Comparative Analysis of Moderate Intensity Aerobic and Progressive Resistance Exercises on Bone Mineral Density and Weight of People Living with HIV/AIDS in Alex-Ekwueme Federal University Teaching Hospital Ebonyi State

Asogwa, Eucharia Ijego¹, Ekine, Rupee Suoton², Asogwa, Okwudilichukwu Okwy³, Chukwu, Odoch Ogbo⁴, Orizu, Ifoema Ada⁵, Akamike, Ifeyinwa Chizoba⁶ and Udeoji, Dioma U.⁷

¹Department of Physiotherapy, College of Health Sciences, Evangel University, Akaeze, Okpoto Campus, Ebonyi State, Nigeria.
²Department of Arts and Social Science Education, Ebonyi State University, Abakaliki, Ebonyi State, Nigeria.
³Department of Physiotherapy, Alex-Ekwueme Federal University Teaching Hospital, Abakaliki, Ebonyi State (AE-FUTHA), Nigeria.
⁴Department of Physiology, College of Health Sciences, Evangel University, Akaeze, Ebonyi State, Nigeria.
⁵Department of Physiology, University of Nigeria, Enugu Campus, Nigeria.
⁶Department of Community Medicine, Alex-Ekwueme Federal University Teaching Hospital, Abakaliki, Ebonyi State (AE-FUTHA), Nigeria.
⁷Internal Medicine Department, Advocate Lutheran General Hospital, Park Ridge, IL, USA.

Authors’ contributions

This work was carried out in collaboration among all authors. Author AEI designed the study, wrote the protocol and wrote the first draft of the manuscript. Author ERS performed the statistical analysis of the study. Authors AOO and COO managed the analysis of the study. Authors OIA, AIC and UDU managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

The main aim of this study was to find out the comparative effects of 6 weeks moderate intensity aerobic exercises (MIAE) and progressive resistance exercise (PRE) on bone mineral density and weight of people living with HIV/AIDS in Alex-Ekwueme Federal University Teaching Hospital Ebonyi State. The study adopted quasi experimental research design. The population of the study was 60 HIV/AIDS patients that attended HIV clinics at AE-FUTHA which formed the 58 sample size for the study after two people dropped from the control group. Simple random sampling technique was adopted for the study. Heel Densitometer (X-rite 331C) and Omron BF 400 was the instrument used for data collection of BMD 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 obtained from the pilot study was 0.835 and 0.994 for BMD and WEIGHT respectively. The major findings revealed that PRE had more effect than MIAE on BMD and Weight.

Keywords: Progressive resistance exercise (PRE); moderate intensive aerobic exercise (MIAE); BMD; weight; HIV/AIDS.

1. INTRODUCTION

Exercise is one type of rehabilitation strategy that maybe used to address disability, such as decreased strength and cardiovascular fitness, for persons living with HIV. Regular physical exercises are part of a healthy lifestyle for everyone, including people living with HIV because it boost one’s mood, sharpen one’s focus, reduce one’s stress, improve one’s sleep, reduces the risk of developing cardiovascular disease, high blood pressure, type 2 diabetes, and several types of cancer United States Department of Health and Human Services [1]. Infection with human immunodeficiency virus (HIV) affects muscle mass, altering independent activities of people living with HIV (PLWH). Resistance training alone (RT) or combined with aerobic exercise (AE) is linked to improved muscle mass and strength maintenance in PLWH PeÁrez et al [2]. Moderate Intensive Aerobic Exercise (MIAE) has been shown to improve strength, cardiovascular function, and psychological status in general populations. However, the safety and effects of aerobic exercise among adults living with HIV are not well-established O'Brien et al [3]. Knowing the effects of aerobic and progressive resistance exercises for people living with HIV may facilitate the appropriate use of the exercise interventions to enhance HIV care and treatment, with the overall goal of improving the health and quality of life of adults living with HIV O'Brien et al. [3].

Progressive resistance training (PRE) is known as strength training or weight training which is the use of resistance to muscular contraction to build the strength, anaerobic endurance, size of skeletal muscles or body weight and bone mineral density Department of Health & Human Services [4]. Bone density is related to genetic, hormonal, nutritional, and environmental factors. Among the environmental factors, physical activity, together with calcium and vitamin D intake, are now known to be major contributions to bone health for individuals of all ages Southwest General Health Center [5]. Be that as it may, activities that cause heavier loads on the bone structure cause more statistical significant gains in bone density Josiel et al. [6]. T-score between +1 and -1 is considered normal or healthy. A T-score between -1 and -2.5 indicates that one has low bone mass, although not low enough to be diagnosed with osteoporosis. A T-score of -2.5 or lower indicates that one has osteoporosis. The greater the negative number, the more severe the osteoporosis World Health Organization [7].

