



## Effect of Aerobic and Progressive Resistance Training on Functional Capacity, Quality of Life and CD4 Count in People with HIV/AIDS

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### ABSTRACT

**Background :** Exercise training in the management of HIV/AIDS patient is not under research in India and if proper exercise training is been proved then quality of life for the HIV affected patients will improve significantly and it might set a new dimension in exercise training. This is the first study in India tried with aerobic and progressive resistance training program for HIV- infected persons to improve functional capacity, Quality of Life and CD4 Count in People with HIV/AIDS. The present study aims to find the effect of Aerobic and Progressive Resistance Training on Functional capacity, Quality of Life and CD4 Count in People with HIV/AIDS.

**Methods :** A total of 36 participants were selected by Simple Random Sampling method for the study based on selection criteria were allocated to Aerobic Training Group, Progressive Resistance Training Group and the Control Group with 12 subjects in each group. Aerobic training with intensity of 50% during first month, 60% during second month and 70% during third month of target heart rate by Karvonen's Formula, Progressive Resistance Training according to DeLorme's Protocol with intensity of exercise (10 RM) calculated every week. Control group was advised not to do any training, but to carry on their Activities of daily living. Functional capacity was assessed by Six Minute Walk Test, Quality Of Life was assessed by MOS-HIV Health Survey and Immune System was assessed by CD4 count. All three outcome measures were tested by blinded evaluator.

**Results :** 36 subjects were recruited for the study and randomly divided in to 3 groups with Mean  $\pm$  SD age of  $42.21 \pm 5.92$  years. Three groups were homogenous at base line in all three outcome measures. Aerobic Exercise, Progressive Resistance group showed significant improvement in all three outcome measures with  $p < 0.05$  where as control group showed no change in CD4 count and quality of life and detrimental change in 6 minute walk test.

**Conclusion :** This study concludes that aerobic training and progressive resistance training can be recommended with confidence for improving functional capacity, immune system and quality of life and also a better adjunct to pharmacological therapy for people living with HIV/AIDS.

**KEYWORDS :** HIV/AIDS, Aerobic Training, Progressive Resistance Training, Functional Capacity, Quality of Life, CD4 count

### INTRODUCTION

Human Immunodeficiency Virus (HIV) and Acquired Immunodeficiency Syndrome (AIDS) were unknown prior to 1982, but since then have grown to become a global epidemic. Indian State wise HIV Statistics 2010 state that adult HIV prevalence is 0.31% in the country which includes men 0.36% and women 0.25%. In that, Tamil Nadu HIV/AIDS infected peoples statistics showed as men 0.39% and women 0.27%. [1]

HIV infection is a disease of the human immune system caused by infection with human immunodeficiency virus. During the initial infection, a person may experience a brief period of influenza-like illness. This is typically followed by a prolonged period without symptoms. As the illness progresses, it interferes more and more with the immune system such as CD4+ T cells and macrophages. It infects primarily mononuclear cells and beta cells, making the person much more likely to get infections, including opportunistic infections and tumors that do not usually affect people who have working immune systems. [2]

There are three main stages of HIV infection: acute infection, clinical latency and AIDS. The initial period following the contraction of HIV is called acute HIV, primary HIV or acute retroviral syndrome. Many individuals develop an influenza-like illness or a mononucleosis-like illness 2–4 weeks post exposure while others have no significant symptoms. Symptoms occur in 40–90% of cases and most commonly include fever, large tender lymph nodes, throat inflammation, a rash, headache, and/or sores of the mouth and genitals. The initial symptoms are followed by a stage called clinical latency, asymptomatic HIV, or chronic HIV. Without treatment, this second stage of the natural history of HIV infection can last from about three years to over 20 years (on average, about eight years). While typically there are few or no symptoms at first, near the end of this stage many people experi-

ence fever, weight loss, gastrointestinal problems and muscle pains. [3,4]

Now -a -days patient with HIV/AIDS are increasing in number, partly due to improved screening, earlier diagnosis, better treatment methods like ART, specifically highly active anti retro viral therapy (HAART), has enhanced HIV infected patient to live longer & healthier lives. [5] Individuals infected with HIV experience numerous comorbidities caused by the disease progression and medications, lack of physical activity, malnutrition. Common symptoms include loss of muscle mass, fatigue, lipodystrophy, lipoatrophy and decrease in strength, functional capacity and overall quality of life. [6]

Persons living with HIV may simultaneously experience a range of impairments, activity limitations and participation restrictions affecting multiple systems including the musculoskeletal, neurological and cardio-respiratory systems, requiring Rehabilitation Intervention. [7] Cardiovascular disease is emerging as the most important cause of death and comorbidity in individuals infected with HIV based on its prevalence in the aging HIV population. [8]

