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Assessment of Progressive Resistance Exercise Training on CD4 Count and Weight of People with HIV/AIDS in A University Teaching Hospital, Ebonyi State Nigeria

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ABSTRACT

This study aimed at assessing the effect of progressive resistance exercise training on CD4 count and weight of people living with HIV/AIDs in Alex-Ekwueme Federal University Teaching Hospital, Ebonyi State Nigeria . The study adopted experimental research design. The population of the study was 40 HIV/AIDS patients that attended HIV clinics at AE-FUTHA. The sample size for the study was 38 due to drop out of two subjects in the control group. Simple random sampling technique by balloting was adopted for the study. Flow cytometry (FACS) and Omron BF 400 were the instruments used for data collection of CD4 counts and weight respectively. Mean, standard deviation and ANCOVA were used to analyze the data obtained. The instruments were not validated because they are standard. The reliability coefficient score obtained from the pilot study were 0.848 and 0.994 representing CD4 counts and Weight of the participants respectively. The major findings revealed that PRE had positive effect on CD4 counts and weight. The hypotheses result showed that PRE had statistical significant effects on CD4 counts but did not have effects on weight. Based on these findings, recommendation were made among others that awareness should be created to government by Physiotherapists, Exercise Physiologists, Physicians and Health Educationists to adjunct PRE which boost immune system by improving CD4 counts and in the management of PLWHA.

KEY WORDS: PROGRESSIVE RESISTANCE EXERCISE, CD4 COUNTS, WEIGHT AND HIV/AIDS.

INTRODUCTION

Progressive resistance exercise (PRE) is a system of dynamic resistance training in which a constant external load is applied to the contracting muscles by some mechanical means (usually a free weight or weight machine) and gradually increased using repetitive maximum as a basis for progression. Similarly, PRE is a style of strength training exercise that involves the utilization of resistance with the overload principle via activities such as isotonic or isometric exercises. The overload principle defines a solution to the problem of our bodies adapting to one maximal dynamic concurrent exercise due to constant repetition of moderate enduring training (O'Brien et al., 2004, Kisner and Colby, 2012).

The principle states that in order to see ongoing training benefits, the load placed on our bodies via exercise must continue to be increased until our bodies adapt to the

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current load. More specifically, PRE basically involves activities like chest press, overhead shoulder press, upright rowing, biceps muscle curls, triceps muscle extension, knee extension with weight, knee flexion with weight, leg press, calf raises and dumbbell lifting. Moreover, PRE as a therapeutic tool in patient's management; is considered safe and effective in improving immune system especially $CD4^+$ T helper cells (Roubenoff et al. 1999, Guadalupe-Grau et al., 2009, Chitu-Tisu et al., 2016, Baker, 2020, Petre et al., 2021).

Anxiety and depression are some of the most common symptoms experienced by HIV population and indicators of low quality of life with concomitant stress (Ma et al. 2013). Stress reduces CD4 cell counts, while exercise enhances CD4 cell counts by reducing negative emotional states and modulating levels of endogenous opiates and stress hormones (Beck et al. 2016). This remarkable increase in CD4 cell counts could also be attributed to the fact that exercise training stimulates the formation of certain antibodies that prevent some potent HIV protein molecules (glycoprotein 120) from attaching to receptor sites of CD4 cells, by this process, the damaged immune system is reconstituted, and HIV disease progression to AIDS is slowed down, similar to the role played by ART/HAART (Battalora et al. 2014, Matovu et al., 2016).

Surprisingly, despite the recorded psychological, immunological and physiological benefits of progressive resistance exercises, some related (empirical) studies which were reviewed disclosed inconsistent experimental research findings concerning the effects of different therapeutic exercises especially PRE with respect to CD4 counts (Shojaa et al., 2020). A previous study reported a stable CD4+ cell count with resistance exercise during a 12-week intervention (45–60 min, 3times/week) study, unlike the control who recorded a significant decrease. Similarly, another study reported that structured resistance exercise also triggers a specific immune response in PLWHA (Multanen et al., 2015). Another previous study demonstrated that resistance exercise for 12weeks (3 times/week) is effective in boosting the CD4+ and CD8+ cell counts with consequent improvement in the integrity of the immune system (Harada and, Rodan, 2003).