Some scholars have reported in their study about the effect of MIAE and PRE. Arazí [8]. Marques [9] found that there is a significant change in BMD. The study also found consistency among results for low-impact exercise studies on LS and FN, although non-significant BMD changes were evident amongst these types of protocols at any site and amongst the RCTs that provided a combined loading impact exercise and FN. Siqiang [10] also found in an experimental study that after MIAE, the weight, body fat content, WHR, BMI, and blood lipid level of both groups reduced significantly. The differences were statistically significant. The effect of the experimental group was significantly better than the control group. The weight loss and physical and mental health condition of the

10
experimental group were better than the control group. The difference was significant. Mohamed et al. [11] found in a study that there was no significant difference between both groups in the pre-treatment mean values of all measured variables. It seems that combination of MIAE and PRE and milk consumption has more efficient impacts on the BMD of young women diagnosed with osteoporosis compared to the milk or concurrent training groups alone Arazi [8]. This treatment can be used as an effective way to improve BMD in young women with diagnosed osteoporosis Arazi [8]. There was a significant increase in BMD with respect to PRE and MIAE Andreoli [12]. This finding did not support that of Arazi [8] in their study that PRE and MIAE witnessed a statistical significant increase in both groups (PRE and MIAE). There exists no statistical significant difference for weight after participant undergone MIAE and PRE intervention Yaghoobi [13]. However, the finding is not in support of Mello [14] who reported in a study that both PRE and MIAE had a significant reduction in weight for PLWHA.

The impacts of HIV/AIDS is multisystem bringing about a variety of clinical manifestations and conditions including gross engine shortage, platelets brokenness Gresele [15], cardiovascular weakness William [16], practical decay Crothers [17], insusceptible lack Kovacs & Hoffman [18] and low bone mineral thickness McComsey [19]. Medication intercession particularly HAART, have been very much recorded with complimentary symptoms MacArthur [20]. In this manner, a need to investigate other physical restorative exercise modalities likes MIAE and PRE. Presently, very little work has been done here locally, while Nigeria positions the second most noteworthy of individuals living with HIV/AIDS around the world National Agency for the Control of AIDS [21]. Shockingly, the impacts of MIAE and PRE on BMD and Weight have a significant boundary in HIV/AIDS and it is under discussed. Consequently, the requirement for more examinations to explain the impacts of MIAE and PRE on BMD and Weight.

1.1 Purpose of the Study

The main purpose of this study is to compare the effects of moderate intensity aerobic exercise and progressive resitive exercises on BMD and Weight of people living with HIV/AIDS who are on HAART (highly active antiretroviral therapy) in Enugu State University Teaching Hospital. Specifically this study will determine:

1. The comparative effects of MIAE and PRE on BMD of people living with HIV/AIDS.
2. The comparative effects of MIAE and PRE on WEIGHT of people living with HIV/AIDS.

1.2 Research Questions

1. What are the comparative effects of MIAE and PRE on BMD of people living with HIV/AIDS?
2. What are the comparative effects of MIAE and PRE on WEIGHT of people living with HIV/AIDS?

1.2.1 Hypotheses

For this study, the following null hypothesis will be tested at alpha level of 0.05.

H₀₁: There will be no significant difference after 6 weeks of comparative effects of MIAE and PRE on BMD of people living with HIV/AIDS.

H₀₂: There will be no significant difference after 6 weeks comparative effects of MIAE and PRE on WEIGHT of people living with HIV/AIDS.

2. RESEARCH METHODOLOGY

2.1 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 (BMD and Weight) of the treatment group (moderate intensity aerobic exercise and progressive resistance exercise).

2.2 Area of Study

The setting for this study was at the 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. This hospital was chosen based on the information obtained from a health record that they diagnose more than 20 HIV/AIDS patients weekly and has up to 25% of 0.8% population of those living with HIV/AIDS in Ebonyi state.

