



Effect of physical exercise, yogic exercise and combination of physical exercise and yogic exercise on selected physical, physiological variables of diabetic persons

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Abstract

Asana is a very ancient practice of yoga. It plays an important role in every find of yoga sadana. "Asanas" in Sanskrit means posture. To achieve the purpose of the study sixty diabetic persons were randomly selected as subjects from Ganapathy area in the Coimbatore district and their age ranged between 30 and 50 years. They were randomly divided into 4 groups of fifteen each, in which Group I underwent physical exercise training, Group II Yogic training, Group III Combination of Physical and Yoga training and Group IV acted as control Group. In the present study the following factors were selected as variables physical variables grip strength and flexibility Physiological variables, systolic blood pressure and diastolic blood pressure. Combination of physical exercise and yogic exercise produced a significant development on grip strength, flexibility, diastolic blood pressure, better than the physical exercise and yogic exercise did, except systolic blood pressure. Physical exercise produced a significant development on grip strength, resting diastolic blood pressure, better than the yogic exercise did, except flexibility and resting systolic blood pressure. Yogic exercise programme improved flexibility better than the physical exercise programme could. The yogic exercise programme improved resting systolic blood pressure better than the physical exercise and combination of physical exercise and yogic exercise could. Combination of physical exercise and yogic exercise programme improved resting systolic blood pressure better than physical exercise programme could.

Keywords: Grip strength, flexibility, systolic blood pressure, diastolic blood pressure

Introduction

Physical inactivity is considered more dangerous than Physical activity. When life has become convenient beyond our wildest dreams, when physical exertion threatens to become absolute, we pay more attention to our television sets, dish washers, washing machines, vacuum cleaners and other machines. People in our country, the young and the old, do not get enough exercise. Modern society is steadily drifting away from the habit of physical work. Most of our work is done by a machine or a computer and a person has to simply sit and watch the work done by them. Inactive people are more likely to add more weight, become obese and develop impaired cardiac function. They have poorer tolerance of physical and mental stress and they are less able to cope with illness and injury. Moreover, inactivity accelerates the process of ageing. The changing trend in lifestyle, industrialization, automation, mechanization and above all the concentration on speed, all these take men to obesity. Growing old is inevitable, but growing old youthfully becomes possible only when we keep our body supple, strong and fit.

Physical Fitness

Fitness is a gift of life. Maintaining of good physical fitness is a gift in present life. But today's life with various miserable factors, everyman has to overcome them. A person who is considered to be completely fit means that he is able to meet any situation irrespective of occupation and activity etc. Fitness is affected due to various reasons such as no proper medical care, no preventive measure, bad health habits and non availability of good nutrition food. Barrow has stated that "Fitness include the mental, emotional, social as well as the physical aspects and all

these components of total fitness play a significant role for a full and happy life. Physical fitness is one's highest possession and it is a pathway to lead healthful living. It has to be earned through a daily routine of physical exercises". Full name of this physical disorder consists of two words 'Diabetes' and 'Mellitus'. There is another word 'Inspid us' also aligned with the two words. In fact the word (or term) 'Diabetes', which owes its origin to Unani language, means 'That which comes out or that which flows' and the term 'Mellitus' (a word of Latin origin) means 'sugar' or 'honey'. Hence, the term 'Diabetes Mellitus' means flow of sugar. The Ayurvedic term 'Madhumeha' means 'Rain of honey' where 'honey' stands for 'Sugar'. Hence, Diabetes Mellitus and 'Madhumeha' are synonyms and they convey the same sense. Diabetes Inspid us, is characterized by the persistent excretion of excessive quantities of urine of low specific gravity but this is not a specific kind of 'True Diabetes'. But when the urine is loaded with excessive content of sugar and the urinary flow, irrespective of the quantity passed in 24 hours, is also on the higher side and it may be called diabetic origin. Diabetes Inspid us can be reduced by excessive thirst and urinary flow in large quantity. When the body fails to utilize the released quantity of sugar, it spills over in to the blood stream and renders the blood laden with sugar. When blood fails to absorb sugar, the excessive quantity passes on to kidneys and loads the urine with sugar. Asana is a very ancient practice of yoga. It plays an important role in every find of yoga sadana. "Asanas" in Sanskrit means posture. The term asana can be defined on the basis of the criteria of 'stability' and 'comfort'. Asanas form a major part of what is known as the system of the yogic physical culture. Asana means a state of being in