Exercise is one key management for people living with HIV infection to address impairment, activity limitation and participation restriction. [9] Participation in an exercise program modify the side effects of ART and quality of life may benefit. [10] Exercise is well accepted as an adjunct therapy in the management of chronic illness and therapeutic exercise among people with HIV has been shown to be both beneficial and safe. [11]

Several studies on aerobic exercise training in HIV positive individuals have demonstrated that it is safe, effective and has a number of beneficial outcomes. [12,13,14,15] Aerobic exercises is the exercise of any activity that uses large muscle group which can be maintained con-

tinuously and is rhythmic in nature. In 1948, the WHO defined "Health is not only absence of disease and infirmity but also the presence of physical, psychological and social well-being." Quality of life is an issue becoming very steadily more important in health care practice and health care research.[16]

6 MWT is a useful measure of functional capacity targeted at people with at least moderately severe impairment. It may better reflect the functional exercise level for daily physical activities.[17] It is proved in many studies that 6MWT assess cardio-vascular fitness and issued in this study. World Health Organization has defined QOL as 'individuals' perceptions of their position of their position in life in the context of the culture and value systems in which they live and in relation to their goals, standards, expectations and concerns. The modified MOS scale with Cronbach alpha of more than 0.7 and linear relationship between CD4 counts and the QOL scores indicated that the instrument was reliable and valid for evaluation of QOL in HIV infected persons in India. Modified QOL is used in this study.[18]

This is the first study in India; tried with aerobic and progressive resistance training program for HIV- infected persons to improve Functional capacity, Quality of Life and CD4 count in people with HIV/AIDS.

## METHOD

Total number of screened subjects were 53, out of which 36 participants was selected for the study based on selection criteria and randomly allotted in to any of the three treatment groups with 12 subjects in each group by using sealed envelopes (Figure-1). All subjects fulfilling selection criteria were provided informed consent for participating in the research. All subjects were allotted with an identification code before starting baseline assessments which was kept confidential. This subject code was only used in all records to assure maximum confidentiality and blinding and to avoid ethical issues and social stigma. The study was conducted at Physiotherapy out Patient Department of Saveetha Medical College and Hospital, Chennai. Study was cleared by institutional ethical committee. 36 subjects of both sexes with HIV infections were included for the study irrespective of their anti-retro viral therapy status. Subjects with active inflammatory disease such as active hepatitis, active gout, other active inflammatory diseases, active malignancy, history of a serious medical condition, including heart problems, tuberculosis, cancer, hypertension, uncontrolled diabetes, or osteoporosis, steroid therapy and already on a consistent and rigorous exercise regimen were excluded.

The experimental groups were receiving Aerobic Exercise, Progressive Resistance Exercise and Control Group. All measures detailed below were performed during study period by Aerobic Exercise, Progressive Resistance exercise group and control group was advised not to do any exercise. Typical duration of intervention was 3 days per week for 3 months of 1 hour per session.

Aerobic training session involved a warming up period for 10 minutes, followed by 30 minutes of Aerobic training and a cooling down period at the end for 10 minutes. Breathing exercises, Stretching activities for major muscle groups and free exercises for major joints were included in the warming up and cooling down session. Treadmill walking, Arm ergo meter, Elliptical trainer each for 10 minute with intensity of 50% during first month, 60% during second month and 70% during third month of target heart rate by Karvonen's Formula.

Progressive Resistance exercise involved a warming up period for 10 minutes, followed by 30 minutes of Progressive Resistance and a cool down period at the end for 10 minutes. Breathing exercises, Stretching activities for major muscle groups and free exercises for major joints were included in the warming up and cool down session. Quadriceps, Hamstrings, Gluteus maximus, Plantar Flexors, Dorsi Flexors, Pectoralis Major Biceps, Triceps, Deltoid, Wrist Flexors and Wrist Extensors were worked according to DeLorme's Protocol with intensity of exercise (10 Repetition Maximum) calculated every week bilaterally for major muscle groups alternatively.

Functional Capacity was assessed by Six Minute Walk Test (6MWD), QoL was assessed by MOS-HIV Health Survey by a post graduate physiotherapist who is blinded to group allotment. Im-

mune System was tested by CD4 count by sending the blood sample to an ISO certified lab outside the study center. All three outcome measures were tested at baseline and end of three months of intervention.