Equally, another study documented a significant effect of PRE in three outcome measures including CD4 count (Seeman and Delmas, 2006). In related studies PRE improved the CD4 count of elderly HIV people as well (Glenn, 2009). Contrarily, Dolan, Fronter, Librizzi, Liungquist and Juan, (2006) stated that PRE does not have positive effect on CD4 cell count, also, Terry, Sprinz and Ribiero, (2006) reported that PRE did not have positive effect on immunologic makers (CD-4 and CD-8). Similarly, O'Brien, Nixon, Tynan and Glazier (2015) equally reported insignificant effects in CD4 count and viral load. More consistently, PRE brought about increase in the weight of HIV/AIDs individuals, hence, PRE is proven to be safe and could be beneficial in improving the weight of adults living with HIV/AIDS. Hence the need for this study to add to knowledge and close off the gap created by inconsistency (O'Brien et al., 2004, Souza et al., 2008).

The main purpose of this study is to evaluate the effects of progressive resistance exercises on CD4 counts and weight of people living with HIV/AIDS (PLWHA) who are on either anti-retroviral therapy (ART) or highly active anti-retroviral therapy (HAART) in Alex-Ekwueme Federal University Teaching Hospital, Abakaliki, Ebonyi State (AE-FUTHA). Specifically, this study sought to determine: the effects of 6weeks progressive resistance exercises on CD4 count of people living with HIV/AIDS, also, to ascertain the effects of 6 weeks progressive resistance exercises on weight of people living with HIV/AIDS.

MATERIAL AND METHODS

Research Design: This study adopted an experimental research design with an equivalent (randomized) pre-test and post-test data, utilized to observe the response of the dependent variables (CD4 count and Weight) of the treatment group (progressive resistance exercise).

Area of Study: The setting for this study was at Physiotherapy department of AE-FUTHA in Ebonyi State. This health facility is a teaching hospital in Abakaliki. It has about 2000 beds, and up to 20 departments. The hospital was chosen based on the information gotten from health record that they diagnose up to 20 HIV/AIDS patients weekly and has up to 25% of 0.8% population of those living with HIV/AIDS in Ebonyi State. Participants These include all HIV/AIDS patients that attend HIV clinics at AE-FUTHA between December, 2019 to February, 2020. Forty volunteers who were on ART/HAART (highly active anti-retroviral treatment) for not less than 24months were randomly grouped into 2 groups (A= the exercising group and B = control group).

Sample and Sampling Technique: Forty (40) participants on ART/HAART who were willing to participate and met the inclusion criteria were assigned to the two groups (A: PRE and B: control), using balloting by replacement [13]. However, only 38 subjects completed the study due to drop out by 2 persons from the control group. Thus, the sample size became 38 for the study.

Selection Criteria: Inclusion Criteria: Only HIV/AIDS patients within the age range of 18 to 60 years and female between 18 to 50 years. Only HIV/AIDS patients that have started taking their ART/HAART for the duration of 24 months and above, prior to the study, and attend HIV/AIDS clinics.

Exclusion Criteria: HIV/AIDS patients below 18 years and above 60years old. Patients that were not on ART/HAART up to duration of 24 months and above prior to the study, also, all subjects with previous history of cardiac and diabetic complications. However, all pregnant subjects were excluded to avoid interference on CD4 count and weight.

Instrument for Data Collection: The following instruments were used for data collection in this study: Flowcytometery (Partec Cyflow counter), Germany; and Omron BF400 weighing scale. The instruments (i.e. Flowcytometery [Partec Cyflow counter] and Omron BF400 weighing scale) are standard and used worldwide. Hence they do not need to be validated. The obtained data during trial testing was subjected to Pearson Product Moment Correlation Co-efficient and the results were 0.848 and 0.994 for CD4 count and weight respectively. These are said to be reliable because they are greater or equal to 0.8 (Glenn, 2009).

Experimental Procedure: The procedure for data collection in this research was assisted by 4 field assistants including; a Physiotherapist, a Radiologist, a Nurse, a laboratory Scientist and a medical doctor. The subjects were recruited at AE-FUTHA and informed consent was issued explaining the purpose, procedure, and relevance of the study before the onset of the intervention. The intervention was supervised by Research and Ethics Committee (REC) of AE-FUTHA. All the willing participants were assessed for baseline data, which included age, weight, blood pressure (BP) and heart rate. Randomized control trial technique by balloting was used to divide the willing participants who met the inclusion criteria into two groups (A: PRE and B: control). None of the groups were blinded. The control group (B) was not allowed to participate in the exercises and they were also asked not do any active exercise program for the period of six (6) weeks of the study.

