



## A COMPARATIVE STUDY ON THE EFFECTIVENESS OF COMBINED AEROBIC AND RESISTANCE TRAINING TO IMPROVE QUALITY OF LIFE IN TYPE II DIABETES

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### ABSTRACT

This study is to find effectiveness of combined aerobic and resistance training over aerobic exercise on blood glucose level to improve quality of life in type II diabetes. Thirty subjects randomly divided into two equal experimental and control group. Both groups were trained for 10 weeks; 3 days a week with duration of 60 minutes per session. The experimental group trained with aerobic exercises, resistant exercises, static bicycling and multi gym exercises. The control group trained with aerobic exercise and brisk walking. Data collected before and after training using blood Glucometer and SF 36 scores. Both groups have shown significant improvement after treatment. Combined aerobic and resistance exercise shown a significant effect on the blood glucose level and quality of life with  $F=36.451$ ,  $P<0.001^{**}$  when compare with control group which had slight improvement. This study concluded that combined aerobic and resistance exercise can improve quality of life among Type II Diabetes.

**KEYWORDS:** Type II Diabetes, Blood Glucose level, Quality of life, Aerobic exercise, Resistance training.



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## INTRODUCTION

Diabetes Mellitus is a metabolic disease that is characterized by deficiencies with the hormone insulin. Deficiencies with insulin lead to hyperglycemia (high blood sugar), which leads to multiple health risks and complications [15, 29]. The three main types of diabetes are Type 1 diabetes, Type 2 diabetes and gestational diabetes. Type 1 diabetes is an autoimmune disease. Type 1 is also termed juvenile onset diabetes. Gestational diabetes develops in some women at their late pregnancy. The most common form of diabetes is Type 2 diabetes, which is also termed adult onset diabetes. In Type 2 diabetes, the body makes some insulin, but not enough. This disease is characterized by a lack of physical activity and poor eating habits [5, 28]. Consuming too many "carbohydrate" will cause the pancreas to release large amounts of insulin. Chronically high serum levels of insulin leads to a reduced sensitivity to insulin and insulin resistance. This, in turn, leads to hyperglycemia and eventually diabetes [13]. The prevalence of diabetes is higher in men than women, but there are more women with diabetes than men. Diabetes will be increasingly concentrated in urban areas. Worldwide surveillance of diabetes is a necessary first step towards its prevention and control, which is now recognized as an urgent priority [12, 21]. In India, several regional studies show a raising prevalence of diabetes. Subjects under 40 years of age had higher prevalence of diabetes. Diabetes showed a positive and independent association with age, BMI, heredity, and sedentary life style. Thus the prevalence of diabetes is high in urban India [19]. Excess body weight promotes insulin resistance and in turn glucose intolerance. Therefore obesity leads to increased insulin that can develop into diabetes [11, 22]. Diabetic clinics have developed with primary aim of increasing physical activity and eating habits to improve the quality of life [7, 8]. Circuit training is an effective method of training that improved functional capacity, lean body mass, strength and glycemic control in subjects with type II diabetes [1, 2, 4, 16]. The combination of aerobic and resistance training is more effective for improving the decreased insulin action in type II diabetes than resistance training alone [6, 10, 23].

### ***Purpose of the study***

Quality of life of the patient usually evaluated by the mental and physical component of patient's activity level, symptoms and impact of the diseases [17, 18, 24, 27]. Effects of aerobic exercise on quality of life and glucose level have proved in many studies. Aerobic exercises play an important role in overcoming impaired quality of life often seen in diabetic patients, by improving insulin level and activity level [26]. The effect of aerobic exercises with resistance training may find more effect on quality of life in type II diabetes. This study aimed to find out the significance of combined aerobic exercise and resistance training to improve the quality of life by improving insulin level on type II diabetes patients.

## MATERIALS AND METHODOLOGY

### ***Population***

The population for the study includes subjects with Type II diabetes with blood glucose level less than 300mg/dl and the age group between 45 – 64 years of both the genders.

### ***Setting of the Study***

The study was done at Columbia Asia Hospital Private Limited, Hebbal, and Bangalore after obtaining the ethical clearance from the ethical committee.

### ***Sampling and Sampling Techniques***

All Samples were diagnosed as Type II diabetes by physician at Columbia Asia Hospital Private Limited, Bangalore, India. The subjects were with the age group between 45 – 64 years and who full fill the inclusion criteria. They were selected by simple random sampling method and divided equally in to experimental group and control group with 15 subjects in each group. The experimental group was given the combined aerobic and resistance training and the control group was given aerobic exercise alone.

