stage of diabetes. Different *Ayurvedic* texts classify it into two broad categories *viz*. *Sahaja Prameha* and *Apathyanimittaja Prameha* (5). The description of *Apathyanimittaja Prameha* has very much similarity with Prediabetes/Type-2 Diabetes

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mellitus. Obesity is one of the important risk factor for DM. The relation of obesity and DM is described by the *Sthula Pramehi*. For *Sthula Pramehi Ayurveda* advocates *Apatarpana* approach for their management (6). The Ayurvedic management of any disease includes samshamana (pacify the vitiated dosha in body) and samshodhana (biopurification procedures) therapy (7). In the present study a samshodhana procedure was adopted for prediabetic patient was Vamana (therapeutic vomiting) procedure by herbal drugs.

Aims and objectives

1. To evaluate the effect of *Vamana Karma* on subjective and objectives parameters in Prediabetics patients.
2. To established *Vamana Karma* as preventive and/or curative measures in Prediabetics.

Materials and Methods

Selection of cases

A total of 60 cases of Prediabetics were selected from Outdoor Patient Department and Indoor Patient Department of *Kayachikitsa*, Sir Sunder Hospital, Institute of Medical Sciences, Banaras Hindu University, Varanasi. All the patients were examined thoroughly according to predefined format before including into study. Ethical approval from institutional ethical committee, I.M.S., B.H.U. was obtained prior to commencement of study.

Inclusion criteria

Patients between 30-60 yrs. age with positive family history of DM, hypertension and Dyslipidemia were registered in the study. These patients have fasting plasma glucose and postprandial level of 100-125 mg/dL and 140-199 mg/dL respectively with HbA_1C ranging 5.7-6.4.

Exclusion criteria

While patients less than 30yrs. and more than 60yrs, previous diagnosed as type I or type II DM with or without complications, endocrinopathies induced diabetes (phaeochromocytoma, acromegaly, cushing's syndrome, hyperthyroidism etc.) and drug/chemical (glucocorticoids, thyroid hormone, thiazides, phenytoin etc.) induced DM excluded from study. Moreover certain genetic syndromes associated with diabetes mellitus e.g. Down's syndrome, Turner's syndrome, Klinefelter's syndrome etc. also not registered in study.

Study design

Out of 60 registered patients, 10 patients were dropped out (7 patients from Group-I and 3 patients from Group-II) in course of study. Group I (n= 30) patients were advised for *Vamana* therapy by *Madanaphala Yoga*. Group II (Control group, n=30) patients were treated with modern drug (Metformin, 500 mg, O.D.) (8).

Vamana Karma

The total procedure of vamana was divided into three phase viz. *purva karma* (initial phase), *mukhya karma* (main phase of *vamana*) and *pachatya karma* (*Samsarjana karma*) (5,6).

Purva karma (initial phase)

The patients were subjected to s*nehapana* with *Go-Ghrita* (30 mL) in the morning (approx. 7:00 AM) on empty stomach. The dose of *grita* was increase by 30 mL/day according to strength of patient. The patients were advised to take only lukewarm water and light meal when he/she feels hunger. The light diet may include wheat *Chapati* with vegetables or *Dala* day time and *Khichadi* in evening.

After *proper Snehana*, 30 mins *Abhyanga* (massage) with N*arayana taila* followed by 30 min *Vashpa Sveda* (steam bath) was given to the patients on alternate days twice a day [morning (at about 10 am) and evening (at about 4.30 pm)]. Further patients were advised to take rest for 15 min on the chair and then after move on bed covered with blanket and not to move in open area.

Kapha Vardhaka (*Krishara* type) articles were administered by the patients on the evening of gap day. The *Krishara* (*Khichadi*) was made with 50-50 g rice, *Masha* (*Urada Dala*), 25-25 g of *Taila*, *Ghrita* and 250 g of curd as well as salt according to taste.