## RESULTS

IBM SPSS Version 20 for windows was used to describe the demographic, baseline and post-intervention evaluation data of each group using means and SDs for all variables. The homogeneity of variances of the data at baseline and significant differences of post intervention data for the three groups were analysed using analysis of variance (ANOVA) test for each continuous variable and Kruskal Wallis (KW) test for ordinal variables. Post *hoc* analysis with Tukey HSD multiple comparisons were done if there was any significant difference between groups. Significant changes within group were analysed with Paired t Test for continuous variables and Wilcoxon signed rank test for ordinal variables. The effect size within group was calculated by using Cohen's *d* analysis for all continuous variables. An overall significance level was maintained at p-value less than 0.05.

There were 10 males in aerobics group, 9 in resistance group and 7 in control group. Females were 2 in aerobics group, 3 in resistance group, and 5 in control group. Males were more in all groups with the total of 26 and females were 10. The Mean  $\pm$  SD age of Group I is 42.25  $\pm$  6.24, Group II is 41.00  $\pm$  6.24, Group III is 42.42  $\pm$  5.23. Total Mean  $\pm$  SD age in years is 42.21  $\pm$  5.92.

The table 1 shows the mean, standard deviation, minimum and maximum values of CD 4 Count in cells/micrL, 6 Min Walk Test in Feet and MOS-HIV scores in all three groups for the 12 subjects included individually. One way ANOVA was done to compare the baseline values between all three groups for CD 4 Count and 6 Min Walk Test distance since they were continuous variables. The MOS-HIV scores of all three groups at baseline were compared by using Kruskal-Wallis Test since it is an ordinal variable. The level of significance fixed for all analysis were  $p = 0.05$ .

The table 2 show p value more than 0.05 proves baseline homogeneity of all three outcome measures between all three groups. Desired 36 subjects have been included in the study and 29 subjects were successfully completed intervention duration of 3 months and 7 subjects were discontinued from the study. 3 subjects moved out of the city, 2 found difficulty in transportation to the study center and remaining 2 were not accessible. In drop out subjects, 2 out of 3 moved out of city and 2 out of 2 found difficulties in transportation were available for follow-up with less than 3 months intervention. A total of 4 subjects post intervention data are not available were 2 moved out of city and remaining 2 were not accessible. It is decided to carry out intention to treat analysis for all outcome measures with individual's latest available data or baseline data as applicable.

The table 2 shows the details of within group analysis of aerobic exercises group for CD4 count and 6 min walk test analyzed by paired t-test. The Mean  $\pm$  SD of CD4 count before intervention is 510.66  $\pm$  112.87 and after intervention is 562.08  $\pm$  126.97 with p value less than 0.05 proves there is statistically significant improvement in CD4 count after intervention. The effect size is 0.428 showing medium effect for all treated cases. Aerobic exercises are effective in increasing CD4 count in subjects with HIV/AIDS.

The Mean  $\pm$  SD score of 6 min walk test before intervention is 649.08  $\pm$  48.07 and after intervention is 725.66  $\pm$  76.37 with p value less than 0.05 proves statistically significant improvement in 6 min walk test after intervention. The effect size is 0.625 for all treated cases. Aerobic exercises are effective in improving 6 min walk test performance in subjects with HIV/AIDS.

The table 3 shows the details of within group analysis of aerobic exercises group for MOS-HIV analyzed by Wilcoxon's signed rank test. The Mean  $\pm$  SD of MOS-HIV scale before intervention is 37.25  $\pm$  14.66 and after intervention is 55.91  $\pm$  13.24 with p value less than 0.05 proves there is statistically significant improvement in MOS-HIV scale scores after intervention.

The table 2 shows the details of within group analysis of resistance exercises group for CD4 count and 6 min walk test analyzed by paired t-test. The Mean  $\pm$  SD of CD4 count before intervention is  $549.58 \pm 117.14$  and after intervention is  $594.91 \pm 128.49$  with p value less than 0.05 proves there is statistically significant improvement in CD4 count after intervention. The effect size is 0.369. Progressive resistance exercises are effective in increasing CD4 count in subjects with HIV/AIDS.

The Mean  $\pm$  SD score of 6 min walk test before intervention is  $754.25 \pm 137.77$  and after intervention is  $804.75 \pm 150.35$  with p value less than 0.05 proves statistically significant improvement in 6 min walk test after intervention. The effect size is 0.350 showing medium effect for all treated cases. Progressive resistance exercises are effective in improving 6 min walk test performance in subjects with HIV/AIDS.

The table 3 shows the details of within group analysis of resistance exercises group for MOS-HIV analyzed by Wilcoxon's signed rank test. The Mean  $\pm$  SD of MOS-HIV scale before intervention is  $43.41 \pm 17.11$  and after intervention is  $55.25 \pm 9.98$  with p value less than 0.05 proves there is statistically significant improvement in MOS-HIV scale scores after intervention.