### ***Inclusion criteria***

- I. Both genders
- II. Patients with drug dependent
- III. Blood glucose level less than 300mg/dl

- IV. All the patients were with standardized drug dose dependent.
- V. History of type II diabetes for 5years or more
- VI. Patients who affected their quality of life due to diabetes

#### **Exclusion criteria**

- I. Insulin depended patients
- II. History of known pulmonary disease
- III. Severely impaired exercise tolerance
- IV. Diabetic neuropathy and retinopathy
- V. High resting blood sugar (300-350mg/dl)
- VI. Drop in blood pressure with exertion
- VII. Associated with known cardio-vascular disorder

#### **Methods of Data Collection**

The subjects selected for the study were assigned into two groups. Experimental and control groups, each consisting of 15 subjects. The experimental group received combined aerobic exercise and resistance training consisting of 9 aerobic exercise, 14 resistance exercises, 10 minutes of static bicycling for the lower limbs and 10 minutes in the multi gym for the upper limb. Frequency of the treatment was 3 days in a week for 10 weeks with the duration of 60 minutes; each session. The control group subjects had performed the aerobic exercises for 30 minutes and 30 minutes of brisk walking. The exercises were demonstrated before starting the intervention program. The aerobic exercise was performed for 30 minutes each session for 3 days in a week for 10 successive weeks, which consists total of 30 sessions. The groups were advised to do aerobic exercises and brisk walking at least once a day.

#### **Tools Selected for the study**

1. Glucometer (ACCU - CHEK): The One Touch II- Glucometer Accu-Chek, Blood glucose meter used in this study was validated by a clinically oriented approach known as the error grid analysis [9, 14, 20].
2. Short Form 36 Questionnaires (SF 36): Comprehensive search of electronic databases for studies measuring Health related quality of life among persons with diabetes using the short form (SF) 36 questionnaire. The short

form (SF) 36 is one of the most frequently used instruments for measuring Health related quality of life [3, 25].

#### **Materials used**

- I. Sterile Needle
- II. Lancets
- III. Stop watch
- IV. Surgical spirit
- V. Thera-band
- VI. Shoulder wheel
- VII. Finger exercise ball
- VIII. Data sheet with each patient details
- IX. Multi gym for Upper Limb (Biceps , Triiceps )
- X. Static bicycle for Lower Limbs (Quadriceps, Hamstring, Calf Muscles)

#### **Group randomization and allocation of treatment**

After screening the subject for inclusion and exclusion criteria, Informed consent [Annexure-II] was taken from each subject. 30 subjects were equally divided (n=15), for both Experimental and Control group by lottery method. The treatment purpose and expected outcomes were freely discussed with the subjects and all the doubts and questions were discussed to the best of the capability of the researcher. In experimental group six (06) Males and nine (09) Females were selected. In control group nine (09) Males and six (6) Females were selected.

#### **Intervention for Experimental group**

The Experimental group trained for 10 weeks with 3 days in a week (each exercise done five times slowly and rhythmically) with duration of 60 minutes in each session. Each 60 minutes session consisted of nine (09) different aerobic exercises, fourteen different resistance exercise, 10 minutes of static bicycling with moderate tension for the lower limbs and 10 minutes in the multi gym for the upper limb. The aerobic exercises were Neck Circles, Flexed leg back stretch, Side Bends, Trunk rotation, Back arch, overhead reach, Achilles stretch, Shin and quadriceps stretch, Hip and thigh stretch.



**Fig.1: Subjects with aerobic exercises on trunk side bends,  
Fig 2.Subjects with aerobic exercises on trunk rotations**

Strengthening exercises: Finger squeezing ball exercise, Shoulder shrug in multi gym, Arm circles in shoulder wheel with moderate tension, Shoulder adduction and internal rotation in multi gym, knee flexion-extension in multi gym, side leg lift with weight, Alternate leg lunges, Calf raises, hip flexion- extension against weight, Squat, Toe raises, Ankle circles with weight, Abdominal strengthening by abdomen curls, Sit and stand up. Resistance

Exercises: Subjects performed the exercises may be with feel of fatigued while performing these exercises but without feel of pain. Patients were asked to perform the exercises with hold of 10-15seconds in end range of movement. Multi Gym exercise: 10 minutes working out in the multi gym for the upper limbs especially triceps, biceps latissimus dorsi and pectorals muscles.



**Latissimus dorsi: Fig 3. Subject with strengthening of Latissimus dorsi,  
Fig 4.Biceps Muscle: Subject with strengthening of Biceps**



**Pectoral Muscles: Fig 5. Subject with strengthening of pectoral muscles**

**Control group**

In this group, subjects received the hand outs with explanation of nine (09) aerobic exercises to be performed for 30 minutes and 30minutes of brisk walking with a speed of 3 miles per hour and set ratio of intensity and rest as 2:1, the exercises done under the supervision of researcher. Pre-treatment assessment was taken with glucometer and SF 36 questionnaire for blood glucose level and quality of life. A post assessment was taken after 10 weeks with the same tools for blood glucose level and SF 36 Questionnaire for quality of life.

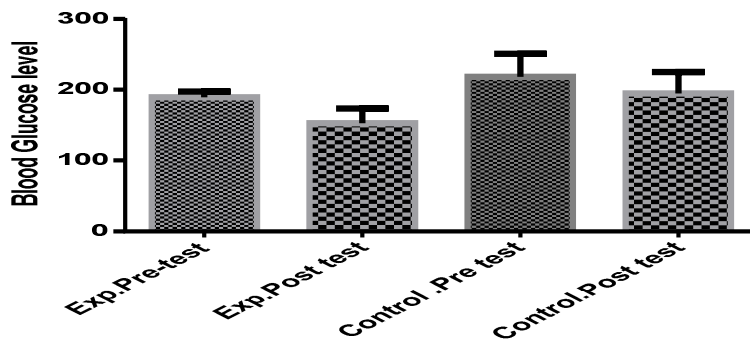
**Statistical Analysis**

Wilcoxon test used to determine the significance difference of effect between the groups. Mann Whitney U test used to compare the sig-

nificance difference in effect between the groups.  $P < 0.05$  is considered as significance of the study.

