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Effect of twelve week yoga programme on type-II diabetes mellitus

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Abstract

Diabetes Mellitus is the most common and possibly one of the oldest metabolic disorders in the worlds. It is characterized by multi-system dysfunction due to an elevated blood sugar level. An objective of the study is to investigate the effect of twelve weeks yoga programme on Type – II diabetic mellitus forty Type – II diabetic patients (n=40) from Health centre were randomly selected as subjects. The age of the subjects ranged from 25 to 60 years. The subjects divided into four group of ten subjects each (n – 10) in which group I underwent to asana exercise, group II underwent pranayama exercise, group III underwent combination of asana & pranayama exercise and group IV acted as control group who did not undergo any special training programme apart from their regular activities. Blood sugar and urine sugar was selected as a test variable and assessed before and after the training period. The collected data were statistically analyzed by using Analysis of Covariance and Post hoc test to determine the paired mean difference. From the result of the study, it was found that there was a significant reduction in blood sugar of training group when compared to control group.

Keywords: Type – II diabetic mellitus, asana exercise, pranayama exercise, blood sugar, urine sugar.

Introduction

The term diabetes has been derived from the Greek word “*διαβήτης*” diabetes meaning syphon was coined by Aretaeus of Cappadocia. Thomas Willis added the word mellitus “*μελίτωσις*”, from the Latin meaning “honey”, a reference to the sweet taste of the urine. This sweet taste had been noticed in urine by the ancient Greek, Chinese, Egyptians, Indians, and Persians. The Indian physician Susruta in 500AD also mentioned the sweet taste of diabetic urine and classified it as Medhumeha advising exercises to “Cure” it (Dwivedi and Dwivedi, 2007). WHO (2006) Classified diabetes on the basis of insulin requirement as Insulin Dependent Diabetes Mellitus (IDDM- type I) and Non-Insulin Dependent Diabetes Mellitus (NIDDM–type II). Type 1 diabetes is also known as insulin – dependent diabetes it is an auto-immune condition in which the immune system of the body (that protects the body against infection and disease) turns against itself. As a result most, or all of the insulin-producing cells of the pancreas are destroyed and the pancreas is not able to produce enough insulin. It is seen among those aged less than 40 years of age. There are different kinds of insulin treatments available. Insulin is usually injected 1-4 times per day depending on the type of insulin. The daily routine of the person, the frequency, timing and quantity of exercise taken. Type 2 diabetes also referred to as non-insulin depended diabetes occurs when the body does not produce enough insulin or the insulin produced does not work properly. Type 2 diabetes usually develops in middle-aged people and later life. But has been seen in younger adults and also recently amongst teenagers. The science of yoga is an ancient one. It is a rich heritage of our culture. Several older books make a mention of the usefulness of yoga in the treatment of certain diseases and preservation of health in normal individual. It has now become the subject of modern scientific evaluation. Yoga is a complete science of life that originated in India many thousands of years ago (Gore, 1987) It is the oldest system of personal development in the world, encompassing body, mind and spirit. Yoga is an ancient art based on a harmonizing system of development for the body, mind, and sprit. The practice of yoga will lead you to a sense of peace and well-being. The practice of yoga makes the body strong and flexible; it also improves the functioning of the respiratory, circulatory, digestive, and harmony systems.

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According to Krishna Raman (1998) Yoga provides and alternate source of healing for diabetes. Yoga helps to strengthen the immune system, improve blood circulation and the flow of vital energy or prana to the internal organs of the body. The secretion of stress hormones due to faulty diet hectic or wrong thinking is controlled by the practice of yoga.