which one can remain steady calm, quite and comfortable both physically and mentally.

Methods and materials

To achieve the purpose of the study sixty diabetic persons were randomly selected as subjects from Ganapathy area in the Coimbatore district and their age ranged between 30 and 50 years. They were randomly divided into 4 groups of fifteen each, in which Group I underwent physical exercise training, Group II Yogic training, Group III Combination of Physical and Yoga training and Group IV acted as control Group. The subjects in control group were not engaged in any activity other than their regular curriculum i.e. conventional exercise during this training period. The subjects were free to withdraw their consent in case of feeling any discomfort during the period of their participation but there was no drop out during the study.

Selection of Variables

In the present study the following factors were selected as variables.

Table 1

Physical Variables		
S. No	Variables	Test
1	Grip Strength	Grip dynamometer
2	Flexibility	Sit and reach test
Psychological Variables		
1	Systolic Blood Pressure	Sphygmomanometer
2	Diastolic Blood Pressure	Sphygmomanometer

Statistical Procedure

The data collected from the four groups namely Physical exercise group, yogic Group, combined physical exercise and yogic Group and Control Group on selected physical physiological and bio chemical variables were statistically analyzed to determine the significant difference, if any, applying analysis of covariance (ANACOVA).

Table 2: Analysis of Covariance for the Data on Grip Strength of Physical Exercise Group, Yoga Group, Combination of Physical Exercise and Yogic Exercise Group

Test	PEG	YG	COM. G	CG	SV	df	SS	MS	F Ratio
Pre-test Mean	35.60	36.73	34.20	35.60	B.G	3	48.40	16.13	0.78
					W.G	56	1160.53	20.72	
Post –test mean	37.20	38.20	36.47	35.27	B.G	3	68.72	22.91	0.94
					W.G	56	1361.47	24.31	
Adjusted Mean	37.13	36.97	37.83	35.20	B.G	3	56.23	18.74	7.11*
					W.G	55	144.94	2.64	

*= Significant at 0.05 level B.G=Between Groups W.G=With in Groups

PEG: Physical Exercise Group, **YG:** Yoga Group, **COM.G:** Combination group, **CG:** Control Group, **SV:** Source of variance, **DF:** degrees of freedom, **SS:** Sum of Square, **MS:** Mean Square

Table 2 shows that the pre-test means on grip strength of physical exercise group, yogic exercise group, combination of physical exercise and yogic exercise group and control group are 35.60, 36.73, 34.20 and 35.60 respectively and the obtained F ratio is 0.78. Since the obtained F ratio of 0.78 for pre test means on grip strength is lesser than the required table value of 2.77, it is found to be insignificant at 0.05 level of confidence for 3 and 56 degrees of freedom. The post-test means on grip strength of physical exercise group, yogic exercise group, combination of physical exercise and yogic exercise group and control group are 37.20, 38.20, 36.47 and 35.27 respectively and the obtained F ratio is 0.94. Since the obtained F ratio of 0.94 for post test means on grip strength is lesser than the required table value of 2.77, it is found to be insignificant at 0.05 level of confidence for 3 and 56 degrees of freedom. The adjusted post-test means on grip strength of physical exercise group, yogic exercise group, combination of physical exercise and yogic exercise group and control group are 37.13, 36.97, 37.83 and 35.20 respectively and the obtained F ratio is 7.11. Since the obtained F ratio of 7.11 for adjusted post test means on grip strength is higher than the required table value of 2.77, it is found to be significant at 0.05 level of confidence for 3 and 55 degrees of freedom.