**RESULTS**

Post intervention blood glucose levels were reduced 10.7% and 19.2% in control and experimental group respectively. Blood Glucose level of Post intervention was significantly low in experimental group when compared to Control group. Significance difference found  $P < 0.0001$  with in experimental and control group and between the post intervention values of experimental and control group. (Appendix 1, Table 2)

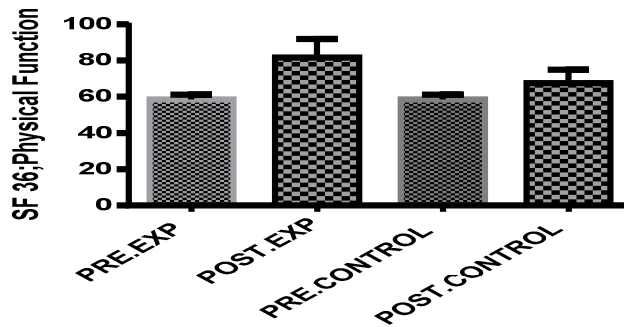


**Graph .1**

**Comparison of pre and post values of experimental and control group found significant difference in reduction of glucose level. Comparison of post intervention values of experimental and control group also found significant difference in the effect in reduction of glucose level.**

Comparison of Physical health problems between and within two groups performed. Compared pre and post values of control and experimental groupby Wilcoxon test, the effect found significant

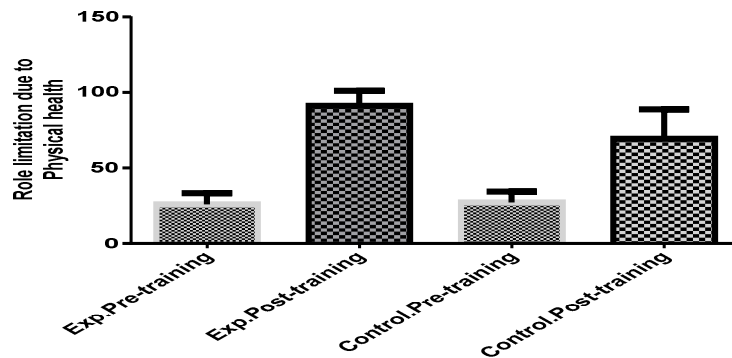
in both groups  $P < 0.0001^{***}$  Mann Whitney test found the effect was significant difference in physical function between the post intervention values of control and experimental groups,  $P < 0.02^*$ . (Appendix 1, Table 3)



**Graph 2**

**Comparison of Physical function in each groups found that there is significance difference in pre and post values of experimental and control group. Comparative test between post values of experimental and control group also found significant difference in effect of physical function between the groups.**

Comparison of Role limitations due to physical health between and within each group performed. Compared pre and post values of control and experimental group by Wilcoxon test, found both significant  $P < 0.0001^{****}$  Compared the post values of control and experimental group by Mann Whitney U test significant difference found in effect of role limitation due to physical health between post intervention values of control and experimental groups  $P < 0.001^{**}$  (Appendix 1, Table 4)

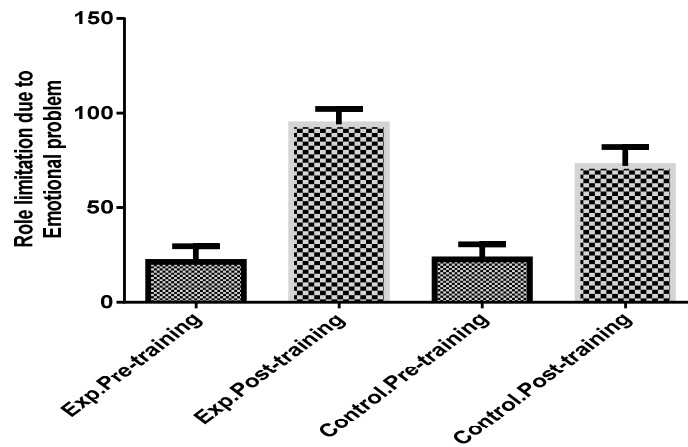


**Graph 3**

**Comparison of pre and post values of each group found significant difference in the effect on role limitations due to physical health within the group. Comparison of role limitations due to physical health between post values of experimental and control group also found significance difference in effect between the groups.**

Comparison of role limitations due to emotional problems between and within each group performed. Compared pre and post values of control and experimental group by Wilcoxon Test, the effect was significant in both groups  $P < 0.0001^{****}$  Compared the post values of control and experimental group by Mann Whitney Test. The effect was significant difference in emotional level with in each group and between the post intervention values of control and experimental groups  $P < 0.0001^{****}$  (Appendix 1, Table 5)