2.3 Population for the Study

These include all HIV/AIDS patients that attend HIV clinics at AE-FUTHA between December 2019 to February 2020. The researcher randomly grouped 60 volunteers who were on ART/HAART.
(antiretroviral treatment / highly active antiretroviral treatment) for not less than 24 months into 3 groups (A = aerobic group, B = progressive group and C = control group).

2.4 Sample and Sampling Technique

60 participants on ART/HAART who were willing to participate and met the inclusion criteria were randomly assigned to the three groups (A: aerobic, B: progressive, C: control), using balloting by replacement Mohar & Dulbarg [22]. However, only 58 subjects completed the study due to drop out by 2 persons from the control group. Thus, the sample size became 58 for the study.

2.5 Selection Criteria

2.5.1 Inclusion criteria

- Only male HIV/AIDS patients within the age range of 18 to 60 years and female between 18 to 50 years of age.
- 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.

2.5.2 Exclusion criteria

- Female subjects above 50 years and male above 60 years old, to avoid interference of post-menopausal BMD degeneration and normal old age degeneration, respectively.
- Patients that are not on ART/HAART up to this duration of 24 months and above prior to the study
- All subjects with a previous history of cardiac and diabetic complications.
- All pregnant subjects.

2.6 Instrument for Data Collection

The following instruments were used for data collection in this study:

- Heel Densitometer (X-rite 331C) Germany.
- Omron weighing scale (BF400) Germany.

2.7 Validation of the Instrument

These instruments [i.e. Heel Densitometer (X-rite 331C) and Omron BF400 weighing scale] are standard and used worldwide. Hence, they need no validation.

2.8 Reliability of the Instrument

The obtained data during trial testing was subjected to Pearson Product Moment Correlation Coefficient and the results were 0.835 and 0.994 for BMD and WEIGHT respectively. These are said to be reliable because they are greater or equal to 0.8 according to Glenn [23].

2.9 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. 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 three groups (A: aerobic, B: progressive and C: control). None of the groups were blinded. The control group was not allowed to participate in the exercise and they were also asked not do any active exercise program for a 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. The MIAE and PRE (duration and frequency) of group (A) and (B) respectively was divided in this order: Aerobic group (A) had 18 sessions of sub-maximal aerobic exercises on Marshal Fitness bicycle ergometer and PA Pro Acting treadmill which consists of four stages: (i) 3 minutes warm up (ii) 3-4 minutes to reach the Target Heart Rate (THR) (iii) 20 minutes holding of the range of the THR, and (iv) 3 minutes cool down for 3 times per week. The intensity of the aerobic exercises were increased gradually in this order: 45-50% heart rate reserve during the first 2 weeks, 50-55% heart rate reserve during the second 2 weeks and 55-60% heart rate reserve during the last 2 weeks. While the progressive resistance exercise group (B) 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, ½ 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 precautions bearing in mind bone adaptation and fracture risk. 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 BMD and Weight were then collected through Heel Densitometer (X-rite 331C) and Omron Weighing Scale (BF400) respectively.

2.10 Method of Data Collection

2.10.1 BMD

The first step to data collection with X-rite heel densitometer is Nulling or zeroing the instrument. The instrument is nulled each time it is to be used or each time is removed from the patient’s body, by pressing the ‘null button’. With the subjects in standing position, his/her right toe is positioned at the center (90°) to the film area directly over the aperture under the ‘reading arm’. The light table is then illuminated before measurement to locate film spots to be measured. The ‘reading arm’ is lowered on the body part while holding the ‘null button’ and the ‘measurement button’ is also pressed with the right index finger of the researcher and captures the reading. Both buttons are held down by the researcher until the reading displayed on screen is stable. The results are displayed in D (mg/cm²) and then converted to T-Score.

2.10.2 Weight

The steps in data collection with Omron BF400 weighing scale started by setting the machine to display kilograms by adjusting the switch at the base, followed by placing it on the tile floor. The center of the scale was then pressed lightly with the researcher’s foot to turn on the scale. The subjects were then asked to step onto the scale without their foot wear and heavy objects on them, placing their both feet side-by-side on the footprints landmark. However, the readings were displayed on screen and the records taken with the subject still standing still and upright on the scale.

2.11 Method of Data Analysis

The data obtained was analyzed using Statistical Package for Social Sciences (SPSS) version 25. The statistical tools used were mean, standard deviation, and analysis of covariance (ANCOVA). The data obtained for Control, PRE and MIAE were paired two-by-two and their significant effects on BMD and Weight were shown in the Tables 4 and 6.