The activities of daily living of the participants in the control group were monitored through a checklist and it was confirmed that none of them participated in any form of active exercise program. While the progressive resistance exercise group (A) used 10 repetitive maximum of 10 percent of their body weight in progression, using 1/3 of their 10% body weight in the first two weeks, 1/2 of their 10% body weight in their 2nd two weeks and finally 10% of their body weight in their last two weeks. The weights were gradually/progressively increased during the 6 weeks of the exercise with consideration of bone adaptation and fracture prevention. Heart rate and blood pressure were monitored before and during each exercise bout. All subjects participated three times a week for the period of six weeks. Post intervention/treatment data of CD4 T-cells and Weight were then collected through Flowcytometery (Partec Cyflow counter) and Omron BF400 weighing scale respectively.

Method of Data Collection: Blood samples were drawn venopunctually for the CD4 count using syringe into a test-tube. Reagents used were brought to room temperature, 850µl of the count check bead green analyzed to make sure that the cyflow machine was working effectively. The needed numbers of Rohren test tubes were labelled appropriately and placed in a test tube rack. 20µl of CD4 easy count kits (CD4 Mab-PE) were pipetted into them for the assay. Thereafter, 20µl of blood samples were also pipetted into each test tube and incubated in the dark for 15 minutes at room temperature after mixing properly followed by the addition of 850µl easy count. Lyse buffer was not added to each test tube. In order to avoid air bubbles, this was mixed properly and analyzed on the Partec Cyflow. The outcome was displayed and copied from the screen.

Ethical Consideration: Ethical approval was sought and obtained from the ethical committee of AE-FUTHA. Participants' privacy and confidentiality was maintained using code numbers instead of names, and ensuring that records were destroyed at the end of the study. Subjects' informed consent were obtained from the subjects before commencing the study and the principle of the Helsink and Ninemberg declarations on the protection of the right of subjects while conducting experimental human research was strictly observed.

Method of Data Analysis: The data obtained (i.e. CD4 counts and weight) in the main study were analyzed using mean, standard deviation and analysis of covariance (ANCOVA).

RESULTS AND DISCUSSION

Table 1. Effects of 6 (six) weeks progressive resistance exercise (PRE) on CD4 counts of people living with HIV/AIDS

Group	N	Pre-test Mean	Post-test Mean	Differences in Mean (Post-Pre)	Pre-test Standard Deviation	Post-test Standard Deviation	Differences in STD (Post-Pre)
PRE	20	414.20	442.15	27.95	197.45	202.37	4.92
Control	18	461.28	384.61	-76.67	237.40	199.20	-38.2
Difference in Mean Effect		-47.08	57.54		-39.95	3.17	

The result in the table 1 above revealed that the participants in experimental group who took part in the PRE had higher pretest observed mean in CD4 counts compared to their counterparts in the control group. Those who were exposed to treatment had mean of 414.20 while those in control group had 461.28 for the pre-test. This shows that there is a difference of -47.08 in favour of subjects in the control group before the intervention. Participants in PRE got a mean value of 442.15 while subjects in control group got 384.61 in the post-test. The mean difference is 57.54 in favour of subjects in the intervention group (i.e. those who

participated in PRE). The difference in observed mean after 6 weeks' intervention of the PRE is 27.95 while that of control is -76.67, showing positive therapeutic benefits in favour of the PRE group. However, the difference in standard deviation values between pretest and posttest is heterogeneous for both groups (i.e. no similarity) as the STD (i.e. 4.92 and -38.2) are above 0.9.

The result in the table 2 above revealed that the participants in experimental group who took part in the PRE had higher pretest observed mean in weight compared to their counterparts in control group. Those who were exposed to treatment had mean of 69.02 while those in control group had 67.08for the pre-test. This shows that there is a difference of 1.45 in favour of subjects in the experimental group before the intervention. Participants in PRE got mean value of 71.09 while subjects in control group got 67.57 in the post-test. The mean difference is 4.01 in favour of subjects in the intervention group (i.e. those who participated in PRE). The difference in observed mean after 6 weeks' intervention of the PRE is 2.07 while that of control is 0.49, showing a weight gain of subjects in PRE group and a slight weight gain in the control group. However, the difference in standard deviation values between pretest and posttest is homogeneous for both groups (i.e. similarity) as the STD (i.e. 0.46 and -0.69) are less than 1.