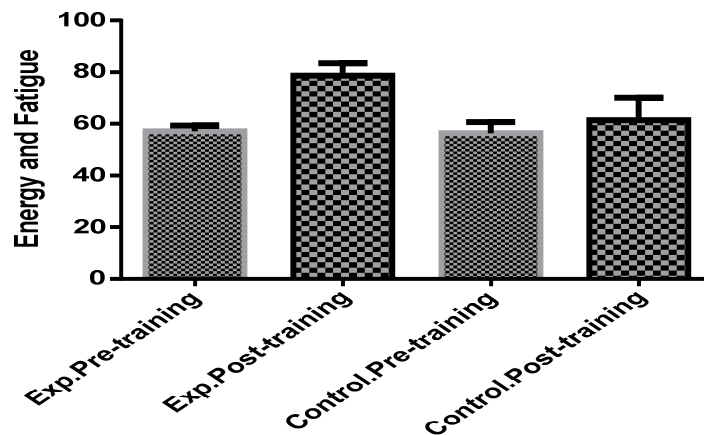




**Graph 4**

**Comparison of pre and post values of each group found significant difference in the effect on role limitations due to emotional problems within the group. Comparison of emotional problems between post values of experimental and control group also found significance difference in effect between the groups.**

Comparison of energy and fatigue between and within each group performed. Compared pre and post values of control and experimental group by Wilcoxon Test, found significant  $P < 0.007^{**}$  and  $< 0.0001^{****}$  respectively. Compared the post values of control and experimental group by Mann Whitney Test; the effect was significant difference in energy and fatigue within each group and between the post intervention values of control and experimental groups  $P < 0.0001^{****}$  (Appendix 1, Table 6)

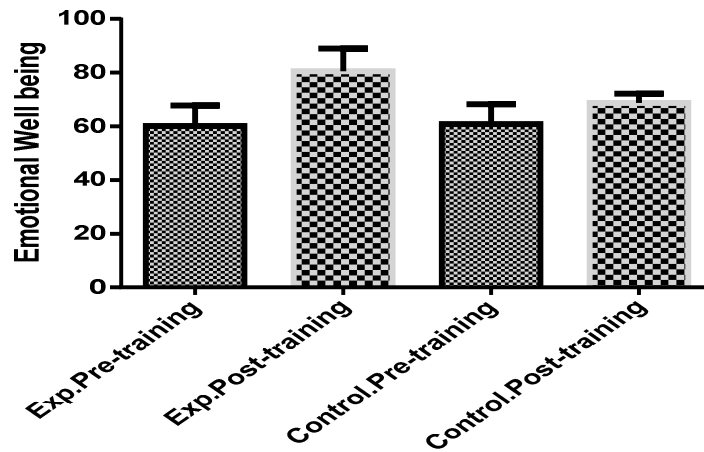


**Graph 5**

**Comparison of pre and post values of each group found significant difference in the effect on energy and fatigue within the group. Comparison of energy and fatigue between post values of experimental and control group also found significance difference in effect between the groups.**

Comparison of Emotional well-being between and within each group performed. Compared pre and post values of control and experimental group by Wilcoxon test, found a significant difference on effect  $P < 0.0005^{***}$  and  $P < 0.0001^{****}$  respectively. Compared the post values of control and experimental group by Mann Whitney U test; the effect was significant difference in emotional well-

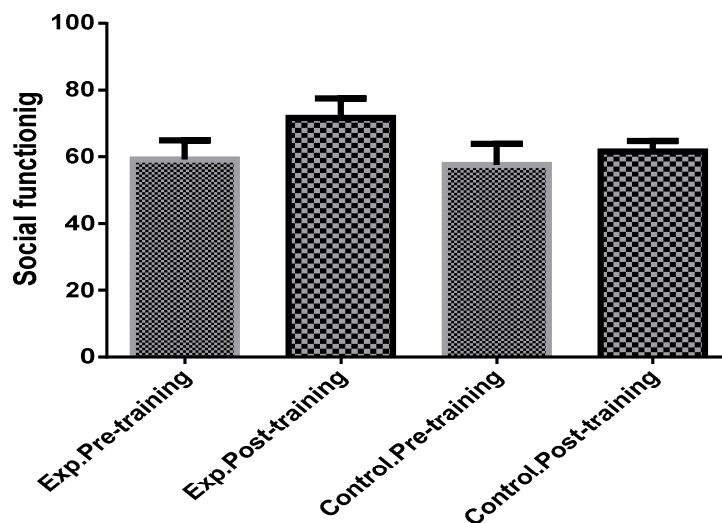
being between the post intervention values of control and experimental groups,  $P < 0.0001^{****}$  (Appendix 1, Table 7)



**Graph 6**

**Comparison of pre and post values of each group found significant difference in the effect on emotional well-being within the group. Comparison of emotional well-being between post values of experimental and control group also found significance difference in effect between the groups.**

Comparison of social functioning between and within each group performed. Compared pre and post values of control and experimental group by Wilcoxon test found no significant difference between control group but the effect was significant between the experimental group  $P < 0.0001^{****}$ . Compared the post values of control and experimental group by Mann Whitney Utest. The effect was significant difference in social functioning between the post intervention values of control and experimental groups. (Appendix 1, Table 8)