Research Question 1:

What is the comparative effect of MIAE and PRE on BMD of people living with HIV/AIDS?

By using the mean difference, the result in Graph 1 shows that there is an ordinal interaction effect of MIAE and PRE on BMD of people living with HIV/AIDS. However, PRE is higher in ranking in the graph than that of MIAE within the period of 6 weeks while that of the Control group has the least estimated marginal means with differences of 0.97, 0.38 and 0.11 respectively.

The result in the bar chart above shows that PRE has more effect on BMD than MIAE while the Control group has the least estimated marginal means of BMD.

Research Question 2:

What are the comparative effects of MIAE and PRE on WEIGHT of people living with HIV/AIDS?

<table>
<thead>
<tr>
<th>Group</th>
<th>Pretest (Mean)</th>
<th>Posttest (Mean)</th>
<th>mean differences</th>
<th>Pretest (SD)</th>
<th>Posttest (SD)</th>
<th>SD difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>MIAE</td>
<td>0.75</td>
<td>1.13</td>
<td>0.38</td>
<td>0.44</td>
<td>0.23</td>
<td>-0.21</td>
</tr>
<tr>
<td>PRE</td>
<td>0.10</td>
<td>1.07</td>
<td>0.97</td>
<td>0.93</td>
<td>0.53</td>
<td>-0.40</td>
</tr>
<tr>
<td>CONTROL</td>
<td>0.68</td>
<td>0.79</td>
<td>0.11</td>
<td>0.86</td>
<td>0.46</td>
<td>-0.40</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Group</th>
<th>Pretest (Mean)</th>
<th>Posttest (Mean)</th>
<th>Mean differences</th>
<th>Pretest (SD)</th>
<th>Posttest (SD)</th>
<th>SD difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>MIAE</td>
<td>70.83</td>
<td>69.92</td>
<td>-0.91</td>
<td>17.61</td>
<td>17.03</td>
<td>0.58</td>
</tr>
<tr>
<td>PRE</td>
<td>69.02</td>
<td>71.09</td>
<td>2.07</td>
<td>12.57</td>
<td>13.04</td>
<td>-0.47</td>
</tr>
<tr>
<td>CONTROL</td>
<td>67.56</td>
<td>67.08</td>
<td>-0.48</td>
<td>17.84</td>
<td>17.15</td>
<td>0.69</td>
</tr>
</tbody>
</table>
By using the mean difference, the result in Graph 2 shows that there is an ordinal interaction effect of MIAE and PRE on Weight of people living with HIV/AIDS. However, PRE is higher in ranking in the graph than that of MIAE within the period of 6 weeks. The graph also revealed that the Control group is higher than MIAE within the period of 6 weeks. The differences are 2.07, -0.48 and -0.91 for PRE, MIAE and Control group respectively.

The result in the bar chart above shows that PRE has more effect on Weight than MIAE based on the estimated marginal means of Weight of people living with HIV/AIDS.

**Hypothesis 1:** There will be no significant difference after 6 weeks comparative effects of MIAE and PRE on BMD of people living with HIV/AIDS.
The result in Table 3 is on the effect of PRE and MIAE on BMD of participants in this study. The table shows a probability value (significant value) of 0.067 for PRE and MIAE and control group. The significant value in Table 3 for groups is above the alpha level of 0.05. This means that the hypothesis earlier stated is accepted. Thus, there is no significant difference after 6 weeks’ PRE and MIAE on BMD of people living with HIV/AIDS. The result in the table shows that there is a positively low effect size of PRE and MIAE on BMD when the experimental groups are compared with the control group in the study.

By checking for pairwise comparison, the result in Table 4 is on the effect of PRE, BMD and
Control comparison based on BMD in this study. The table shows that MIAE paired with PRE, MIAE paired with Control, PRE paired with MIAE, PRE paired with Control, Control paired with MIAE and Control paired with PRE all show not significant based on their respective probability value in Table 4. Thus, all these show that the result is in line with that of Tests of Between-Subjects Effects, that there is no significant difference after 6 weeks’ of comparing PRE and MIAE on BMD of people living with HIV/AIDS.

**Hypothesis 2:** There will be no significant difference after 6 weeks comparative effects of MIAE and PRE on WEIGHT of people living with HIV/AIDS.