The results of the study indicate that there is statistically significant difference among the adjusted post-test means of physical exercise group, yogic exercise group, combination

of physical exercise and yogic exercise group and the control group on grip strength. Therefore, it may be concluded that there is significant difference among physical exercise group, yogic exercise group, combination of physical exercise and yogic exercise group and the control group on grip strength. To determine which of the paired means had a significant difference, the Scheffe’s test was used as a post-hoc test and the results are presented in table-4.1 a.

Table 3: Scheffe’s Test for the Differences Between the Adjusted Post-Test Paired Means of Grip Strength

Physical Exercise Group	Yoga Group	Combination Group	Control Group	Mean difference	Confidence interval
37.13	36.97	-	-	0.16	1.69
37.13	-	37.83	-	0.70	1.69
37.13	-	-	35.20	1.93*	1.69
-	36.97	37.83	-	0.86	1.69
-	36.97	-	35.20	1.77*	1.69
-	-	37.83	35.20	2.63*	1.69

*= Significant at 0.05 level

Table 3 shows that the adjusted post-test mean differences on grip strength between physical exercise group and yogic exercise group, physical exercise group and combination of physical exercise and yogic exercise group, and yogic exercise group and combination of physical exercise and yogic exercise group are 0.16, 0.70 and 0.86 respectively, which are lesser than the confidence interval value of 1.69 for insignificance at 0.05 level of confidence for 3 and 55 degrees of freedom. It also shows that the adjusted post-test mean differences on grip strength between physical exercise

group and control group, yogic exercise group and control group, and combination of physical exercise and yogic exercise group and the control group are 1.93, 1.77 and 2.63 respectively, which are higher than the confidence interval value of 1.69 for significance at 0.05 level of confidence for

3 and 55 degrees of freedom.

The mean values of physical exercise group, yogic exercise group, combination of physical exercise and yogic exercise group and control group on grip strength are graphically represented in figure-4.1

Table 4: Analysis of Covariance for the Data on Flexibility of Physical Exercise Group, Yoga Group, Combination of Physical Exercise and Yogic Exercise Group and Control Group

Test	PEG	YG	COM. G	CG	SV	df	SS	MS	F Ratio
Pre-test Mean	13.67	12.87	12.80	13.93	B.G	3	14.58	4.86	0.80
					W.G	56	342.90	6.11	
Post –test mean	15.63	15.33	15.93	14.27	B.G	3	21.40	7.13	1.14
					W.G	56	336.93	6.02	
Adjusted Mean	14.81	15.75	16.42	13.69	B.G	3	60.75	20.25	28.57*
					W.G	55	38.99	0.11	

*= Significant at 0.05 level B.G=Between Groups W.G=With in Group

Table 4 shows that the pre-test means on flexibility of physical exercise group, yogic exercise group, combination of physical exercise and yogic exercise group and control group are 13.67, 12.87, 12.80 and 13.93 respectively and the obtained F ratio is 0.80. Since the obtained F ratio of 0.80 for pre test means on flexibility is lesser than the required table value of 2.77, it is found to be insignificant at 0.05 level of confidence for 3 and 56 degrees of freedom. The post-test means on flexibility of physical exercise group, yogic exercise group, combination of physical exercise and yogic exercise group and control group are 15.13, 15.33, 15.93 and 14.27 respectively and the obtained F ratio is 1.19. Since the obtained F ratio of 1.19 for post test means on flexibility is lesser than the required table value of 2.77, it is found to be insignificant at 0.05 level of confidence for 3 and 56 degrees of freedom. The adjusted post-test means on flexibility of physical exercise group, yogic exercise group, combination of physical exercise and yogic exercise

group and control group are 14.81, 15.75, 16.42 and 13.69 respectively and the obtained F ratio is 28.57. Since the obtained F ratio of 28.57 for adjusted post test means on flexibility is higher than the required table value of 2.77, it is found to be significant at 0.05 level of confidence for 3 and 55 degrees of freedom.