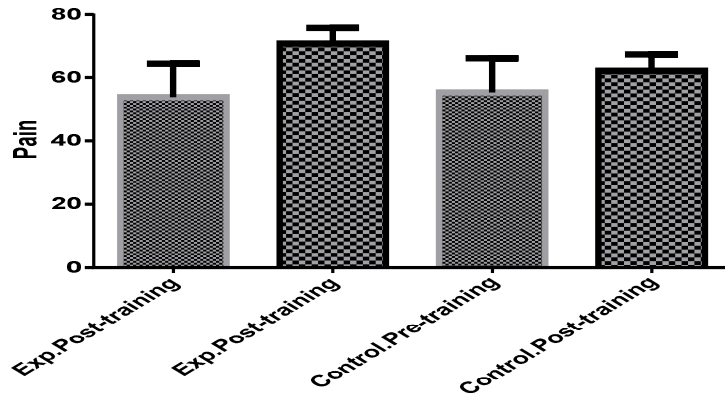


**Graph 7**

**Comparison of pre and post values of each group found significant difference in the effect on social well-being within the group. Comparison of social well-being between post values of experimental and control group also found significance difference in effect between the groups.**



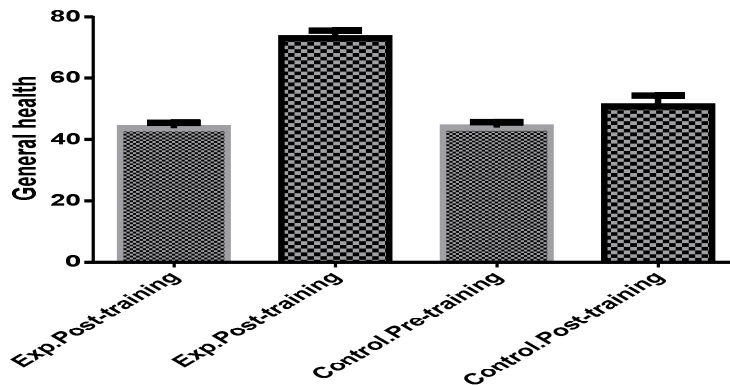
Comparison of pain between and within each group performed. Compared pre and post values of control and experimental group by Wilcoxon test, found significant difference on effect within both groups,  $P < 0.004^{**}$  and  $P < 0.0001^{****}$  respectively. Compared the post values of control and experimental group by Mann Whitney U test; the effect was significant difference in effect of pain between the post intervention values of control and experimental groups,  $P < 0.0009^{***}$ . (Appendix 1, Table 9)



**Graph 8**

**Comparison of pre and post values of each group found significant difference in the effect on pain within the group. Comparison of pain between post values of experimental and control group also found significance difference in effect between the groups.**

Comparison of general health between and within each group performed. Compared pre and post values of control and experimental group by Wilcoxon test, found significant difference on effect in both groups  $P < 0.0001^{***}$  Compared the post values of control and experimental group by Mann Whitney test; the effect was significant difference in general health within each group and between the post intervention values of control and experimental groups  $P < 0.0001^{****}$  (Appendix 1, Table 10).



**Graph 9**

**Comparison of pre and post values of each group found significant difference in the effect on general health within the group. Comparison of general health between post values of experimental and control group also found significance difference in effect between the groups.**

## DISCUSSION

Prevalence of diabetes in adults worldwide was estimated to be 4.0% in 1995 and to risk in 5.4% by the year 2025. It is higher in developed than in developing countries. There will be a 42% to 228 million in the developing country. The most common diabetes is Type 1 and Type 2. Type 2 diabetes is most common form of diabetes. The recent dramatic increase indicates that Obesity and sedentary life style may be particularly strong in relating genetic elements, which cause Type 2 diabetes. Diabetes significantly affects quality of life for mental and physical components. The short form (SF) 36, is are of the most frequently used instruments for measuring health related quality of life evaluated by Susan Norris et al (2004) The objective of this study was to find out the individual effect of combined aerobic and resistance training on blood sugar level to improve quality of life in Type 2 diabetic subjects and to compare the effectiveness of combined aerobic and resistance training over aerobic exercise on blood glucose level to improve quality of life in Type diabetic subjects. The outcome has been computed statistically to find the effect of Combined aerobic and resistance training in type II diabetes to improve quality of life. Wil-

coxon signed rank test and Mann Whitney U-test has been used to find the significance of Blood glucose level and SF 36 between Experimental and Control group. This result has been well supported by several recent studies. R J Sigal et al (September 2007): Conducted a study included 251 adults. The aerobic and resistance training group have improved blood sugar control. The bottom line by "Dr. Sigal" said that doing both aerobic and resistance exercises are the way to maximize the effects of exercise on blood glucose control in Type II diabetes.

### **Recommendation for Further Studies**

1. In further studies in this particular area, it is recommended to do a combination of anaerobic exercise to improve quality of life.
2. Large sample size and randomized trial will give result that can be much more accurate and applicable to larger population.
3. Further investigation is needed for a better understanding of the mechanisms underlying the development of and rehabilitation for the type II diabetes commonly seen in the population.

### **Annexure –I Assessment Performa**

Name:

Age:

Sex:

Occupation:

Address:

Chief complaints:-

Past medical history:-

Present medical history:-

Drug history:-

Personal History:-

Vitals signs: - BP: -

Pulse:-

Medical Diagnosis:

Problem List:

Treatment Aim:

Therapy Plan:

**Questionnaire**

Name: \_\_\_\_\_ Ref Dr: \_\_\_\_\_ Date: \_\_\_\_\_

Id: \_\_\_\_\_ Age: \_\_\_\_\_ Gender: \_\_\_\_\_

Please answer 36 questions of the survey completely, honestly and without interruption.