The result in Table 5 is on the comparative effect of PRE and MIAE on Weight of participants in this study. The table shows a probability value (significant value) of 0.001 for PRE and MIAE and control group. The significant value in Table 5 for groups is less than the alpha level of 0.05. This means that the hypothesis earlier stated is not accepted. Thus, there is a significant difference after 6 weeks of comparative effects of MIAE and PRE on WEIGHT of people living with HIV/AIDS. The result in the table also shows that there is a positively low effect size of PRE and MIAE on WEIGHT when the experimental groups are compared with the control group in the study.

The result in Table 6 shows pairwise comparisons of MIAE, PRE and Control based on WEIGHT in this study. The table shows that MIAE paired with PRE, MIAE paired with Control, PRE paired with MIAE, PRE paired with Control, Control paired with MIAE and Control paired with PRE and all were not significant based on their respective probability value in Table 6. Thus, the results are not in line with that of Tests of Between-Subjects Effects which shows a significant difference after 6 weeks of PRE and MIAE on WEIGHT of people living with HIV/AIDS.

**Table 3. Significant difference after 6 weeks comparative effects of MIAE and PRE on BMD of people living with HIV/AIDS**

<table>
<thead>
<tr>
<th>Source</th>
<th>Type III sum of squares</th>
<th>df</th>
<th>Mean square</th>
<th>F</th>
<th>Sig.</th>
<th>Effect size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corrected Model</td>
<td>1.409*</td>
<td>3</td>
<td>.470</td>
<td>2.530</td>
<td>.067</td>
<td>.123</td>
</tr>
<tr>
<td>Intercept</td>
<td>31.845</td>
<td>1</td>
<td>31.845</td>
<td>171.541</td>
<td>.000</td>
<td>.761</td>
</tr>
<tr>
<td>GROUP * BMDpre</td>
<td>1.409</td>
<td>3</td>
<td>.470</td>
<td>2.530</td>
<td>.067</td>
<td>.123</td>
</tr>
<tr>
<td>Error</td>
<td>10.024</td>
<td>54</td>
<td>.186</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>70.176</td>
<td>58</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corrected Total</td>
<td>11.433</td>
<td>57</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a. R Squared = .123 (Adjusted R Squared = .075); b. Significant level - *P < 0.05, Ns Not significant: (P > 0.05)

**Table 4. Pairwise comparisons of PRE, MIAE and control group of BMD**

<table>
<thead>
<tr>
<th>(I) GROUP</th>
<th>(J) GROUP</th>
<th>Mean difference (I-J)</th>
<th>Std. error</th>
<th>Sig. a</th>
<th>95% confidence interval for difference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Lower bound</td>
<td>Upper bound</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MIAE</td>
<td>PRE</td>
<td>-.021</td>
<td>.084</td>
<td>.802</td>
<td>-.189 .147</td>
</tr>
<tr>
<td></td>
<td>CONTROL</td>
<td>.108</td>
<td>.075</td>
<td>.157</td>
<td>-.043 .260</td>
</tr>
<tr>
<td>PRE</td>
<td>MIAE</td>
<td>.021</td>
<td>.084</td>
<td>.802</td>
<td>-.147 .189</td>
</tr>
<tr>
<td></td>
<td>CONTROL</td>
<td>.129</td>
<td>.074</td>
<td>.084</td>
<td>-.018 .277</td>
</tr>
<tr>
<td>CONTROL</td>
<td>MIAE</td>
<td>-.108</td>
<td>.075</td>
<td>.157</td>
<td>-.260 .043</td>
</tr>
<tr>
<td></td>
<td>PRE</td>
<td>-.129</td>
<td>.074</td>
<td>.084</td>
<td>-.277 .018</td>
</tr>
</tbody>
</table>

Based on estimated marginal means; a. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments); b. Significant level - *P < 0.05, Ns Not significant: (P > 0.05)
Table 5. There will be no significant difference after 6 weeks comparative effects of MIAE and PRE on WEIGHT of people living with HIV/AIDS