The table 2 shows the details of within group analysis of control group for CD4 count and 6 min walk test analyzed by paired t-test. The Mean  $\pm$  SD of CD4 count before intervention is  $509.75 \pm 114.62$  and after intervention is  $480.00 \pm 139.07$  with p value equal to 0.072 proves there is no statistically significant improvement in CD4 count after intervention. Even though there is no statistical significance observed that the after intervention mean values are less compared baseline values shows that there is reduction in CD 4 count. The effect size has got no importance since there is no significant difference.

The Mean  $\pm$  SD score of 6 min walk test before intervention is  $669.83 \pm 102.44$  and after intervention is  $615.16 \pm 107.06$  with p value less than 0.05 proves statistically significant reduction in 6 min walk test performance after intervention. The mean values are showing greater reduction in after intervention scores than in baseline scores with medium effect size around 0.5. Control group shows a non-significant reduction in CD4 count and a significant reduction in 6 min walk test performance.

The table 3 shows the details of within group analysis of control group for MOS-HIV analyzed by Wilcoxon's signed rank test. The Mean  $\pm$  SD of MOS-HIV scale before intervention is  $36.83 \pm 14.58$  and after intervention is  $32.33 \pm 13.15$  with p value more than 0.05 proves there is no statistically significant improvement in MOS-HIV scale scores after intervention. Even though there is no statistical significance observed that the after intervention mean values are less compared baseline values shows that there is reduction in quality of life.

The table 4 shows inter group comparison values analysed by one way ANOVA for CD4 count of all three groups after intervention for both sample size i.e. subjects as randomized and subjects as treated. P value for both cases is more than 0.05 proves that there is no statistically significant different between groups in CD4 count after intervention.

The table 4 shows inter group comparison values analysed by one way ANOVA for 6 min walk test of all three groups after intervention. P value is less than 0.05 proves that there is statistically significant difference between groups in 6 min walk test after intervention. Since there is significant difference between groups post hoc analysis with Tukey HSD multiple comparisons were done. The details are shown in table 5.

The table 5 shows values of post hoc analysis by Tukey HSD multiple comparisons. There is statistically significant difference between group I and group III with p value equal to 0.001 and also group II and group III with p value equal to 0.013. There is no statistical difference between group I and group II.

The tables 6 show after intervention analysis of MOS-HIV scores by KW Test. P value of the test score is less than 0.05 shows that there is statistically significant difference between all three groups in qual-

ity of life measured by MOS-HIV scale. Aerobic group and Resistance group scores are more than Control group. The mean rank is highest in aerobic group followed by resistance group. Control group score is less than other two groups.

## DISCUSSION

An ever-growing number of published studies suggest and acknowledge that exercise is the best and effective therapeutic interventions for HIV/AIDS infected people to make their living qualitatively. Notwithstanding, to the best of our knowledge, this is the first study done for Indian peoples with HIV/AIDS.

36 participants were selected for the study based on selection criteria and randomly allotted in to any of the three treatment groups with 12 subjects in each group. All subjects were provided informed consent for participating in the research. All subjects were allotted with an identification code before starting baseline assessments which was kept confidential. This subject code was only used in all records to assure maximum confidentiality & blinding and also to avoid ethical issues and social stigma. In all groups, making the participants to understand the exercises was faced as difficult in initial week. Finding 10RM for the resistance group was little tough in earlier week of this study. Slowly the participants adhered to the study protocol and followed all instructions. All exercises were performed under supervision.

The results of Aerobic trainings group and progressive Resistance trainings group had shown that there was statistically significant difference in CD4 counts, improvement in the performance of 6MWT, and improvement in quality of life that was assessed by MOS-HIV scales. These results had been supported by many studies.[9,22- 24] O' Brein et al stated that, performing constant or interval aerobic exercises for at least three times per week for four weeks may lead to increased CD4 count, improved cardiopulmonary fitness and improved psychological status.[9]

Improvement in self-efficacy cardiovascular fitness was proved in a study done for HIV peoples by Fillipas et al [25]. The most significant effects of resistance training on strength, but positive effects of the combined resistance aerobic program on other measures, including cardio respiratory fitness, body composition (muscle area and attenuation and waist circumference) and endurance were observed in women with HIV infection by Dolan et al.[23]

Review done on effects of exercise on Immune functions by Laperriere[26] found that, a trend towards an increase in the number of CD4 cells in all study. Mustafa and colleagues [29] found that HIV infected individuals self-reporting exercise participation had 107.5% higher CD4 counts when compared to HIV- infected individuals who denied exercise participation.