**General Health:**

In general would you say your health is?

Excellent      Very good      Good      Fair      Poor

Compared to one year ago, how would rate your health in general now?

- Much better now than one year ago
- Somewhat better now than one year ago
- About the same
- Somewhat worse than one year ago
- Much worse than one year ago

**Limitation of activities:**

The following items are about activities you might do during a typical day. Does your health now limit you in these activities? If so, how much ?

**1.Vigorous activities such as running, lifting heavy objects, participating in strenuous sports**

Yes limited a lot      Yes limited a little      No Not limited at all

**2.Moderate activities,such as moving a table , pushing a vaccum cleaner, bowling or plaing golf**

Yes limited a lot      Yes limited a little      No Not limited at all

**3.Lifting or carrying groceries**

Yes limited a lot      Yes limited a little      No Not limited at all

**4.Climbing several flights of stairs**

Yes limited a lot      Yes limited a little      No Not limited at all

**5.Climbing one flight of stair**

Yes limited a lot      Yes limited a little      No Not limited at all

**6.Bending, Kneeling or stooping**

Yes limited a lot      Yes limited a little      No Not limited at all

**7.Walking more than a mile**

Yes limited a lot                      Yes limited a little                      No Not limited at all

**8. Walking several blocks**

Yes limited a lot                      Yes limited a little                      No Not limited at all

**9. Walking one block**

Yes limited a lot                      Yes limited a little                      No Not limited at all

**10. Bathing or dressing yourself**

Yes, Limited a Lot                      Yes, Limited a Little                      No, Not Limited at all

**11. PHYSICAL HEALTH PROBLEMS:**

During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities as a result of your physical health?

**12. Cut down the amount of time you spent on work or other activities**

Yes                      No

**13. Accomplished less than you would like**

Yes                      No

**14. Were limited in the kind of work or other activities**

Yes                      No

**15. Had difficulty performing the work or other activities (for example, it took extra effort)**

Yes                      No

**16. EMOTIONAL HEALTH PROBLEMS:**

During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities as a result of any emotional problems (such as feeling depressed or anxious)?

**17. Cut down the amount of time you spent on work or other activities**

Yes                      No

**18. Accomplished less than you would like**

Yes                      No

**19. Didn't do work or other activities as carefully as usual**

Yes                      No

**20. SOCIAL ACTIVITIES: Emotional problems interfered with your normal social activities with family, friends, neighbors, or groups?**

Not at all   Slightly   Moderately   Severe   Very Severe

**PAIN:**

**21. How much bodily pain have you had during the past 4 weeks?**

None          Very Mild    Mild Moderate    Severe          Very Severe

**22. During the past 4 weeks, how much did pain interfere with your normal work (including both work outside the home and housework)?**

Not at all      A little bit    Moderately    Quite a bit    extremely

**ENERGY AND EMOTIONS**

These questions are about how you feel and how things have been with you during the last 4 weeks. For each question, please give the answer that comes closest to the way you have been feeling.

**23. Did you feel full of pep?**

- All of the time
- Most of the time
- A good Bit of the Time
- Some of the time
- A little bit of the time
- None of the Time

**24. Have you been a very nervous person?**

- All of the time
- Most of the time
- A good Bit of the Time
- Some of the time
- A little bit of the time
- None of the Time

**25. Have you felt so down in the dumps that nothing could cheer you up?**

- All of the time
- Most of the time
- A good Bit of the Time
- Some of the time
- A little bit of the time
- None of the Time

**26. Have you felt calm and peaceful?**

- All of the time
- Most of the time
- A good Bit of the Time
- Some of the time
- A little bit of the time
- None of the Time

**27. Did you have a lot of energy?**

- All of the time
- Most of the time
- A good Bit of the Time
- Some of the time

- A little bit of the time
- None of the Time

**28. Have you felt downhearted and blue?**

- All of the time
- Most of the time
- A good Bit of the Time
- Some of the time
- A little bit of the time
- None of the Time

**29. Did you feel worn out?**

- All of the time
- Most of the time
- A good Bit of the Time
- Some of the time
- A little bit of the time
- None of the Time

**30. Have you been a happy person?**

- All of the time
- Most of the time
- A good Bit of the Time
- Some of the time
- A little bit of the time
- None of the Time

**31. Did you feel tired?**

- All of the time
- Most of the time
- A good Bit of the Time
- Some of the time
- A little bit of the time
- None of the Time

**32. SOCIAL ACTIVITIES: During the past 4 weeks, how much of the time has your physical health or emotional problems interfered with your social activities (like visiting with friends, relatives, etc.)?**

- All of the time
- Most of the time
- Some of the time
- A little bit of the time
- None of the Time

**GENERAL HEALTH**

How true or false is each of the following statements for you?

