International Journal of Immunology
2018; 6(3): 43-47
http://www.sciencepublishinggroup.com/j/iji
doi: 10.11648/j.iji.20180603.11
ISSN: 2329-177X (Print); ISSN: 2329-1753 (Online)

Effects of Aerobic Exercise on CD4 Count Among People Living with HIV/AIDS in Nekemte, Ethiopia

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To cite this article:
Girma T. Jaleta, Soumitra Mondal, Mahmud Abdulkedar, Mathi Vanan. Effects of Aerobic Exercise on CD4 Count Among People Living with HIV/AIDS in Nekemte, Ethiopia. *International Journal of Immunology*. Vol. 6, No. 3, 2018, pp. 43-47. doi: 10.11648/j.iji.20180603.11

Received: September 13, 2018; **Accepted**: October 12, 2018; **Published**: November 1, 2018

Abstract: The study was aimed to determine the effect of aerobic exercises on CD4 count among people living with HIV/AIDS in Ethiopia, Nekemte. The study was a randomized controlled trial of pre post design. Fifty eight subjects were participants and randomly assigned to experimental and control groups. Baseline values of the variables were determined. Experimental group participated in moderate intensity aerobic exercise treadmill aerobic exercise for 12 weeks. The control group was encouraged to highly active antiretroviral therapy (ART) and advised usually day to day activity. Approval and ethical clearance of the protocol was sought form Health Research and Ethical Review Committee of Mekelle University registration No ERC0771/2016 and registered under clinical trials. Gov of registration NO. NCT0300914 The collected data were analyzed using SPSS version 20. The level of significance for all analyses was set at $P < 0.05$. From data obtained mean ages in year's participants 34.66+(4.56) of control group and 38.1+(4.90) experimental group. There was significant improvement ($p < 0.05$) in the variables between pre- and post-tests in the experimental group. In the control group, there were CD4 cell counts, insignificant improvement was observed. CD4 cell of PLWHIV/AIDS who participated in the 12 weeks moderate intensity treadmill aerobic exercise were significantly improved.

Keywords: HIV/AIDS, Aerobic Exercise, ART, CD4, Viral Load, PLWHIV/AIDS

1. Introduction

Anti immunodeficiency sidearm (AIDS) epidemic is one of the most destructive health crises of modern times ravaging families and communities around the world. By the end of 2008, UNAIDS/WHO estimated that globally, a total of 33.4 million people were living with Human Immunodeficiency Virus (HIV), whereby 31.3 million were adults. In sub-Saharan Africa, 22.4 million people were living with HIV in 2008 [35]. Currently 367,000 patients, including 23,000 children under the age of 15, are taking ART. Based on the estimation given in 2014, the ART need is 542,121 for adult and 178,500 for children under age 15 years of age [13]. In Ethiopia, free ART service was launched in January 2005 and public hospital started providing free ARTs in March 2005. Currently ART service is available at 1045 Health facilities. On the basis of the 2010-2014 strategic plan, ART coverage for adult (age 15+) has reached 76%, but the coverage remains low (23.5%) for children (age <15) living with HIV [13].

According to single point HIV related estimates and projections for Ethiopia 2014, the national HIV prevalence is 1.14%. The recent 2011 Ethiopia Demographic and Health Survey (EDHS) was shown that the urban prevalence was 4.2%, which was seven times higher than that of the rural (0.6%). The 2011 EDHS also show that the HIV prevalence varies from region to region, ranging from 0.9% in (south nation, nationality of people regionally) SNNPR to 6.5% Gambela. Furthermore, the HIV related estimates and projections indicate that the 2013 prevalence from 0.8% to 5.8% [10].

The Government of Ethiopia has been steadfast in its

response to the epidemic. For instance, in 1985, prior to the first laboratory diagnosis of HIV in Ethiopia, the government established a National HIV/AIDS Task Force within the Ministry of Health. In addition, in 1987-89 Short and Medium Term Plan were drawn out to respond to the budding epidemic. As the epidemic began to spread, the government responded by issuing a national AIDS policy, the strategic framework and the establishment of a multi-sectoral and broad based National AIDS council (NAC) and the secretariat, which evolved to the current HIV/AIDS Prevention and Control Office (HAPCO). Despite these and other concerted efforts, the epidemic still has continued to prevail both in urban and rural settings claiming the lives of most productive segment of the Ethiopian society. HIV/AIDS has now become one of the major challenges to the socio-economic development of the country. The high prevalence of HIV/AIDS in this most productive age has great impact on health, economic and social aspects [13].

Several studies [2, 21, 33, 36] had demonstrated the efficacy of exercise on physiological and immunological functions of HIV infected persons. Either aerobic or resistance exercise, or both are of utmost benefits to this population, without the gratuitous cost, toxicity and potential adverse effects of pharmacological interventions.