The results of the study indicate that there is statistically significant difference among the adjusted post-test means of physical exercise group, yogic exercise group, combination of physical exercise and yogic exercise group and the control group on flexibility. Therefore, it may be concluded that there is significant difference among physical exercise group, yogic exercise group, combination of physical exercise and yogic exercise group and the control group on flexibility. To determine which of the paired means had a significant difference, the Scheffe’s test was used as a post-hoc test and the results are presented in table-4.2 a.

Table 5: Scheffe’s Test for the Differences Between the Adjusted Post-Test Paired Means of Flexibility

Physical Exercise Group	Yoga Group	Combination Group	Control Group	Mean difference	Confidence interval
14.81	15.75	-	-	0.95*	0.87
14.81	-	16.42	-	1.61*	0.87
14.81	-	-	13.69	1.12*	0.87
-	15.75	16.42	-	0.66	0.87
-	15.75	-	13.69	2.06*	0.87
-	-	16.42	13.69	2.72*	0.87

*= Significant at 0.05 level

Table 5 shows that the adjusted post-test mean differences on flexibility between yogic exercise group and combination of physical exercise and yogic exercise group is 0.66 respectively, which is lesser than the confidence interval value of 0.87 for insignificance at 0.05 level of confidence for 3 and 55 degrees of freedom. It also shows that the adjusted post-test mean differences on flexibility between physical exercise group and yogic exercise group, physical

exercise group and combination of physical exercise and yogic exercise group, physical exercise group and control group, yogic exercise group and control group, and combination of physical exercise and yogic exercise group and control group are 0.95, 1.61, 1.12, 2.06 and 2.72 respectively, which are higher than the confidence interval value of 0.87 for significance at 0.05 level of confidence for 3 and 55 degrees of freedom.

Table 6: Analysis of covariance for the data on systolic blood pressure of physical exercise group, yoga group, combination of physical exercise and yogic exercise group and control group

Test	PEG	YG	COM. G	CG	SV	df	SS	MS	F Ratio
Pre-test Mean	147.33	140.13	149.60	140.93	B.G	3	987.40	329.13	1.05
					W.G	56	17481.6	312.17	
Post –test mean	136.53	128.53	136.27	142.40	B.G	3	1455.73	485.24	1.95
					W.G	56	13960.0	249.29	
Adjusted Mean	134.54	131.60	132.69	144.90	B.G	3	1662.23	554.08	5.70*
					W.G	55	5344.74	97.18	

The table value for Significance at 0.05 Level with (3, 56) and (3, 55) is 2.77

Table 6 shows that the pre-test means on resting systolic blood pressure of physical exercise group, yogic exercise group, combination of physical exercise and yogic exercise group and control group are 147.33, 140.13 149.60 and 140.93 respectively and the obtained F ratio is 1.05. Since the obtained F ratio of 1.05 for pre test means on resting systolic blood pressure is lesser than the required table value of 2.77, it is found to be insignificant at 0.05 level of confidence for 3 and 56 degrees of freedom. The post-test means on resting systolic blood pressure of physical exercise group, yogic exercise group, combination of physical exercise and yogic exercise group and control group are 136.53, 128.53, 136.27 and 142.40 respectively and the obtained F ratio is 1.95. Since the obtained F ratio of 1.95 for post test means on resting systolic blood pressure is lesser than the required table value of 2.77, it is found to be insignificant at 0.05 level of confidence for 3 and 56 degrees of freedom. The adjusted post-test means on resting systolic blood pressure of physical exercise group, yogic exercise group, combination of physical exercise and yogic exercise group and control group are 134.54, 131.60, 132.69 and 144.90 respectively and the obtained F ratio is 5.70. Since the obtained F ratio of 5.70 for adjusted post test means on resting systolic blood pressure is higher than the required table value of 2.77, it is found to be significant at 0.05 level of confidence for 3 and 55 degrees of freedom. The results of the study indicate that there is statistically significant difference among the adjusted post-test means of physical exercise group, yogic exercise group, combination of physical exercise and yogic exercise group and the control group on resting systolic blood pressure. Therefore, it may be concluded that there is significant difference among physical exercise group, yogic exercise group, combination of physical exercise and yogic exercise group and the control group on resting systolic blood pressure.