**33. I seem to get sick a little easier than other people**

Definitely true    Mostly true    Don't know    Mostly false    Definitely false

**34. I am as healthy as anybody I know**

Definitely true    Mostly true    Don't know    Mostly false    Definitely false



**35. I expect my health to get worse**

Definitely true    Mostly true    Don't know    Mostly false    Definitely false

**36. My health is excellent**

Definitely true    Mostly true    Don't know    Mostly false    Definitely false

**Score method of Rand SF-36 Questionnaire**

**STEP 1  
SCORING QUESTIONS**

QUESTION NUMBER	ORIGINAL RESPONSE	RECORDED VALUE
1,2,20,22,34,36	1	100
	2	75
	3	50
	4	25
	5	0
3,4,5,6,7,8,9,10,11,12, 10	2	50
	3	100
	1	0
13,14,15,16,17,18,19	2	100
	1	0
21,23,26,27,30	1	100
	2	80
	3	60
	4	40
	5	20
	6	0
24,25,28,29,31	1	0
	2	20
	3	40
	4	60
	5	80
	6	100
32,33,35	1	0
	2	25
	3	50
	4	75
	5	100

**STEP 2  
AVERAGING ITEMS TO FORM 8 SCALES**

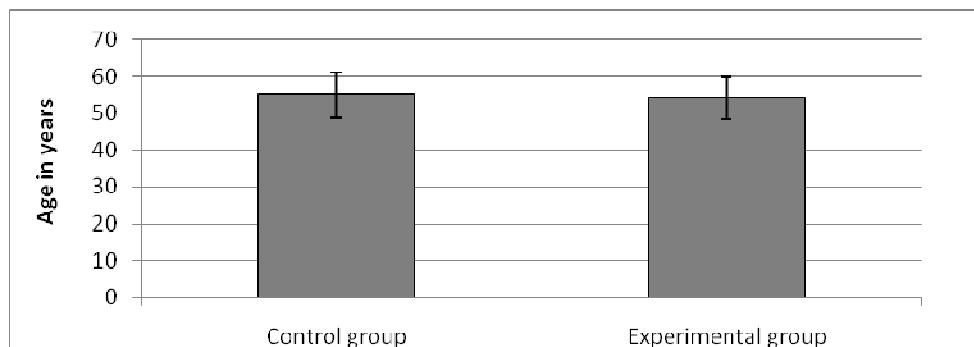
SCALE	NUMBER OF ITEMS	AFTER RECORDING AS PER TABLE 1, AVERAGE THE FOLLOWING ITEMS
Physical functioning	10	3,4,5,6,7,8,9,10,11,12
Role limitations due to physical health	4	13,14,15,16
Role limitations due to emotional problems	3	17,18,19
Energy/ fatigue	4	23,27,29,31
Emotional well being	5	24,25,26,28,30
Social functioning	2	20,32
Pain	2	21,22,
General health	5	1,33,34,35,36

**Appendix. I**

Basic characteristics	Control group	Experimental group	P value
Age in years; Mean ± SD	54.93±6.29	54.07±5.63	0.694
Sex; Male: Female	9:6	7:8	0.464

**Table 1**

**Mean Age in Control group is 54.93 (SD: 6.29) and in experimental group was 54.07 (SD: 5.83) the samples compared with age matched with P=0.694 similarly samples are sex matched with P=0.464**



**Figure 10**  
**Age distribution between two groups of subjects studied**

Blood glucose (mg/dl)	Control group (Mean $\pm$ SEM)	Experimental group (Mean $\pm$ SEM)	P -Value (MannWhitney Test)
Pre-Intervention	218.0 $\pm$ 8.43	189.2 $\pm$ 8.06	< 0.01*
Post-Intervention	194.7 $\pm$ 7.80	152.8 $\pm$ 5.31	< 0.0001****
P-Value (Wilcoxon Test)	< 0.0001****	< 0.0001****	

**Table 2**

**Comparison of Blood glucose levels (mg/dl) in control and experimental groups; Compared pre and post values of control and experimental group by Wilcoxon Test, compared the post values of control and experimental group by Mann Whitney Test. The effect was significance in reduction of blood glucose level with in the groups and between the groups.**

Physical health problems	Control group (Mean $\pm$ SEM)	Experimental group (Mean $\pm$ SEM)	P-Value (MannWhitney Test)
Pre-Intervention	58.54 $\pm$ 0.65	57.85 $\pm$ 0.63	NS
Post-Intervention	67.56 $\pm$ 1.89	81.67 $\pm$ 2.61	0.02*
P-Value(Wilcoxon Test)	< 0.0001***	< 0.0001****	-

**Table 3**

**Comparison of Physical health problems between and within two groups performed. Compared pre and post values of control and experimental group by Wilcoxon Test compared the post values of control and experimental group by Mann Whitney Test. The effect was significant difference in physical function within each group and between the post intervention values of control and experimental groups.**

Role limitations due to physical health	Control group (Mean $\pm$ SEM)	Experimental group (Mean $\pm$ SEM)	P-Value (Mann Whitney Test)
Pre-Intervention	27.33 $\pm$	26.00 $\pm$ 1.902	NS
Post-Intervention	69.33 $\pm$	91.33 $\pm$ 2.557	0.001**
P value (Wilcoxon Test)	< 0.0001****	< 0.0001****	-