Materials and Methods

For this purpose type 2 male diabetes patients from Belda health centre, were randomly selected as subject their age were ranged between 25 to 60 years. The selected forty subjects (40 type 2) divided into four groups of ten each. Out of which group I (n-10) underwent Asana exercise group II (n-10) underwent pranayama exercise, group III (n-10) underwent combination of asana and pranayama exercise and group IV (n-10) remained as control. The training programme was carried out for six days per week during morning session only (6 am to 8 am) for twelve weeks blood sugar and urine sugar was selected as criterion variable for this study and it was measured by blood sugar level by god pod method and urine sugar by Benedict method. All experimental groups initially performed through warming up exercise. After that

group I performed the following yoga exercise. These are the exercises were given Suryanamaskar, Vipritakrani, Matasyasna, Ardha Pavanumktasna, Ardha Hal asana, Ardha Chakrasana, Shavasana. Group II (Pranayama group) Kapalbhathi, Nadi Shodan pranayama, Bhramari pranayama. Group III (Asana & Pranayama group) Suryanamaskar, Vipritakrani, Matasyasna, Ardha Pavanumktasna, Ardha Hal asana, Ardha Chakrasana, Shavasana. (Pranayama) Kapalbhathi, Nadi Shodan pranayama, Bhramari pranayama. Group IV control group will remain their own schedule.

Statistical Procedure

The Analysis of Covariance was applied to see the effect of Asanas, Pranayama, and combination of Asana and pranayama on Blood Sugar and Urine sugar levels of Diabetes Type 2 patients. Further to find out which training program was more effective on blood sugar and urine sugar level of diabetes type 2 patients the post hoc test was used with the level of significance was set at 0.05 levels.

Blood Sugar Level (Fasting) of Type-II Subjects

Table 13. Mean and standard deviation of blood sugar level (fasting) of asana, pranayama, combination and control group for type- II subjects.

Groups Test	Asana	Pranayama	Combined	Control	Mean ± SD
Pre-test	176.20 ± 10.59	183.80 ± 5.12	181.20 ± 7.04	178.80 ± 7.41	180.00 ± 8.01
After 6 weeks	174.40 ± 10.86	181.80 ± 5.03	178.90 ± 7.11	176.80 ± 7.47	177.98 ± 8.07
After 12 weeks	165.20 ± 10.22	168.40 ± 4.48	170.90 ± 6.79	179.10 ± 7.20	170.90 ± 8.86
	Groups (G)		Test (T)		G × T
SEm (±)	1.409		1.220		2.440
CD (P=0.05)	3.950		3.420		6.840

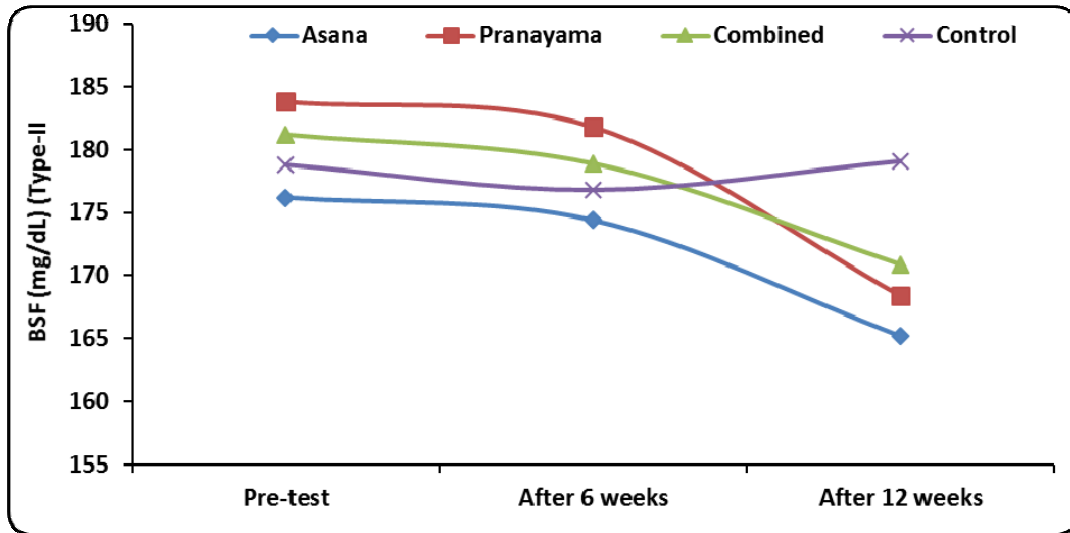


Fig. 4. Pretest and Posttests of blood sugar level (fasting) of four groups for type – II subjects