Table 2. Effects of 6 (six) weeks progressive resistance exercise on weight of people living with HIV/AIDS

Group	N	Pre-test Mean	Post-test Mean	Differences in Mean (Post-Pre)	Pre-test Standard Deviation	Post-test Standard Deviation	Differences in STD (Post-Pre)
PRE	20	69.02	71.09	2.07	12.58	13.04	0.46
Control	18	67.08	67.57	0.49	17.84	17.15	-0.69
Difference in Mean Effect		1.45	4.01		-5.26	-4.11	

Table 3. There was no significant difference after 6 weeks' progressive resistance exercise (PRE) on CD4 count of people living with HIV/AIDS

Source	Type III Sum of Squares	Df	Mean Square	F	P-value	Effect Size
Corrected Model	1.104E6	2	552153.827	50.886	.000	
Intercept	30837.785	1	30837.785	2.842	.101	
Group(PRE/Control)	84369.691	1	84369.691	7.775	.009	3.84
Pretest CD4 Count	1072942.903	1	11072942.903	98.881	.000	
Error	379777.925	35	10850.798			
Total	8025316.000	38				
Corrected Total	1484085.579	37				

a. R Squared = .759 (Adjusted R Squared = .745)
b. Significant level-*P < 0.05, Ns Not significant: (P > 0.05)
c. Effect size: d = 0.2 (small effect); d = 0.5 (medium effect); d = 0.8 (large effect)

The table above compared the post test of PRE Group and Control Group on CD4 count. The result is on the effect of progressive resistance exercise (PRE) on CD4 count of people living with HIV/AIDS. The table shows a probability value (significant value) of 0.009 for progressive resistance exercise and control groups. The significant value in the table above for groups is less than the alpha level of 0.05. The decision rule is that if the probability value (significant value) is less than the alpha level of 0.05, then the earlier stated null hypothesis will not be accepted. This means that the hypothesis earlier stated will not be accepted. Thus, there is a significant difference after 6 weeks' progressive resistance exercise on CD4 count of people living with HIV/AIDS. On the aspect of effect size, the table shows that the mean difference between pre-test and post-test from the study when experimental and control groups are compared is high. This shows that there is a large effect size of PRE on CD4 counts and it implies that the mean difference is important.

The result in the above table is on the effect of progressive resistance exercise (PRE) on weight of people living with HIV/AIDS. The table shows a probability value (significant value) of 0.134 for progressive resistance exercise (PRE) and control group. The significant value in the table above for groups is greater than the alpha level of 0.05. The decision rule is that if the probability value (significant value) is greater than the alpha level

of 0.05, then the earlier stated null hypothesis will be accepted. This means that the hypothesis earlier stated will be accepted. Thus, there is no significant difference after 6 weeks' progressive resistance exercise on weight of people living with HIV/AIDS. The result in the table shows that there is a large effect size of PRE on Weight. This large effect size indicates an increase in the mean value after comparing the pre-test and post-test of the two groups in the study.

Table 4. There was no significant difference after 6 weeks' progressive resistance exercise (PRE) on Weight of people living with HIV/AIDS

Source	Type III Sum of Squares	Df	Mean Square	F	P-value	Effect Size
Corrected Model	7394.064a	2	3697.032	130.372	.000	
Intercept	56.657	1	56.657	1.998	.166	
Group(PRE/Control)	66.854	1	66.854	2.358	.134	2.68
Pretest WEIGHT	7241.895	1	7241.895	255.379	.000	
Error	992.512	35	28.357			
Total	190310.610	38				
Corrected Total	8386.576	37				

a. R Squared = .882 (Adjusted R Squared = .875)
b. Significant level-*P < 0.05, Ns Not significant: (P > 0.05)
c. Effect size: d = 0.2 (small effect); d = 0.5 (medium effect); d = 0.8 (large effect)