Vamana Karma

Main procedure of *Vamana* was perform with *madanphaladi yoga* (containing *Madanphala*, *Vacha Churna*, *Madhu* and *Saindhava* mixed in the quantity of 6 gms, 2 gms, 20 gms and 1.5 gms respectively) per oral. 200 mL milk was provided to the patient 5 min before the madanphaladi yoga administration. After 10 min of drug administration milk was again provided as much as patient can drink.

The emesis started within 10 min and during the *Vamana Vega* the patient was assist by a attendant which presses his/her abdomen with palms as well as provide gentle massage in upwards direction.

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Presence of *Pitta* in vomitus was considered as end point of procedure. 2 L lukeworm saline water was used to induce emesis. After emesis patient was transfer in a fumigated room and put under observation for one day.

Samsarjana karma

The emesis was categories into three phases *Pravara*, *Madhyama* & *Avara* on the basis of symptoms after emesis. Depend upon type of emesis specific s*amsarjana krama* was adopted for individual patient accordinf to their appetite. Different recopies such as *Peya*, *Vilepi*, *Mudga Yusha* and rice with *Mudga Yusha* were given once, twice and thrice in a day for *Pravara*, *Madhyama* & *Avara emesis* respectively from the evening of *Vamana* day for 3, 5 & 7 days respectively. All the patients were advised to continue their normal diet and life style after *samsarjana karma*.

Assessment criteria

Both subjective and objective parameters were used to assess the effect of the treatment on subjects.

i. Subjective Assessment

Different symptoms such as *Atimutrata* (Polyuria), *Atitrishna* (Polydipsia), *Atikshudha* (Polyphagia), *Hastha-Pada Shuunyata* (Numbness in hands and feet), *Hastha-Pada Daha* (Burning sensation in hands and feet), *Atisveda* (Excessive Sweating), *Alasya* (Laziness), *Atinidra* (Excessive sleep) and *Shithilangata* (Flabbiness of the body) were graded in to four scale parameters (0-3) as follows.

0 : Completely relieved.
1 : Mild symptoms present.
2 : Moderate symptoms present
3 : Severe symptoms present.

Other symptoms like *Mukha Shosha* (dryness in mouth) and *Sheeta Priyata* (Liking of cold things) were evaluated on the basis of their absence (0) and presence (1).

ii. Objective Assessment

Objective assessment includes BMI (body mass index), fasting blood glucose and postprandial blood glucose level.

Results

The study shows the incidence of age and sex of 60 patients of Prediabetes revealed that the registered patients were fall in the age range between 30 to 60 years. The sex incidence in 60 cases, the greater number of patients were male i.e. 42 (70.00%) followed by female 18 (30.00%).

Clinical Symptomatology

Incidence of clinical symptomatology in 60 patients of Prediabetes revealed that in Group-I, the maximum number of patients (90%) had Laziness followed by Polyurea (66.6%), Polyphagia (63.4%), dryness in mouth (63.3%), Polydipsia (56.6), Burning sensation (53.3%), Excessive Sleep (50%), Excessive Sweating (46.7%), Flabbiness (33.3%), Liking of Cold things (20%), and Numbness (3.3%). In Group-II, Incidence of clinical symptomatology in 60 patients of Prediabetes revealed that the maximum number of patients (73.4%) had Laziness followed by Polyurea & Polyphagia (60%), Dryness in mouth (53.4%), Polydipsia / Burning sensation / Excessive Sleep (50%), Excessive Sweating (33.3%), Flabbiness (30%), Liking of Cold things (13.3%) and Numbness (6.7%) (Table 1).