Lox et al found that both 12 weeks of aerobic and 12 weeks of resistance exercise were sufficient to increase positive well-being and reduce perceived distress relative to controls. Likewise, another study showed significant increase in various markers of psychological well-being after 12 weeks of exercise training. This study compared the effects of exercise training (aerobic and/or resistance) combined with testosterone therapy to testosterone therapy alone. Both groups decreased in depression but the exercise also reported reductions in anxiety and increased in quality of life scores that were not found for the controls. This finding is consistent with the earliest reports of the beneficial psychological effects of exercise in the population.[9]

Fillipas et al [25] had done a supervised, aerobic and resistance exercise for HIV infected people along with a control group and duration of the study was six months. The experimental group was given a program consisting of group aerobic and resistance exercises performed twice weekly. Participants allocated to control group undertook a six month program consisting of walking performed twice weekly. Outcome measures were, self-efficacy by General Self Efficacy Scale, Functional capacity was measured using the Kasch pulse Recovery test, Quality of life by MOS-HIV Scales, Health Status was measured by CD4 counts in cells/mm<sup>3</sup>. The results revealed that there was improvement in self-efficacy, functional capacity and Quality of life, when compared to control group. No changes in CD4

counts in both groups.

In this study, it was totally 3 groups, three experimental groups namely Aerobic training group, Resistance training group and third is a control group. Typical duration of intervention was 3 days per week for 3 months of 1 hour per session. Three outcome measures were Six Minute Walk Test for assessing Functional capacity, Quality Of Life by MOS-HIV Health Survey, and CD4 count by lab investigation for assessing Immune System. The results revealed that there was improvement in performance of 6 Minute walk Test, improvement in quality of life, CD4 counts increased in all two experimental groups, when compared to control group.

The study would be better if HIV infected participants are differentiated either receiving HAART or not. The limitations in this study may be inclusion of other bio chemical analysis as outcome measures like lymphocyte count, platelet count, WBC count, CD3, and CD8 count. Long time follow up of the subjects like 2 to 5 years after intervention were not analyzed in this study due to lack of time. The sample size in this research is calculated as 9 by estimation of mean for the significance level of 0.05 based on the pilot studies.[22,28,29] It was decided to recruit 12 in each group considering number of subjects reporting to study center and possible dropouts, so sample size included in the study was 36.

Aerobic training in an HIV positive patient group is safe and effective in improving exercise tolerance. In addition, it proves most marked improvements in aerobic function and quality of life occur with high intensity exercise training. Aerobic training should be promoted as a non-pharmacological therapy for the treatment of HIV positive patients in the intermediate stages of their disease. [14,24]

Anandhet al concluded in three different studies on the effect of aerobic exercise and resistance exercise in the subjects with HIV/AIDS for improving cardiovascular fitness assessed by 3 minute step test and quality of life by MOS-HIV Scale.[22,28,29]

In summary, our results indicate that three month supervised aerobic training and resistance training improves the functional capacity, increase in CD4 counts, and improvement in Quality of life. When implementing therapeutic exercise programs for HIV infected patients, it is recommended that programs be individualized on the basis of the functional capacity and individual symptomology of each client and their trainers should be in constant contact with the subject's physician regarding progress and changes in health and performance levels.

**CONCLUSION**

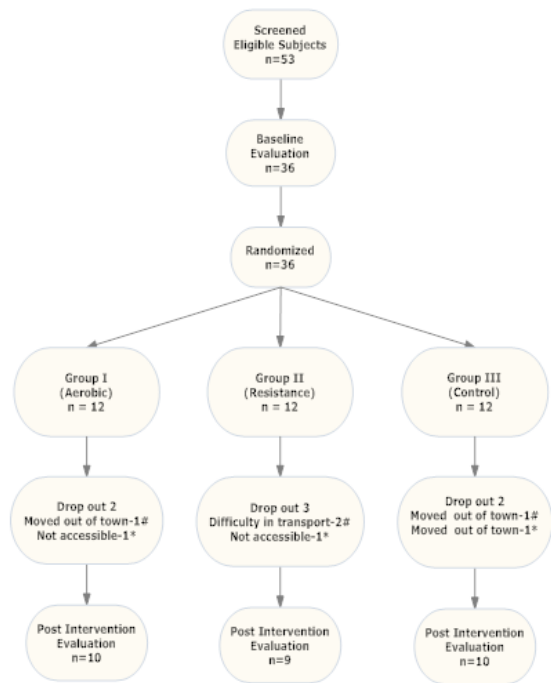
In the present study it is proved that aerobic training and PRT (3 days/week for 3 months of 1 h/session) improves Functional Capacity, Immune System and QoL of people with HIV/AIDS. There is no difference between two forms of exercises in improving Immune System. Aerobic trainings show substantial improvement than PRT in functional capacity and QoL. Control group is showing obvious detrimental effect on functional capacity and immune system with no evident change in QoL.