In table 1, the findings revealed that the mean difference is 57.54 in favour of subjects in the intervention group (i.e. those who participated in PRE). The difference in observed mean after 6 weeks' intervention of the PRE is 27.95 while that of control is -76.67, showing a positive therapeutic benefit in favour of the PRE group. However, the difference in standard deviation values between pretest and posttest is heterogeneous for both groups (i.e. no similarity) as they are above 0.9. This implies that after 6 weeks of intervention, PRE had positive effect on CD4 counts of people living with HIV/AIDs. This finding is in support of the findings of Souza, Jacob-Filho, Santarém, Silva, Li and Burattini, (2008) that PRE improved the CD4 count of elderly HIV people. On the contrary, this finding disagrees with that of Dolan, Fronter, Librizzi, Liungquist and Juan, (2006) that PRE does not have positive effect on CD4 cell count.

In table 2, the findings revealed that the mean difference is 4.01 in favour of subjects in the intervention group (i.e. those who participated in PRE). The difference in observed mean after 6 weeks' intervention of the PRE is 2.07 while that of control is 0.49, showing a Weight gain of subjects in PRE group and a slight weight gain in the control group. However, the difference in standard deviation values between pretest and posttest is homogeneous for both groups (i.e. similarity) as they are less than 1. This result shows that people living with HIV/AIDs had increase in weight after 6 weeks of PRE. This finding supported that of Souza, Jacob-Filho, Santarém, Silva, Li and Burattini, (2008) that PRE brought about increase in the weight of HIV/AIDs individuals. In addition, it was also supported that PRE is proven to be safe and could be beneficial for adults living with HIV/AIDS in their weight increment (O'Brien et al., 2004).

The finding in table 4 shows that there is a significant difference after 6 weeks' progressive resistance exercise (PRE) on CD4 count of people living with HIV/AIDS. The finding shows that there is a significant increase in CD4 count in posttest compared to pretest. Thus, the result is in line with that of Souza et al. (2008) who reported that PRE had significant increase in CD4 count of elderly HIV people. On the contrary, a previous study reported that there was no significant difference in mean changes of CD4 count of participant in PRE for PLWHA which is not in support of the present findings (O'Brien et al. 2017). There is no significant difference after 6 weeks' progressive resistance exercise on weight of people living with HIV/AIDS. Though, PRE had only a very slight increase (i.e. 69.02 for pretest and 71.09 for posttest) in weight of people living with HIV. Thus, the finding agrees with previous studies that reported that PRE never had any significant effect on weight of elderly HIV people (Crothers et al. 2014; Chaparro et al. 2018). This did not concur with the present study findings because they found in their study that there exists a statistically significant improvement in weight of participants in PRE living with HIV/AIDS (O'Brien et al., 2017; Dianatinasab et al., 2018).

The observed mean increase in CD4 counts of PRE group compared to subjects in the control group shows that PRE has positive therapeutic response on immune system of PLWHA when combined with ARV drugs. This implies that CD4 T-cells' production and proliferations are stimulated by PRE (Aboodarda et al. 2012; Yarasheski et al. 2011). The PRE group equally revealed a higher increase in Weight compared to subjects in the control group. This is very understandable because PRE is a weight bearing exercise that builds the muscle mass

through repetitive maximum and definitely can lead to weights gain of the participants over time (Gresele et al., 2012; Ibeneme et al., 2019; Kovacs and Hoffman 2011).

The revealed significant difference after 6 weeks' progressive resistance exercise on CD4 count suggested that PRE introduction to the management of PLWHA improved the immune system of PLWHA which is associated with the production of CD4 T-cells. Though, this production maybe as a result of proliferation of the T-cells from organs to the blood stream (MacArthur et al., 2012; Maduagwu et al. 2015; Marques et al., 2012). Thus, this may explain why the reports are always said to be noted with caution. The result revealed no significant difference on weight of PLWHA who participated in PRE compared to subjects in the control group maybe as a result short duration of the exercise (Nall, 2005, Ntsekhe and Hakim, 2005; Tiozzo et al., 2013).

CONCLUSION

The major findings of this study have revealed that PRE had positive effect on CD4 counts and weight. The hypotheses result showed that PRE had statistical significant effects on CD4 counts but did not have effects on weight. Based on these findings, recommendation are made among others that awareness should be created by Physiotherapists, Exercise Physiologists, Physicians and Health Educationists to adjunct PRE which boost immune system by improving CD4 counts and in the management of PLWHA.

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