Table 1: Incidence of clinical symptomatology in 60 cases of Prediabetes

Presence of Symptoms initially	No. of Patients & Percentage (%)			
	Group I	Group II	Group III	Group IV
Polyuria	20 (66.6)	23 (76.7)	23 (76.6)	18 (60)
Polydipsia	17 (56.6)	21 (70)	20 (66.6)	15 (50)
Polyphagia	19 (63.4)	19 (63.3)	17(56.7)	18 (60)
Numbness	1 (3.3)	1 (3.3)	2 (6.7)	2 (6.7)
Burning sensation	16 (53.3)	5 (16.7)	20 (66.6)	15 (50)
Excessive Sweating	14 (46.7)	13 (43.4)	16 (53.3)	10 (33.3)
Laziness	27 (90)	27 (90)	21 (70)	22 (73.4)
Excessive Sleep	15 (50)	23 (79.6)	15 (50)	15 (50)
Flabbiness	10 (33.3)	10 (33.4)	12 (40)	9 (30)
Dryness in mouth	19 (63.3)	15 (50)	18 (60)	16 (53.4)
Liking of Cold things	6 (20)	7 (23.3)	6 (20)	4 (13.3)

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Effect of trial treatment on clinical symptomatology of prediabetes

The study shows the significant shift of grades of Polyurea in different trial groups (Table 2),

Table 2: Effect on Polyurea

Groups	Grade	No. of Cases (%) BT	F1	F2	F3	Within the group comparison (Friedman test)
Group I (n=23)	0	10 (33.3)	10 (37)	5 (16.7)	21 (91.3)	χ^2= 35.97 p<0.001 HS
	1	13 (43.3)	14 (51.9)	16 (53.3)	2 (8.7)	
	2	7 (23.3)	3 (11.1)	9 (30)	0 (0.0)	
	3	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	
Group II (n=27)	0	12 (40)	13 (43.3)	1 (3.3)	19 (70.4)	χ^2=23.967 P<0.001 HS
	1	15 (50)	14 (46.7)	19 (63.3)	8 (29.6)	
	2	3 (10)	3 (10)	10 (33.3)	0 (0.0)	
	3	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	
Between the group comparison, Chi- square Test		χ^2= 4.682 p>0.05 NS	χ^2= 4.382 p>0.05 NS	χ^2= 6.399 p>0.05 NS	χ^2= 5.771 p>0.05 NS	

it was statistically highly significant (p<0.001, χ^2= 35.97) in Group-I and in Group-II, it was statistically highly significant (p<0.001, χ^2=23.967) after 3 month of trial treatment. On Polydipsia, it was statistically highly significant in Group-I (p<0.001, χ^2= 22.2), while in Group-II shift of grade was statistically significant (p<0.05, χ^2=14.130) after 3 month of trial observation (Table 3).

Table 3: Effect on Polydipsia

Groups	Grade	No. of Cases (%) BT	F1	F2	F3	Within the group comparison (Friedman test)
Group I (n=23)	0	13 (43.3)	22 (81.5)	17 (68)	20 (87)	χ^2= 22.281 p<0.001 HS
	1	12 (40)	2 (7.4)	8 (32)	3 (13)	
	2	5 (16.7)	3 (11.1)	0 (0.0)	0 (0.0)	
	3	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	
Group II (n=27)	0	15 (50)	21 (70)	19 (65.5)	19 (70.4)	χ^2=14.130 P<0.05 S
	1	12 (40)	7 (23.3)	10 (34.5)	8 (29.6)	
	2	3 (10)	2 (6.7)	0 (0.0)	0 (0.0)	
	3	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	
Between the group comparison,Chi- square Test		χ^2= 3.726 p>0.05 NS	χ^2= 4.159 p>0.05 NS	χ^2=0.056 p >0.05 NS	χ^2= 3.534 p>0.05 NS	

On Polyphagia, it was statistically significant (p<0.05, χ^2= 11.822) in Group-I, while in Group-II shift of grade was also statistically significant (p<0.05, χ^2=12.174) (Table 4).