Table 14. Analysis of variance of blood sugar level (fasting) for four groups of type – II subjects

Source	Sum of Squares	df	Mean Square	F
Group	785.558	3	261.853	4.398
Test	1826.217	2	913.108	15.335
Group * Test	888.317	6	148.053	2.486
Error	6430.700	108	59.544	
Total	3739381.000	120		

Table 15: Analysis of co-variance of blood sugar level (fasting) for four groups of type –II subjects

Test	Mean				Ancova table					
	Asana	Praayam	Combined	Control	Source of variance	SS	df	MS	F	Sig.
Pre	176.20	183.80	181.20	178.80	B	317.600	3	105.867	1.745	.175
					W	2184.400	36	60.678		
Post	165.20	168.40	170.90	179.10	B	1059.800	3	353.267	6.353*	.001
					W	2001.800	36	55.606		
Adjusted	168.0	165.6	170.0	153.8	B	1179.483	3	393.161	16.724*	.000
					W	822.811	35	23.509		

Table 16: Post hoc mean difference among the group of blood sugar level (fasting) for type –II subjects.

Dependent variable	(I) type of group	(J) type of group	Mean Difference (I-J)	Std. Error	Sig.
Post-test Blood Sugar Fasting (Type 2)	asana	pranayama	-3.20000	3.33483	.344
		combined	-5.70000	3.33483	.096
		control	-13.90000*	3.33483	.000
	pranayama	asana	7.60000*	3.48361	.036
		combined	2.60000	3.48361	.460
		control	5.00000	3.48361	.160
	combined	asana	5.70000	3.33483	.096
		pranayama	2.50000	3.33483	.458
		control	-8.20000*	3.33483	.019
	control	asana	13.90000*	3.33483	.000
		pranayama	10.70000*	3.33483	.003
		combined	8.20000*	3.33483	.019

Based on estimated marginal means

a. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

*. The mean difference is significant at the .05 level

Mean score and standard deviation of pretest of four groups of blood sugar level (fasting) for type –II subjects i.e asana, pranayama and combined group and control group were 176.20 ± 10.59, 183.80 ± 5.12, 181.20 ± 7.04 and 178.80 ± 7.41 in (tabe no. 13). After six weeks exercise programme mean scores and standard deviation were 174.40 ± 10.86, 181.80 ± 5.03, 178.90 ± 7.11 and 176.80 ± 7.47. and after twelve weeks exercise programme mean scores and standard deviation were 165.20 ± 10.22,168.40 ± 4.48,170.90 ± 6.79 and 179.10 ± 7.20 respectively. Participating in asana, parnayama and combination all the groups decreased the blood sugar level.

Since all the mean scores of blood sugar level (fasting) for type –II were not equal. Analysis of variance was computed in (table no.14) to find out the significant difference among the four means. It was observed from the (table no.14) that the F values was significant at .05 level. (ANCOVA (table no. 15) was done to find out the significance of difference after participating in the asana, pranayama, and combined yoga programme among the groups. So treatment had positive effect on the groups. In pretest pranayama group

wasmaximum then other three groups. After twelve weeks of exercise programme all the three groups decreased blood sugar level except the control group. From (table no.15). Significant differences were found in blood sugar level (fasting) type II subjects among the group.

From the blood sugar level (fasting) point of view a number of Researchers (saraswati 2002)^[1] that the initial test result of fasting blood glucose was in the range of 93-412 mg% with a mean of 213 mg% . The yoga practice which administered was shaktaran, asana and pranayama. The practice were very effective in controlling blood sugar level.

After twelve weeks of yoga training programme the blood sugar level decreased in all experimental groups in comparison to control group at .05 level of significance. Saraswati (2002)^[1] observed a significant reduction in blood sugar level. So analyzing the result it may be concluded that hypothesis no 2(chapter 1.8) in relation to BSF type II subjects may be accepted.

Blood Sugar Level (Post Prandial) Of Type-Ii Subjects

Table 17: Mean and standard deviation of blood sugar level (post prandial) of asana, pranayama, combination and control group for type II subjects.