Table 8: Analysis of covariance for the data on diastolic blood pressure of physical exercise group, yoga group, combination of physical exercise and yogic exercise group and control group

Test	PEG	YG	COM. G	CG	SV	df	SS	MS	F Ratio
Pre-test Mean	96.93	94.40	97.60	90.53	B.G	3	461.07	153.69	1.58
					W.G	56	5453.87	97.39	
Post –test mean	88.93	88.67	85.33	92.53	B.G	3	389.60	129.87	2.04
					W.G	56	3565.33	63.67	
Adjusted Mean	87.60	88.97	83.57	95.33	B.G	3	994.88	331.63	14.14*
					W.G	55	1290.03	23.46	

The table value for Significance at 0.05 Level with (3, 56) and (3, 55) is 2.77

Table 8 shows that the pre-test means on resting diastolic blood pressure of physical exercise group, yogic exercise group, combination of physical exercise and yogic exercise group and control group are 96.93, 94.40, 97.60 and 90.53 respectively and the obtained F ratio is 1.58. Since the obtained F ratio of 1.58 for pre test means on resting diastolic blood pressure is lesser than the required table value of 2.77, it is found to be insignificant at 0.05 level of confidence for 3 and 56 degrees of freedom. The post-test means on resting diastolic blood pressure of physical exercise group, yogic exercise group, combination of physical exercise and yogic exercise group and control group are 88.93, 88.67, 85.33 and 92.53 respectively and the obtained F ratio is 2.04. Since the obtained F ratio of 2.04 for post test means on resting diastolic blood pressure is lesser than the required table value of 2.77, it is found to be insignificant at 0.05 level of confidence for 3 and 56 degrees of freedom. The

To determine which of the paired means had a significant difference, the Scheffe’s test was used as a post-hoc test and the results are presented in table-4.5 a.

Table 7: Scheffe’s Test for the Differences Between the Adjusted Post Test Means of Systolic Blood Pressure

Physical Exercise Group	Yoga Group	Combination Group	Control Group	Mean difference	Confidence interval
134.54	131.60	-	-	2.95	10.24
134.54	-	132.69	-	1.86	10.24
134.54	-	-	144.90	10.36*	10.24
-	131.60	132.69	-	1.09	10.24
-	131.60	-	144.90	13.31*	10.24
-	-	132.69	144.90	12.22*	10.24

*= Significant at 0.05 level

Table 7 a shows that the adjusted post-test mean differences on resting systolic blood pressure between physical exercise group and yogic exercise group, physical exercise group and combination of physical exercise and yogic exercise group and yogic exercise group and combination of physical exercise and yogic exercise group are 2.95, 1.86 and 1.09 respectively, which are lesser than the confidence interval value of 10.24 for insignificance at 0.05 level of confidence for 3 and 55 degrees of freedom. It also shows that the adjusted post-test mean differences on resting systolic blood pressure between physical exercise group and control group, yogic exercise group and control group and combination of physical exercise and yogic exercise group and control group are 10.36, 1331 and 12.22 respectively, which are higher than the confidence interval value of 10.24 for significance at 0.05 level of confidence for 3 and 55 degrees of freedom.