Table 4: Effect on Polyphagia

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Groups	Grade	No. of Cases (%) BT	F1	F2	F3	Within the group comparison (Friedman test)
Group I (n=23)	0	11 (36.7)	12 (44.4)	15 (60)	18 (78.3)	χ^2= 11.822
	1	14 (46.7)	11 (40.7)	10 (40)	5 (21.7)	p<0.05
	2	5 (16.7)	4(14.8)	0 (0.0)	0 (0.0)	S
	3	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	
Group II (n=27)	0	12 (40)	14 (46.7)	17 (58.6)	19 (70.4)	χ^2=12.174
	1	15 (50)	13 (43.3)	12 (41.4)	8 (29.6)	P<0.05
	2	3 (10)	3 (10)	0 (0.0)	0 (0.0)	S
	3	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	
Between the group comparison,Chi- square Test		χ^2= 1.848 p>0.05 NS	χ^2= 4.382 p>0.05 NS	χ^2= 6.399 p>0.05 NS	χ^2= 5.771 p>0.05 NS	

On Numbness in hands and feet, it was statistically insignificant (p>0.05) in both Group-I & Group- II (Table 5).

Table 5: Effect on Numbness in hands and feet

Groups	Grade	No. of Cases (%) BT	F1	F2	F3	Within the group comparison (Friedman test)
Group I (n=23)	0	29 (96.7)	27 (100)	25 (100)	23 (100)	χ^2= 0
	1	1 (3.3)	0 (0.0)	0 (0.0)	0 (0.0)	p=0
	2	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	NS
	3	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	
Group II (n=27)	0	28 (93.3)	29 (96.7)	29 (100)	27 (100)	χ^2=4.714
	1	2 (6.7)	1 (3.3)	0 (0.0)	0 (0.0)	P>0.05
	2	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	NS
	3	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	
Between the group comparison, Chi- square Test		χ^2= 0.702 p>0.05 NS	χ^2= 2.858 p>0.05 NS	χ^2= 0.0 p=0.0 NS	χ^2= 0 p=0 NS	

On Burning sensation in different trial groups, it was statistically highly significant (p<0.001, χ^2= 31.909) in Group-I and Group-II (p<0.001, χ^2=31.312) (Table 6).

Table 6: Effect on Burning sensation

Groups	Grade	No. of Cases (%) BT	F1	F2	F3	Within the group comparison (Friedman test)
Group I (n=23)	0	14 (46.7)	12 (44.4)	19 (76)	20 (87)	χ^2= 31.909
	1	10 (33.3)	13 (48.8)	6 (24)	3 (13)	p<0.001
	2	6 (20)	2 (7.4)	0 (0.0)	0 (0.0)	HS
	3	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	
Group II (n=27)	0	15 (50)	16 (53.3)	24(82.8)	24 (88.9)	χ^2=31.312
	1	10 (33.3)	12 (40)	5 (17.2)	3 (11.1)	P<0.001
	2	5(16.7)	2 (6.7)	0 (0.0)	0 (0.0)	HS
	3	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	
Between the group comparison, Chi- square Test		χ^2= 17.543 p<0.05 S	χ^2= 16.207 p<0.05 S	χ^2= 2.956 p>0.05 NS	χ^2= 6.465 p>0.05 NS	

On Excessive Sweating, shift of grade was statistically significant (p<0.05, χ^2= 10.077) in Group-I and also statistically significant (p<0.05, χ^2=10.814) in Group-II (Table 7).

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Table 7: Effect on Excessive Sweating

Groups	Grade	No. of Cases (%) BT	F1	F2	F3	Within the group comparison (Friedman test)
Group I (n=23)	0	16(53.3)	21 (77.8)	22 (88)	19 (82.6)	χ^2= 10.077
	1	14(46.7)	6 (22.7)	3 (12)	4 (18.4)	p<0.05
	2	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	S
	3	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	
Group II (n=27)	0	20 (66.7)	23 (76.7)	26 (89.6)	24 (88.9)	χ^2=10.814
	1	10 (33.3)	7 (23.3)	3 (10.3)	3 (11.1)	P<0.05
	2	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	S
	3	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	
Between the group comparison, Chi- square Test		χ^2=7.353 p>0.0 NS	χ^2=0.729 p>0.05 NS	χ^2= 1.125 p>0.05 NS	χ^2=0.522 p>0.05 NS	

On Laziness, it was statistically highly significant (p<0.001, χ^2= 33.945) in Group-I and also statistically highly significant (p<0.001, χ^2=30.574) in Group-II (Table 8).