The study reported that aerobic exercise acts as an immune stimulant for both HIV positive and HIV negative individuals by creating a type of natural vaccine [36]. These scholars asserted that aerobic exercise if widely adopted will contribute to the worldwide reduction of HIV pandemic and probably leads to its prevention.

However, apart from the observed poor attitude towards exercise among the HIV population [9], and indeed the general public, fatigue, one of the major reported symptoms of HIV infected persons, prevents them from engaging in any form of exercise. Consequently, in addition to their low immunity, they present with reduced functional capacity and metabolic syndrome. This inability to engage in exercise also has the potential to exacerbate HIV-related symptoms and accelerate the rate of disease progression to acquired immunodeficiency syndrome (AIDS). Thus, engaging in exercise at moderate intensity levels is of utmost importance for HIV population. In addition, in most developing countries, including Ethiopia, little or no attention is paid to the benefits of exercise in the overall management of HIV infection and complications arising from its drug therapy.

The authors therefore envisaged that this little or no attention paid to the efficacy of exercise on the health of HIV infected persons in Ethiopia may be the basis for the lack of literature on the effect of exercise on the health of the overwhelming population living with HIV and AIDS in the country [2]. Probably, this may be the rationale why the authors have observed over the years, the non inclusion of therapeutic exercise as one of the treatment strategies for the vast number of HIV population attending antiretroviral (ARV) clinic at health centers. The failure to include exercise in the management of HIV infected persons may be as a result of lack of very good knowledge on the effect of exercise on HIV population among substantial number of health care professionals as reported by [21]. These observations and report, as well as the paucity of literature in Ethiopia on this field prompted the authors to conceptualize this study.

The aim of this study is to determine the effect of exercise on CD4 count among people living with HIV/AIDS.

2. Methods

2.1. Location/Area of the Study

This study was conducted in Nekemete town found in the east Wollega zone, Oromia regional state, Ethiopia. It is found 311kms from the capital city, Addis Ababa.

2.2. Sample and Sampling Techniques

58 volunteers of both male and female in the age range of 18 – 45 years old were selected to be research participants. By using simple random sampling lottery method, 29 participants were assigned in control and 29 in the experimental groups. Of the total 58 participants, 33 were female and 25 were male. The researchers used inclusion and exclusion criteria during the selection of participants. Accordingly, those who were on antiretroviral therapy for at least three months; those were able to walk without assistive devices, those who had CD4 count greater than 350 cells per cubic millimeter and those who were free of any external infections were included into the study. Whereas, pregnant and lactating women, people with history of central nervous system dysfunctions, amputee and diabetes were excluded.

2.3. Design of the Study

The study design was pre-post randomized controlled clinical trial. It was 12-weeks aerobic exercise training intervention of three days per week of 40 min supervised aerobic exercise.

2.4. Ethical Considerations

Approval and ethical clearance of the protocol was sought form Health Research and Ethical Review Committee of Mekelle University registration No ERC0771/2016 and was registered under clinical trials. gov of registration NO. NCT03009149.

2.5. Data Analysis

Descriptive statistics of percentages and frequency counts summarized socio-demographic characteristics of the participants. Paired t-test compared significant difference between the variables at baseline and 12th week in the experimental group and the control group. The independent t - test was used to analyze significant difference in the variables between the control and experimental groups at baseline and the end of the study. All analyses were executed using Statistical Package for the Social Sciences (SPSS) version 20.0 software. $P< 0.05$ was considered significant.

3. Results

Demographic and socioeconomic strata of control and exercise and control subjects.

The present study was conducted between Feb 2017 and Apr, 2017. Initial enrollment was included 29 experimental and 29 control subjects of total 58. Of these, 33 were female and 25 were male (As shown in Table 1). 23 experimental and 20 control participants of total 43 (28F, 15M) completed both pre and post evaluations of CD4 count and viral load. Fifteen subjects of which 6 experimental (2 female and 4 male) and 9 control group (3 female and 6 male) dropped out of the study due to lack of interest and some unsatisfied financial/family problems. Participants in the experimental group attended on average 25.44 weeks (70.7%) of the supervised exercise sessions. The mean monthly income of the participants was 987.3 per where male 934.8 and female 1027.15. The mean time under ART was 3.5 years. Most participants were married (n = 31, 53.4%); 11 (18%) of them were single, 10 (17.2) of them were living as married and the rest 6 (10.3) was divorced. Most participants graduated from high school (n = 23, 39.6%), elementary school (n = 24, 41.3%), graduated from college diploma (n = 4, 6.8%), or attended preparatory school (n = 7, 12%).