Groups Test	Asana	Pranayama	Combined	Control	Mean ± SD
Pre-test	244.50 ± 24.61	255.80 ± 13.37	266.00 ± 10.94	263.00 ± 9.17	257.33 ± 17.27
After 6 weeks	242.70 ± 24.17	253.10 ± 12.68	262.30 ± 10.1	260.90 ± 9.49	254.75 ± 16.69
After 12 weeks	233.60 ± 26.74	240.10 ± 14.12	256.60 ± 15.66	264.30 ± 8.04	248.65 ± 20.94
	Groups (G)		Test (T)		G × T
SEm (±)	2.958		2.561		5.123
CD (P=0.05)	8.292		NS		NS

NS = Not significant

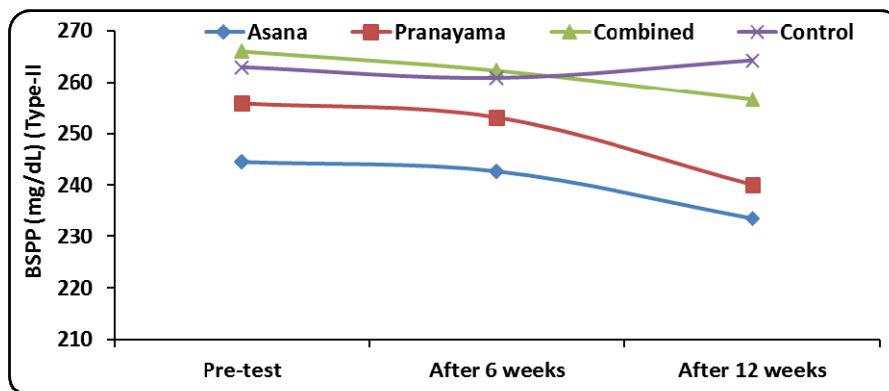


Fig. 5. Pretest and Posttest of blood sugar level (Post Prandial) of four groups for type-II subject

Table 18. Analysis of variance of blood sugar level (Post Prandial) of four groups for type-II subjects

Source	Sum of Squares	df	Mean Square	F
Group	10235.958	3	3411.986	13.001
Test	1587.950	2	793.975	3.025
Group * Test	1011.517	6	168.586	0.642
Error	28343.900	108	262.444	
Total	7757213.000	120		

Table 19: Analysis of co-variance of blood sugar level (Post Prandial) for four groups of type –II subjects

Test	Mean				ANCOVA table					
	Asana	Praayam	Combined	Control	Source of variance	SS	df	MS	F	Sig.
Pre	244.50	255.80	266.00	263.00	B	2742.675	3	914.225	3.701	.020
					W	8892.100	36	247.003		
Post	233.60	240.10	256.60	264.30	B	6077.300	3	2025.767	6.618*	.001
					W	11019.800	36	306.106		
Adjusted	247.2	241.7	247.4	258.3	B	1399.151	3	466.384	16.020*	.000
					W	1018.937	35	29.112		

Table 20: Post hoc mean difference among the group of blood sugar level (Post Prandial) for type –II subjects.

(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig. ^a	95% Confidence Interval for Difference ^a	
					Lower Bound	Upper Bound
asana	pranayama	5.484*	2.498	.035	.412	10.555
	combined	-.199	2.708	.942	-5.697	5.300
	control	-11.080*	2.635	.000	-16.430	-5.731
pranayama	asana	-5.484*	2.498	.035	-10.555	-.412
	combined	-5.683*	2.483	.028	-10.723	-.643
	control	-16.564*	2.448	.000	-21.534	-11.595
combined	asana	.199	2.708	.942	-5.300	5.697
	pranayama	5.683*	2.483	.028	.643	10.723
	control	-10.882*	2.419	.000	-15.793	-5.971
control	asana	11.080*	2.635	.000	5.731	16.430
	pranayama	16.564*	2.448	.000	11.595	21.534
	combined	10.882*	2.419	.000	5.971	15.793

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

a. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

From the table no. 17 it was found that mean score and standard deviation of blood sugar level (Post Prandial) type II subjects before exercise programme of all the groups were $244.50 \pm 24.61, 255.80 \pm 13.37, 266.00 \pm 10.94$ and 263.00 ± 9.17 after six weeks exercise programme were $242.70 \pm 24.17, 253.10 \pm 12.68, 262.30 \pm 10.1$ and 260.90 ± 9.49 and after twelve weeks of exercise programme were $233.60 \pm 26.74, 240.10 \pm 14.12, 256.60 \pm 15.66$ and 264.30 ± 8.04 respectively.