Table 8: Effect on Laziness

Groups	Grade	No. of Cases (%) BT	F1	F2	F3	Within the group comparison (Friedman test)
Group I (n=23)	0	3 (10)	12 (44.4)	22 (88)	18 (78.3)	χ^2= 33.945
	1	21 (70)	13 (48.1)	3 (12)	5 (21.7)	p<0.001
	2	6 (20)	2 (7.4)	0 (0.0)	0 (0.0)	HS
	3	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	
Group II (n=27)	0	8 (26.7)	16 (53.3)	21 (72.4)	21 (77.8)	χ^2=30.574
	1	17 (56.7)	12 (40)	8 (27.6)	6 (22.2)	P<0.001
	2	5 (16.7)	2 (6.7)	0 (0.0)	0 (0.0)	HS
	3	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	
Between the group comparison, Chi- square Test		χ^2= 6.937 p>0.05 NS	χ^2= 0.941 p>0.05 NS	χ^2= 3.347 p>0.05 NS	χ^2= 4.042 p>0.05 NS	

On Excessive Sleep, it was statistically highly significant (p<0.001, χ^2= 23.883) in Group-I and also statistically highly significant (p<0.001, χ^2=22.606) in Group-II (Table 9).

Table 9: Effect on Excessive Sleep

Groups	Grade	No. of Cases (%) BT	F1	F2	F3	Within the group comparison (Friedman test)
Group I (n=23)	0	15 (50)	19 (7.4)	23 (92)	21 (91.3)	χ^2= 23.883
	1	13 (43.3)	8 (29.6)	2 (8)	2 (8.7)	p<0.001
	2	2 (6.7)	0 (0.0)	0 (0.0)	0 (0.0)	HS
	3	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	
Group II (n=27)	0	15 (50)	20 (66.7)	24(82.8)	23 (85.2)	χ^2=22.606
	1	13 (43.3)	10 (33.3)	5 (17.2)	4 (14.8)	P<0.001
	2	2 (6.7)	0 (0.0)	0 (0.0)	0 (0.0)	HS
	3	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	
Between the group comparison, Chi- square Test		χ^2= 6.754 p>0.05 NS	χ^2= 0.187 p>0.05 NS	χ^2= 3.162 p>0.05 NS	χ^2= 3.865 p>0.05 NS	

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On Flabbiness, shift of grade was statistically highly significant ($p<0.001$, $\chi^2=22.082$) in Group-II, while it was statistically significant ($p<0.05$, $\chi^2=10.500$) in Group-I (Table 10).

Table 10: Effect on Flabbiness of the body

Groups	Grade	No. of Cases (%) BT	F1	F2	F3	Within the group comparison (Friedman test)
Group I	0	20 (66.7)	24 (88.9)	24 (96)	23 (100)	$\chi^2= 10.500$
(n=23)	1	10 (33.3)	3 (11.1)	1 (4)	0 (0.0)	p<0.05
	2	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	S
	3	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	
Group II	0	21 (70)	27 (90)	28 (96.6)	27 (100)	$\chi^2=22.082$
(n=27)	1	8 (26.7)	3 (10)	1 (3.4)	0 (0.0)	P<0.001
	2	1 (3.3)	0 (0.0)	0 (0.0)	0 (0.0)	HS
	3	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	
Between the group comparison, Chi- square Test		$\chi^2=5.065$ p>0.05 NS	$\chi^2= 0.799$ p>0.05 NS	$\chi^2= 0.797$ p>0.05 NS	$\chi^2=0$ p=0 NS	

On Dryness in mouth, the study shows the significant shift of grades in different trial groups, it was statistically highly significant ($p<0.001$, $\chi^2=28.653$) in Group-I and also statistically highly significant ($p<0.001$, $\chi^2=23.041$) in Group-II (Table 11).