adjusted post-test means on resting diastolic blood pressure of physical exercise group, yogic exercise group, combination of physical exercise and yogic exercise group and control group are 87.60, 88.97, 83.57 and 95.33 respectively and the obtained F ratio is 14.14. Since the obtained F ratio of 14.14 for adjusted post test means on resting diastolic blood pressure is higher than the required table value of 2.77, it is found to be significant at 0.05 level of confidence for 3 and 55 degrees of freedom. The results of the study indicate that there is statistically significant difference among the adjusted post-test means of physical exercise group, yogic exercise group, combination of physical exercise and yogic exercise group and the control group on resting diastolic blood pressure. Therefore, it may be concluded that there is significant difference among physical exercise group, yogic exercise group,

combination of physical exercise and yogic exercise group and the control group on resting diastolic blood pressure. To determine which of the paired means had a significant difference, the Scheffe’s test was used as a post-hoc test and the results are presented in table-4.6 a.

Table 9: Scheffe’s Test for the Differences Between the Adjusted Post Test Means of Resting Diastolic Blood Pressure

Physical Exercise Group	Yoga Group	Combination Group	Control Group	Mean difference	Confidence interval
87.60	88.97	-	-	1.37	5.03
87.60	-	83.57	-	4.03	5.03
87.60	-	-	95.33	7.73*	5.03
-	88.97	83.57	-	5.40*	5.03
-	88.97	-	95.33	6.36*	5.03
-	-	83.57	95.33	11.76*	5.03

*= Significant at 0.05 level

Table 9 a shows that the adjusted post-test mean differences on resting diastolic blood pressure between physical exercise group and yogic exercise group, physical exercise group and combination of physical exercise and yogic exercise group are 1.37 and 4.03 respectively, which are lesser than the confidence interval value of 5.03 for insignificance at 0.05 level of confidence for 3 and 55 degrees of freedom. It also shows that the adjusted post-test mean differences on resting diastolic blood pressure between physical exercise group and control group, yogic exercise group and combination of physical exercise and yogic exercise group, yogic exercise group and control group and combination of physical exercise and yogic exercise group and control group are 7.73, 5.40, 6.36 and 11.76 respectively, which are higher than the confidence interval value of 5.03 for significance at 0.05 level of confidence for 3 and 55 degrees of freedom.

Discussion on Findings

The current study examined the effects on selected physical and physiological variables due to physical exercise, yogic exercise and combination of physical exercise and yogic exercise on diabetic persons. In combination training the combined effect of physical exercise and yogic exercise only produces the larger benefit than physical exercise alone and yogic exercise alone. Because the combination of adequate intensity of physical exercise and selected yogic asanas, increase progressively double positive work load i.e. additional treatment for specific improvement in individual diabetic person. This is in agreement with the study of Sahay BK and Sahay RK (2002) who conducted a study on Exercise includes yoga practices which have a role to play in the prevention of type 2 diabetes. So combination of physical exercise and yogic exercise programme is more effective than the physical exercise alone and yogic exercise alone in improving the selected physical, physiological and bio chemical variables of diabetic persons. It is inferred from the above literature and from the results of the present study that the physical exercise, yogic exercise and combination of physical exercise and yogic exercise have greater influence on the selected physical, physiological and bio chemical variables of the diabetic persons.

Conclusions

Based on the results of the study the following conclusions were drawn.

1. Combination of physical exercise and yogic exercise produced a significant development on grip strength, flexibility, resting heart rate, resting diastolic blood pressure, better than the physical exercise and yogic exercise did, except resting systolic blood pressure.
2. Physical exercise produced a significant development on grip strength, resting heart rate, resting diastolic blood pressure, better than the yogic exercise did, except flexibility and resting systolic blood pressure.
3. Yogic exercise programme improved flexibility better than the physical exercise programme could.
4. The yogic exercise programme improved resting systolic blood pressure better than the physical exercise and combination of physical exercise and yogic exercise could.
5. Combination of physical exercise and yogic exercise programme improved resting systolic blood pressure better than physical exercise programme could.

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