**Table 4**

**Comparison of Role limitations due to physical health between and within each group performed. Compared pre and post values of control and experimental group by Wilcoxon Test compared the post values of control and experimental group by Mann Whitney Test. The effect was significant difference in role limitation due to physical health with in each group and between the post intervention values of control and experimental groups.**

Role limitations due to emotional problems	Control group (Mean $\pm$ SEM)	Experimental group (Mean $\pm$ SEM)	P-Value (MannWhitney Test)
Pre-Intervention	22.67 $\pm$ 2.06	21.33 $\pm$ 2.15	NS
Post-Intervention	72.00 $\pm$ 2.62	94.00 $\pm$ 2.14	< 0.0001****
P-Value(Wilcoxon Test)	< 0.0001****	< 0.0001****	-

**Table 5**

*Comparison of role limitations due to emotional problems between and within each group performed. Compared pre and post values of control and experimental group by Wilcoxon Test, compared the post values of control and experimental group by Mann Whitney Test. The effect was significant difference in emotional problem with in each group and between the post intervention values of control and experimental groups.*

Energy & fatigue	Control group (Mean $\pm$ SEM)	Experimental group (Mean $\pm$ SEM)	P-Value ( Mann Whitney Test)
Pre-Intervention	56.30 $\pm$ 1.11	57.07 $\pm$ 0.58	NS
Post-Intervention	61.40 $\pm$ 2.23	78.53 $\pm$ 1.26	< 0.0001****
P- value(Wilcoxon Test)	<0.007**	<0.0001****	-

**Table 6**

*Comparison of energy and fatigue between and within each group performed. Compared pre and post values of control and experimental group by Wilcoxon Test, compared the post values of control and experimental group by Mann Whitney Test. The effect was significant difference in energy and fatigue within each group and between the post intervention values of control and experimental groups.*

Emotional Well being	Control group (Mean $\pm$ SEM)	Experimental group (Mean $\pm$ SEM)	P-Value ( Mann Whitney Test)
Pre-Intervention	60.87 $\pm$ 1.89	60.20 $\pm$ 1.96	NS
Post-Intervention	68.80 $\pm$ 0.89	80.53 $\pm$ 2.18	<0.0001****
P- value(Wilcoxon Test)	0.0005***	0.0001****	-

**Table 7**

*Comparison of Emotional well-being between and within each group performed. Compared pre and post values of control and experimental group by Wilcoxon Test, compared the post values of control and experimental group by Mann Whitney Test. The effect was significant difference in emotional well-being within each group and between the post intervention values of control and experimental groups.*

Social functioning	Control group (Mean $\pm$ SEM)	Experimental group (Mean $\pm$ SEM)	P-Value ( Mann Whitney Test)
Pre-Intervention	57.50 $\pm$ 1.64	59.17 $\pm$ 1.48	NS
Post-Intervention	61.53 $\pm$ 0.83	71.67 $\pm$ 1.48	<0.0001****
P- value(Wilcoxon Test)	NS	<0.0001****	-

**Table 8**

*Comparison of social functioning between and within each group performed. Compared pre and post values of control and experimental group by Wilcoxon Test, compared the post values of control and experimental group by Mann Whitney Test. The effect was significant difference in social functioning within each group and between the post intervention values of control and experimental groups.*

Pain	Control group (Mean $\pm$ SEM)	Experimental group (Mean $\pm$ SEM)	P-Value ( Mann Whitney Test)
Pre-Intervention	55.33 $\pm$ 2.79	53.83 $\pm$ 2.72	NS
Post-Intervention	62.17 $\pm$ 1.33	70.77 $\pm$ 1.27	0.0009***
P- value(Wilcoxon Test)	0.004**	0.0001****	-

**Table 9**

*Comparison of pain between and within each group performed. Compared pre and post values of control and experimental group by Wilcoxon Test, compared the post values of control and experimental group by Mann Whitney Test. The effect was significant difference in pain within each group and between the post intervention values of control and experimental groups.*

General health	Control group (Mean $\pm$ SEM)	Experimental group (Mean $\pm$ SEM)	P-Value ( Mann Whitney Test)
Pre-Intervention	43.90 $\pm$ 0.46	43.67 $\pm$ 0.47	NS
Post-Intervention	50.77 $\pm$ 0.92	73.00 $\pm$ 0.65	<0.0001****
P- value(Wilcoxon Test)	0.0001***	0.0001****	-

**Table 10**

*Comparison of general health between and within each group performed. Compared pre and post values of control and experimental group by Wilcoxon Test, compared the post values of control and experimental group by Mann Whitney Test. The effect was significant difference in general health within each group and between the post intervention values of control and experimental groups.*

## CONCLUSION

The subjects with type 2 diabetes significantly affect quality of life for both mental and physical components. Earlier studies have shown that aerobic exercises alone cannot improve quality of life for type II diabetes patients. Combination of aerobic exercises and resistance training play significant role in overcoming impaired quality of life often seen in diabetic patients, by improving insulin and activity level. In this study the post test of experimental

group found that there was significant reduction of glucose level and improvement in quality of life in type II diabetes, which done combined aerobic exercises and resistance training program, when compared with the control group subjects. In conclusion, combination of aerobic exercises and resistance training play an important role in improving the quality of life in type II diabetes.

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