Table 1. *Socio-demographic Characteristics of the Participants (n = 64).*

Variables	CG	EG
Age	34.66	38.1
Gender		
M	7	8
F	13	15
Marital status		
Single	6	5
Married	16	15
Living as married	5	5
Divorced	2	4
Income per month (Birr)	979.24	995.44
Year of ART	4	3
Session		25.44
Educational level		
None	0	0
Elementary	6	3
High school	9	12
Preparatory	4	5
Diploma	1	3
First degree	0	0
Second degree	0	0

Table 2. *Independent t-test of mean baseline CD4 cell count of the control and experimental groups.*

Variables	Exp. Group (M+SD)	Control group (M+SD)	Mean difference	T-Test	P-value
CD4 count (cells/mm3)	456.69+65.36	446.95 (68.98)	-9.74	-0.475	0.63

Shows where an insignificant difference exists, that is, $p > 0.05$.

Table 3. *Summary of paired t-test analysis comparing the baseline and 12th week mean values of CD4 cell count of experimental and control groups.*

Group	Variables	Pre-test	Post-test	Mean difference	Correlation	P-value
Exp. Group (M+SD)	CD4 count	456.69+65.36	513.13+55.60	56.43+48.51	0.69	0.00*
Control group (M+SD)	(cells/mm^3)	460.05+68.01	456.70+70.90	9.75+19.94	0.96	0.07**

*Shows where significant difference exists, that is, $p < 0.05$ whereas ** insignificant $p>0.05$.

Table 4. *Independent t-test for mean 12th week values of CD4 cell count and viral load of the control and experimental groups.*

Variables	Exp. Group (M+SD)	Control group (M+SD)	Mean difference	T-Test	P-value
CD4 count (cells/mm^3)	513.13+55.60	456.70+70.90	-56.43	-0.475	0.03*

*Shows where significant difference exists, that is, $p < 0.05$.

4. Discussion

According to data obtained and analyzed, none of them were attended university education. Female's participants were in majority than men. Participants with high school education were in preponderance in the CG and EX group. None of them were registered under informal education in both CG and EX group. According to the social, demographic data obtained from the survey, marital status, gender, income per month, educational level and length of diagnosed were mentioned below table 1

Our trial exhibited a 25.8% drop-out rate which is consistent with the findings of a Meta analysis on aerobic exercise and HIV/AIDS, in which six studies reported dropout rates higher than 20% and two others higher than 50% [24]. Furthermore, our experimental participants achieved higher completion than control group exercise (85% and 75%, respectively) and the same rate (81%) reported [12, 31].

Effect of moderate intensity aerobic exercise on CD4 cell counts in HIV infected persons was examined. At baseline, independent t-test showed insignificant differences in the variables between the experimental and control groups of both variables. P-values of EX and CG were 0.63 and 0.20 (Table-2) respectively. This implies baseline similarities of the two groups; hence observed changes at the end of this study could be attributed to the effect of the aerobic exercise training.

The present study showed that a three-month aerobic exercise program can lead to substantial improvements in CD4 among people living with HIV/AIDS. According to paired pre-post test result on *table 3* CD4 count of *EX* and CG p-values were showing a significant effect 0.00 and 0.07 respectively. *Table 4* has shown 12 weeks post effect of the study. Within table 4 independent t-test for mean 12th week

values of CD4 cell count of the control and experimental groups showed up-values 0.03. This indicated that in addition to ART therapy aerobic exercise has own contribution in control HIV infection by controlling increment of CD4 count.

Immunological markers not only give predictive information on HIV, but they are also linked to HIV-related illness and mortality. Study of these clinical trials have consistently shown significant improvements in CD4+ T cell count levels after moderate aerobic training [30, 32]. Our findings confirm these observations.

Our trial included people of participating in aerobic exercise may have indirectly caused a normalization of stress-induced CD4+ T cell count depletion. A similar result was reported in a study performed before the HAART era in which a 10-week aerobic exercise program showed an increase of CD4+cell count in individuals with the exercise intervention [6]. Another possible explanation is the social support that our exercise intervention provided which may have caused better adherence to HAART and subsequently improved immunological profile in the EX group. Similar results on social support and enhanced adherence to HAART have already been demonstrated in several previous studies [18, 24].

In conclusion, results showed that a three-month, supervised, and moderate aerobic program performed three times a week, can result show favorable clinical findings were demonstrated with respect to immunological markers, signifying that patients can attain a more positive prognosis with respect to their HIV related health outcomes than CG. Given the promising results of this study, future trials should focus more upon longer duration exercise programs for enhancing the general health status of individuals infected with HIV. Finally, it would be relevant to specifically target HIV patients, since they represent individuals with greater susceptibility to disease progression and premature mortality.

5. Conclusion

Aerobic exercise has a positive effect on the Immune (CD4 count) in people living with HIV/AIDS when it combines with ART rather than ART alone. The quantitative data provided confirmation that a 12 week aerobic exercise program enhanced the health status. It seems that aerobic exercise is a safe, complimentary method to manage HIV symptoms, and in this manner enhances of immunity. The conclusion can be made that, aerobic exercise does slow down the progression of the disease, it is safe for HIV patients. Bearing in mind all the benefits derived from aerobic exercise, this safe modality should be highly recommended for the management of HIV symptoms.

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