This study confirms that aerobic training and PRT can be better adjunct to pharmacological therapy for people with HIV/AIDS. By analyzing results it can be concluded that aerobic training and PRT can be recommended with confidence for improving functional capacity, immune system and QoL in people with HIV/AIDS.

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**PROCEDURE**



#-Incomplete \*-Dropout

**Figure-1: CONSORT Diagram of randomized clinical trial: number of participants screened, randomized, and retained and analyses**

**Table-1: Descriptive Statistics of outcome measures for baseline and after intervention**

| Groups / Outcome  | CD 4 Count cells/micrL |         | 6 Min Walk Test in Meters |           | MOS-HIV     |       |
|-------------------|------------------------|---------|---------------------------|-----------|-------------|-------|
|                   | Mean ± SD              | Range   | Mean ± SD                 | Range     | Mean ± SD   | Range |
| Aerobic - Pre     | 510.66±112.87          | 311-694 | 649.08 ± 48.07            | 591 - 734 | 37.25±14.66 | 16-61 |
| Aerobic - Post    | 562.08±126.97          | 311-768 | 725.66±76.37              | 581-809   | 55.91±13.24 | 16-67 |
| Resistance - Pre  | 549.58±117.14          | 391-782 | 652.58 ± 47.80            | 585 - 714 | 43.41±17.11 | 22-82 |
| Resistance - Post | 594.91±128.49          | 432-781 | 692.41±75.36              | 566-765   | 55.25±9.98  | 43-79 |
| Control - Pre     | 509.75±114.62          | 331-723 | 604.25 ± 91.24            | 476 - 751 | 36.83±14.58 | 21-64 |
| Control - Post    | 480.00±139.07          | 311-798 | 589.33±96.60              | 441-758   | 32.33±13.15 | 18-57 |

**Table-2: Intra group analysis of Aerobic Group, Resistance Group and Control Group for CD 4 count and 6 Min Walk Test.**

| Intra group analysis |                 |        | N  | Mean ± SD     | Min | Max | Effect Size | t      | p    |
|----------------------|-----------------|--------|----|---------------|-----|-----|-------------|--------|------|
| Aerobic Group        | CD 4 Count      | Before | 12 | 510.66±112.87 | 311 | 694 | -0.428      | -2.966 | .013 |
|                      |                 | After  | 12 | 562.08±126.97 | 311 | 768 |             |        |      |
|                      | 6 Min Walk Test | Before | 12 | 649.08±48.07  | 591 | 734 | -0.625      | -4.143 | .002 |
|                      |                 | After  | 12 | 725.66±76.37  | 581 | 809 |             |        |      |
| Resistance Group     | CD 4 Count      | Before | 12 | 549.58±117.14 | 391 | 782 | -0.369      | -2.308 | .041 |
|                      |                 | After  | 12 | 594.91±128.49 | 432 | 781 |             |        |      |
|                      | 6 Min Walk Test | Before | 12 | 652.58±47.80  | 585 | 714 | -0.350      | -2.506 | .029 |
|                      |                 | After  | 12 | 692.41±75.36  | 566 | 765 |             |        |      |
| Control Group        | CD 4 Count      | Before | 12 | 509.75±114.62 | 331 | 723 | 0.233       | 1.986  | .072 |
|                      |                 | After  | 12 | 480.00±139.07 | 311 | 798 |             |        |      |
|                      | 6 Min Walk Test | Before | 12 | 604.25±91.24  | 476 | 751 | 0.522       | 2.715  | .020 |
|                      |                 | After  | 12 | 589.33±96.60  | 441 | 758 |             |        |      |

**Table-3: Intra group analysis of Aerobic Group, Resistance Group and Control Group for MOS-HIV Scale**

| Intra group analysis |        | N  | Mean ± SD   | Min | Max | Z      | p    |
|----------------------|--------|----|-------------|-----|-----|--------|------|
| Aerobic Group        | Before | 12 | 37.25±14.66 | 16  | 61  | -2.845 | .004 |
|                      | After  | 12 | 55.91±13.24 | 16  | 67  |        |      |
| Resistance Group     | Before | 12 | 43.41±17.11 | 22  | 82  | -2.847 | .004 |
|                      | After  | 12 | 55.25±9.98  | 43  | 79  |        |      |
| Control Group        | Before | 12 | 36.83±14.58 | 21  | 64  | -1.482 | .138 |
|                      | After  | 12 | 32.33±13.15 | 18  | 57  |        |      |