Table 11: Effect on Dryness in Mouth

Groups	Grade	No. of Cases (%) BT	F1	F2	F3	Within the group comparison (Friedman test)
Group I	0	11 (36.7)	16 (59.3)	24 (96)	20 (87)	$\chi^2= 28.653$
(n=23)	1	16 (53.3)	10 (37)	1 (4)	3(13)	p<0.001
	2	3 (10)	1 (3.7)	0 (0.0)	0 (0.0)	HS
	3	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	
Group II	0	14 (46.7)	18 (60)	26 (89.7)	22 (81.5)	$\chi^2=23.041$
(n=27)	1	14 (46.7)	12 (40)	3 (10.3)	5 (18.5)	P<0.001
	2	2 (6.7)	0 (0.0)	0 (0.0)	0 (0.0)	HS
	3	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	
Between the group comparison, Chi- square Test		$\chi^2=2.036$ p>0.05 NS	$\chi^2= 3.492$ p>0.05 NS	$\chi^2= 3.403$ p>0.05 NS	$\chi^2= 2.625$ p>0.05 NS	

On Liking of Cold things, shift of grade was statistically significant ($p<0.05$, $\chi^2= 9.000$) in Group-I and also statistically significant ($p<0.05$, $\chi^2=9.429$) in Group-II (Table 12)**.**

Table 12: Effect on Liking of cold things

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Groups	Grade	No. of Cases (%) BT	F1	F2	F3	Within the group comparison (Friedman test)
Group I (n=23)	0	24 (80)	26 (96.3)	25 (100)	23 (100)	χ^2= 9.000
	1	6 (20)	1 (3.7)	0 (0.0)	0 (0.0)	p<0.05
	2	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	S
	3	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	
Group II (n=27)	0	26 (86.7)	28 (93.3)	29 (100)	27 (100)	χ^2=9.429
	1	4 (13.3)	2 (7.7)	0 (0.0)	0 (0.0)	P<0.05
	2	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	S
	3	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	
Between the group comparison, Chi- square Test		χ^2= 1.022 p>0.05 NS	χ^2= 1.958 p>0.05 NS	χ^2= 0 p=0 NS	χ^2= 0 p=0 NS	

On the basis of Chi- square Test, between the Group comparison, the differences were statistically not significant (p>0.05) in any group.

Effect of trial treatment on laboratory parameters

BMI: The BMI study shows that the initial mean and SD for Group-I was 26.67±2.978 which decreased to 25.71±3.119 after trial treatment; the result was statistically highly significant (p<0.001). In Group-II mean was decreased from 24.63±2.194 to 24.53±1.768 showing statistically insignificant result (p>0.05). The difference in means was highest in Group-I (1.056) followed by Group-II (0.146) (Table 13).

Table 13: Effect on Effect of treatment on BMI (n=60)

Groups	BMI Mean ±SD BT	AT	Within the group comparison, Paired 't' test, (BT-AT)
Group I (n=23)	26.67 ± 2.978	25.71 ±3.119	1.056 ±1.222 t = 4.161 p<0.001 HS
Group II (n=27)	24.63 ±2.194	24.53 ±1.768	0.146 ±1.236 t=0.614 P>0.05 NS
Between the group comparison, One- Way ANOVA	F = 3.251 P<0.05 S	F= 1.803 P>0.05 NS	
Post-Hoc test (Bonferroni), Significant pairs (p<0.05)	-	-	

Fasting Blood Sugar

The blood sugar fasting in Group-I, the initial mean ± S.D. was 112.03 ± 8.28 which reduced to 98.22 ± 11.917 after complete follow-up, the improvement was statistically highly significant (p<0.001). While in Group-II, the initial mean ± SD 112.60 ± 8.253 reduced to 100.03 ± 10.979, this fall was also statistically highly significant (p<0.001). The reduction in means was highest in Group-I (12.848) followed by Group-II (12.233) (Table 14).