Participating in yoga exercise programme all the experimental groups decreased their blood sugar level (table no.17). Since all the mean scores of blood sugar level (Post Prandial) were

not equal. Analysis of variance was computed (table no. 18) to find the significance. It was observed from the table no. 18 that the F value was significant at 0.05 level. (ANCOVA (table no 19) was done to find out the significant effect after participating in the yoga programme among the groups. So treatment had positive effect on the groups expect control group.

Saraswati (2002) [1] found significant decreased blood sugar level. Gore (1988) [2] conducted a study on yogic treatment for diabetes through 5 weeks of yogic treatment for diabetes through 5weeks of yoga training, (N-9) were selected as a subject beneficial effect of yoga training was observed.

So analyzing the result it may be concluded that hypothesis no

2 (chapter no. 1.8) in relation to blood sugar level (Post Prandial) type II may be accepted. It may be concluded that the present study was in close proximity to other Researcher.

Urine Sugar Level of Type –II Subjects

Table 21: Mean and standard deviation of urine sugar level of asana, pranayama, and combination and control group for type- II subjects.

Groups Test	Asana	Pranayama	Combined	Control	Mean ± SD
Pre-test	272.00 ± 9.67	276.40 ± 6.04	275.30 ± 8.30	277.00 ± 8.03	275.17 ± 8.04
After 6 weeks	270.30 ± 10.00	274.70 ± 6.36	272.80 ± 8.14	274.60 ± 7.62	273.10 ± 8.02
After 12 weeks	262.00 ± 9.45	263.50 ± 4.77	264.10 ± 6.67	277.50 ± 7.62	266.78 ± 9.46
	Groups (G)		Test (T)		G × T
SEm (±)	1.436		1.244		2.488
CD (P=0.05)	4.025		3.487		NS

NS = Not significant

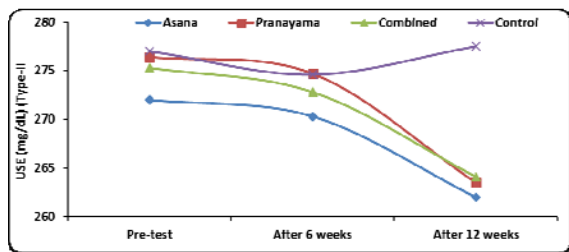


Fig. 6. Pretest and Posttest of urine sugar level of four groups of type-II subjects

Table 22: Analysis of variance of urine sugar level for four groups of type-II subjects

Source	Sum of Squares	df	Mean Square	F
Group	1070.967	3	356.989	5.768
Test	1531.617	2	765.808	12.373
Group * Test	762.783	6	127.131	2.054
Error	6684.600	108	61.894	
Total	8867470.000	120		

Table 23: Analysis of co-variance of blood sugar level (Urine sugar level) for four groups of type –II subjects

Test	Mean				ANCOVA table					
	Asana	Praayam	Combined	Control	Source of variance	SS	df	MS	F	Sig.
Pre	272.00	276.40	275.30	277.00	B	149.275	3	49.758	.756	.526
					W	2370.500	36	65.847		
Post	262.00	263.50	264.10	277.50	B	1557.075	3	519.025	9.672*	.000
					W	1931.900	36	53.664		
Adjusted	264.5	262.5	264.00	176.00	B	1153.157	3	384.386	32.224*	.000
					W	417.499	35	11.929		

Table 24: Post hoc mean difference among the group of blood sugar level (Urine sugar level) for type –II subjects.