**Table-4: One way ANOVA for CD4 count and 6 min walk test after intervention comparison**

|                 |                | Sum of Squares | df | Mean Square | F     | Sig. |
|-----------------|----------------|----------------|----|-------------|-------|------|
| CD4 count       | Between Groups | 103508.196     | 2  | 34502.732   | 2.545 | .072 |
|                 | Within Groups  | 460858.778     | 33 | 13554.670   |       |      |
|                 | Total          | 564366.974     | 35 |             |       |      |
| 6 min walk test | Between Groups | 121274.056     | 2  | 60637.028   | 8.726 | .001 |
|                 | Within Groups  | 229310.250     | 33 | 6948.795    |       |      |
|                 | Total          | 350584.306     | 35 |             |       |      |

| Dependent Variable | (I) group | (J) group | Mean Difference (I-J) | Std. Error | Sig. | 95% Confidence Interval |             |
|--------------------|-----------|-----------|-----------------------|------------|------|-------------------------|-------------|
|                    |           |           |                       |            |      | Lower Bound             | Upper Bound |
| 6 Min Walk Test    | 1.00      | 2.00      | 33.25000              | 34.03135   | .596 | -50.2559                | 116.7559    |
|                    |           | 3.00      | 136.33333*            | 34.03135   | .001 | 52.8274                 | 219.8393    |
|                    | 2.00      | 1.00      | -33.25000             | 34.03135   | .596 | -116.7559               | 50.2559     |
|                    |           | 3.00      | 103.08333*            | 34.03135   | .013 | 19.5774                 | 186.5893    |
|                    | 3.00      | 1.00      | -136.33333*           | 34.03135   | .001 | -219.8393               | -52.8274    |
|                    |           | 2.00      | -103.08333*           | 34.03135   | .013 | -186.5893               | -19.5774    |

\*. The mean difference is significant at the 0.05 level.

**Table-6: Kruskal-Wallis Test for after intervention analysis of MOS-HIV scores**

| Group      | N  | Mean Rank | Mean ± SD   |
|------------|----|-----------|-------------|
| Aerobic    | 12 | 33.63     | 55.91±13.24 |
| Resistance | 12 | 29.00     | 55.25±9.98  |
| Control    | 12 | 10.42     | 32.33±13.15 |

|         | Chi-Square | df | Sig.  |
|---------|------------|----|-------|
| MOS-HIV | 18.554     | 3  | <.001 |