Table 14: Effect on Blood Sugar Fasting (n=60)

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Groups	BSF Mean ±SD				Within the group comparison,Paired 't' test, (BT-FU3)
	BT	FU1	FU2	FU3	
Group I (n= 23)	112.03 ± 8.28	106.76 ± 6.98	101.40 ± 8.13	98.22±1 1.92	12.848 ±12.572 t=4.90 p<0.001 HS
Group II (n= 27)	112.60 ± 8.25	107.47 ± 6.35	103.64 ± 7.22	100.03± 10.97	12.233 ± 10.026 t=6.340 p<0.001 HS
Between the group comparison, One-Way ANOVA	F = 0.499 P>0.05 NS	F = 0.358 P>0.05 NS	F = 0.660 P>0.05 NS	F = 0.917 P>0.05 NS	
	-	-	-	-	

Postprandial Blood Sugar

The postprandial blood sugar estimations in Group-I, the initial mean ± S.D. was 174.54 ± 15.535 which decreased to 140.37 ± 13.85 after 3rd follow-up, the reduction was statistically highly significant (p<0.001). While in Group-II, the initial mean ± SD was 175.32 ± 15.295 decreased to 143.33 ± 17.136, it was also statistically highly significant (p < 0.001). The difference in means was highest in Group-I (34.943) followed by Group-II (31.856) (Table 15).

Table 15: Effect on Blood Sugar Postprandial (n=60)

Groups	BSPP Mean ±SD				Within the group comparison,Paired 't' test, (BT - FU3)
	BT	FU1	FU2	FU3	
Group I (n=23)	174.54±15 .535	154.39 ± 20.442	146.24±18. 620	140.37±13 .85	34.943 ± 16.266 t=10.303 p<0.001 HS
Group II (n=27)	175.32±15 .295	157.87±20 .575	149.67±20. 133	143.33±17 .136	31.856 ± 16.415 t=10.04 p<0.001 HS
Between the group comparison, One-Way ANOVA	F = 0.078 p>0.05 NS	F = 0.762 p>0.05 NS	F = 2.036 p>0.05 NS	F = 3.303 p< 0.05 S	
Post-Hoc test (Bonferroni), Significant pairs (p<0.05)	-	-	-	-	

Mean percentage fall in FBS & PPBS in different trial group

The Group-I (*Vamana Karma* Group) shows maximum fall (11.47%) in fasting blood sugar level followed by Group-II (Control Group) (10.86%). The rate of fall in postprandial blood sugar in Group-I was maximum (20.02%) followed by Group-II (18.17%) (Table 16).

Table 16: Mean % fall in FBS and PPBS in Different trial group

Group	% fall in FBS	% fall in PPBS
I	11.47	20.02
II	10.86	18.17

Discussion

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Prediabetes has been reported as a risk factor for developing macrovascular disease and diabetes (9,10). Various organizations have defined it in a different manner. In prediabetes blood glucose levels is higher than normal but under the definite threshold of diabetes. Although the up and down of blood sugar level is a continuous process therefore, prediabetes cannot be considered as a diseases state. However, it an alarming stage from where a person can return to normal or develop into a diabetic. Prediabetes may be an initial phase of impaired insulin secretion and peripheral insulin resistance. *Bahudravasleshma* (target tissue defect) and Bahuabaddhameda (lipid derangement) are two important factors in pathogenesis of *Prameha* (11). Vamana karma is describe as main *shamshodhan* procedure for alleviating primarily Kapha and to some extent pitta also (12). Whole procedure of Vamana appears helpful in utilization of glucose by muscles and overcome from peripheral insulin resistance through alleviating Bahudrava kapha. In addition, Vamana also helpful in diminishing the *Meda* (6).

The Body mass index (BMI) reveals that patients of Group-I i.e. *Samshodhana (Vamana Karma)* therapy; shows greater reduction of BMI (1.056), While least reduction was observed in modern medicine treated Group-II (0.146). The selected *Vamana Karma* measures have shown statistically highly significant hypoglycemic effect in terms of reducing FBS by 11.47% and PPBS by 20.02%. This signifies *Vamana Karma* can be a useful panchkarma procedure in the management of prediabetes and prevention of Type-2 DM.

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