(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig. ^a	95% Confidence Interval for Difference ^a	
					Lower Bound	Upper Bound
asana	pranayama	2.017	1.576	.209	-1.182	5.216
	combined	.538	1.562	.733	-2.634	3.709
	control	-11.504*	1.585	.000	-14.721	-8.286
pranayama	asana	-2.017	1.576	.209	-5.216	1.182
	combined	-1.479	1.547	.345	-4.619	1.660
	control	-13.520*	1.545	.000	-16.657	-10.384
combined	asana	-.538	1.562	.733	-3.709	2.634
	pranayama	1.479	1.547	.345	-1.660	4.619
	control	-12.041*	1.549	.000	-15.186	-8.896
control	asana	11.504*	1.585	.000	8.286	14.721
	pranayama	13.520*	1.545	.000	10.384	16.657
	combined	12.041*	1.549	.000	8.896	15.186

Based on estimated marginal means

a. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

*. The mean difference is significant at the .05 level.

From the (table no.21) it was found that mean scores and standard deviation of urine sugar level of type II subjects before exercise programme of all the groups were 272.00 ± 9.67,276.40 ± 6.04,275.30 ± 8.30 and 277.00 ± 8.03 after six weeks exercise programme mean and standard deviation were 270.30 ± 10.00,274.70 ± 6.36,272.80 ± 8.14 and 274.60 ± 7.62 and after twelve weeks exercise programme mean and standard deviation were 262.00 ± 9.45,263.50 ± 4.77,264.10 ±

6.67 and 277.50 ± 7.62 respectively.

Participating in asana, pranayama, and combination. All experimental groups decreased their urine sugar level. Since all the mean scores of urine sugar level of type -II were not equal, analysis of variance was computed in (table no.22). To find the significant difference among the four means. It was observed from (table no.22) that the F value was significant at 0.05 level. (ANCOVA (table no. 23) was done to find out the

significant effect after participating in the yoga programme among the groups (table no.24). So treatment had positive effect on the groups. After six and twelve weeks training programme urine sugar level of type -II subjects decreased in all experimental groups except control group at 0.05 level of significant.

Gore (1988) ^[2] indicated that yogic training decreased the sugar in urine glucose tolerance test and medication was significant. So analyzing the result it may be concluded that hypothesis no 4 (chapter no 1.8) in relation to USE may be accepted.

Discussion

This study clearly showed significant effect of yoga asana, pranayama and combination of asana & pranayama on blood sugar testing namely fasting blood sugar test among type – I diabetic male patients. The asana exercise and pranayama is well established and very popular and so easy to perform by any individual. Participants in this study showed confidence over time in recommending this program to their friends who are at high risk for diabetics and expressed high satisfaction with the program. Many researcher studies revealed that Asana and Pranayama exercise is helping to reduce the blood glucose level (saraswati, 2002) ^[1] showed that yoga practice which administered was shatkarmas, Asanas and Pranayama were very effective in controlling blood sugar levels and also in decreasing the amplitude of risk factors of DM and CDM. Gore (1988) ^[2] showed a yogic treatment with emphasis on tranquillization and relaxation of the patient. Only one exercise session was insufficient to determine whether exercise can improve carbohydrate metabolism in women with gestational diabetes shown by O'shea (1987). Sahay et.al. (1991) ^[5] showed physical training exercises also improve exercise performance and postpone anaerobic threshold but yogic practices seem to be so without increasing oxygen consumption. Sackey and Jefferson (1996) showed that there was a significant correlation between activity and glycaemic control warrants further investigation, he also showed that patients who engage in energetic activity early in the morning may achieve lower blood glucose and fructosamine level than their active peers.

Conclusion

These studies have confirmed the useful role of Asanas, pranayama and combination of both asanas and pranayama on type II- diabetes mellitus. It has a significant effect on patients as it reduced the blood sugar level of patients, it has also increased the metabolic rate due to increase rate of oxidation and vigorous abdominal movements. In summary the results of this study suggests that the twelve week yoga programme on type-II diabetes mellitus has got a significant effect on patients. The results of the study indicates that there was significant changes seen as it lowered the blood sugar level of the patients are due to Twelve week yoga program on type-II diabetes mellitus

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