## REFERENCES

1. Ministry of Health and family welfare. HIV/AIDS in India and state wise statistics. 2010. | 2. Nixon S, O'Brien K, Glazier RH, Tynan AM. Aerobic exercise interventions for adults living with HIV/AIDS Cochrane base of systemic Review. 2005; 18(2): CD001796. | 3. Stages of HIV. U.S. Department of Health & Human Services. Dec 2010. Retrieved 13 June 2012. Available from: URL: <http://aids.gov/hiv-aids-basics/just-diagnosed-with-hiv-aids/hiv-in-your-body/stages-of-hiv/> | 4. Evian C. Primary HIV/AIDS care: a practical guide for primary health care personnel in a clinical and supportive setting. Houghton: Jacana; 2006. 29. | 5. Kalra S, Kalra B, Agrawal N, Unnikrishnan AG. Understanding diabetes in patients with HIV/AIDS. *Diabetology & Metabolic Syndrome*. 2011; 3(2). | 6. Hand GA, William LG, Jaggers JR, Dudgeon WD. Impact of aerobic and resistance exercise on the health of HIV-infected persons. *Am J Lifestyle Med*. 2009; 3(6): 489-99. | 7. O'Brien K, Nixon S, Tynan AM, Glazier RH. Aerobic exercise interventions for people living with HIV/AIDS: Implications for Practice, Education, and Research. *Physiotherapy Can*. 2006; 58(2): 114-29. | 8. Kraemer WJ, Adams K, Cararelli E, Dudley GA, Dooly C, Fegenbaum MS, Fleck SJ, Franklin B, Fry AC, Hoffman JR, Newton RU, Potteiger J, Store MH, Ratamess NA, McBride TT. Progression models in resistance training for healthy adults. *Medicine and Science in Sports and Exercise*. 2002; 34(2): 364-80. | 9. Perna FM, LaPerriere A, Klimas N, Ironson G, Perry A, Pavone J, Goldstein A, Majors P, Makemson D, Talutto C, Schneiderman N, Fletcher MA, Meijer OG, KoppesL. Cardiopulmonary and CD4 cell changes in response to exercise training in early symptomatic HIV infection. *Med Sci Sports Exerc*. 1999; 31(7): 973-9. | 10. O'Brien K, Nixon S, Glazier RH, Tynan AM. Progressive resistive exercise intervention for adults living with HIV/AIDS Cochrane base of systemic Review. 2004; 18(4): CD004248. | 11. Roubenoff R, McDermott A, Weiss L, Suri J, Wood M, Bloch R, Gorbach S. Short term progressive resistance training increases strength, lean body mass in adults with HIV. *AIDS*. 1999; 13: 231-9. | 12. Andrea Petroczi, Kim Hawkins, Gareth Jones, Naughton DP. HIV patient characteristics that affect adherence to exercise programmes: An Observational Study. *AIDS J*. 2010; 25(4): 148-55. | 13. Malita FM, Karelis AD, Toma E, Rabasa-Lhoret R. Effects of different types of exercise on body composition and fat distribution in HIV-infected patients: A brief review. *Can J Appl Physiol*. 2005; 30(2). | 14. Stringer WW, Berezovskaja M, O'Brien WA, Beck CK, Casaburi R. The effect of exercise training on aerobic fitness, immune indices, and quality of life in HIV positive patients. *Medicine and science in sports and exercise*. 1998; 30(1): 11-6. | 15. Paton NI, Chapman CA, Chan SP, Tan KM, Leo YS, Aboulhab J, Soh CH. Validation of the medical outcomes study HIV health survey as a measure of quality of life in HIV-infected patients in Singapore. *Int J STD AIDS*. 2002; 13(7): 456-61. | 16. Wu AW, Revicki DA, Jacobson D, Malitz FE. Evidence for reliability, validity and usefulness of the medical outcomes study HIV health survey (MOS-HIV), quality of life research. 1997; 6(6): 481-93. | 17. ATS Board of Directors ATS Statement: Guidelines for the Six-Minute Walk Test. 2002; 166: 111-7. | 18. Kohli RM, Suvarna Sane, Kishore Kumar, Paranjape RS, Mehendale SM. Modification of medical outcome study (MOS) instrument for quality of life assessment & its validation in HIV infected individuals in India. *Indian J Med Res*. 2005; 122: 297-304. | 19. Enright PL, Sherrill DL. Reference Equations for the Six-Minute Walk in Healthy Adults. *AM J Respiratory Critical Care Med*. 1998; 158: 1384-1387. | 20. Troosters T, Gosselink R, Decramer M. Six minute walking distance in healthy elderly subjects. *EurRespir J*. 1999; 14: 270-274. | 21. Vaish H, Ahmed F, Singla R, Shukla DK. Reference equation for the 6-minute walk test in healthy North Indian adult males. *Int J Tuber Lung Dis*. 17(4): 698-703. | 22. Anandh V, Dsa IP, Rathod V, Alagesan J. Effect of aerobic exercises on cardio vascular fitness and quality of life in people with HIV/AIDS. *International Journal of Current Research and Review*. 2011; 3(8): 65-70. | 23. Dolan SE, Frontera W, Librizzi J, Ljungquist K, Juan S, Dorman R, Cole ME, Kanter JR, Grinspoon S. Effects of a supervised home-based aerobic and progressive resistance training regimen in women infected with human immunodeficiency virus: A randomized trial. *Arch Intern Med*. 2006; 166(12): 1225-31. | 24. Galantino ML, Shepard K, Krafft L, Laperriere A, Ducette J, Sorbello A, Barnish M, Condoluci D, Farrar JT. The effect of group aerobic exercise and tai chi on functional outcomes and quality of life for persons living with acquired immunodeficiency syndrome. *J Altern Complement Med*. 2005; 11(6): 1085-92. | 25. Fillipas S, Oldmeadow LB, Bailey MJ, Cherry CL. A six-month, supervised, aerobic and resistance exercise program improves self-efficacy in people with human immunodeficiency virus: A randomised controlled trial. *Aus J Physiotherapy*. 2006; 52: 185-90. | 26. LaPerriere A, Klimas N, Fletcher MA, Perry A, Ironson G, Perna F, Schneiderman N. Change in CD4+ cell enumeration following aerobic exercise training in HIV-1 disease: possible mechanisms and practical applications. *Int J Sports Med*. 1997; 18(1): 56-61. | 27. Mustafa T, Sy FS, Macera CA, Thompson SJ, Jackson KL, Selassie A, Dean LL. Association between exercise and HIV disease progression in a cohort of homosexual men. *Ann Epidemiol*. 1999; 9(2): 127-31. | 28. Anandh V, Dsa IP, Alagesan J, Rathod V. Effect of Progressive Resistance exercises on cardio vascular fitness and quality of life in people with HIV/AIDS. *Journal of Pharmaceutical and Biomedical Sciences*, 2011; 13(19). | 29. Anandh V, Dsa IP, Alagesan J, Prabhavathi D, Rajendran K. Effect of Progressive Resistance Training on Cardio Vascular Fitness, Quality of Life and CD4 Count in People with HIV/AIDS. *Biomedicine*, 2013;33(4):555-9. |