<table>
<thead>
<tr>
<th>Source</th>
<th>Type III sum of squares</th>
<th>Df</th>
<th>Mean square</th>
<th>F</th>
<th>Sig.</th>
<th>Effect size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corrected Model</td>
<td>3483.620</td>
<td>3</td>
<td>1161.207</td>
<td>6.017</td>
<td>.001</td>
<td>.251</td>
</tr>
<tr>
<td>Intercept</td>
<td>3666.739</td>
<td>1</td>
<td>3666.739</td>
<td>18.999</td>
<td>.000</td>
<td>.260</td>
</tr>
<tr>
<td>GROUP * preWEIGHT</td>
<td>3483.620</td>
<td>3</td>
<td>1161.207</td>
<td>6.017</td>
<td>.001</td>
<td>.251</td>
</tr>
<tr>
<td>Error</td>
<td>10421.582</td>
<td>54</td>
<td>192.992</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>293612.300</td>
<td>58</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corrected Total</td>
<td>13905.202</td>
<td>57</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a. R Squared = .251 (Adjusted R Squared = .209); b. Significant level:*P < 0.05, Ns Not significant: (P > 0.05)

Table 6. Pairwise comparisons of PRE, MIAE and control group of WEIGHT

<table>
<thead>
<tr>
<th>(I) GROUP</th>
<th>(J) GROUP</th>
<th>Mean difference (I-J)</th>
<th>Std. error</th>
<th>Sig.*</th>
<th>95% confidence interval for difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>MIAE</td>
<td>PRE</td>
<td>-5.420</td>
<td>4.274</td>
<td>.210</td>
<td>-13.988 to 3.148</td>
</tr>
<tr>
<td>PRE</td>
<td>MIAE</td>
<td>5.420</td>
<td>4.274</td>
<td>.210</td>
<td>-3.148 to 13.988</td>
</tr>
<tr>
<td>PRE</td>
<td>CONTROL</td>
<td>2.065</td>
<td>4.468</td>
<td>.646</td>
<td>-6.892 to 11.022</td>
</tr>
<tr>
<td>CONTROL</td>
<td>PRE</td>
<td>-2.065</td>
<td>4.468</td>
<td>.646</td>
<td>-11.022 to 6.892</td>
</tr>
</tbody>
</table>

Based on estimated marginal means; a. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments)

3. RESULTS AND DISCUSSION

The result in research question 1 shows that PRE, MIAE and Control groups had increased posttest BMD. However, the finding shows that the BMD on the PRE group is higher in ranking as demonstrated in the graph than that of MIAE within the period of 6 weeks while that of the Control group has the least estimated marginal means with differences of 0.97, 0.38 and 0.11 respectively for BMD. The bar chart result revealed the same thing about PRE, MIAE and the Control group for BMD. Thus, it shows that the mean difference for both MIAE and PRE are all higher than that of the non-intervention group (control group). However, the difference in standard deviation values between pretest and posttest for the three groups in the study is homogeneous (i.e. there is similarity) as they are less than 1. This finding is in line with Arazi et al. [8] who reported in a study that there exists an increase in both PRE and MIAE and the Control group for BMD. Though, the finding did not concur with Andreoli et al. [12] which stated that there was a significant increase effect of BMD with respect to PRE over MIAE. The finding equally supported that of Mohamed et al. [11] which stated that there was noncomparative significant difference between both groups in the pre-treatment mean values of all measured variables; meaning that both exercises could be used to achieve improvement of BMD in PLWHA. Moreover, the result also showed a positively low effect size (0.123) of PRE and MIAE on BMD when the experimental groups were compared with the control group in the study. This was consistent for both tests between subject effects and pairwise comparison and could have affected the significance of this study.

The finding for Weight revealed that PRE is higher in ranking in the graph than that of MIAE with mean differences of 2.07 and -0.91 for PRE and MIAE group respectively with a higher mean difference of control group compared to participants in the MIAE Group. However, the difference in standard deviation values between
pretest and posttest for the three groups in the study is homogeneous (i.e. there is similarity) as they are less than 1. This finding does not agree with Kebrít & Hailu [25] who stated that both PRE and MIAE increased body weight. In addition, PRE and MIAE have positive effects on weight as they do help to maintain or build muscle mass for adults living with HIV/AIDS United States Department of Veterans Affairs [26]. On the aspect of the control group having higher mean difference than that of MIAE, such findings agree with Siqiang [10] who found in an experiment that after MIAE, the weight, body fat content, WHR, BMI, and blood lipid level of both groups reduced significantly. The hypothesis result on weight shows that there is a significant difference of comparative effect of MIAE and PRE on WEIGHT of people living with HIV/AIDS for tests between subjects’ effect while that of pairwise comparison shows that there is no significant difference after 6 weeks’ PRE and MIAE on WEIGHT of people living with HIV/AIDS. The result also shows that there is a positively low effect size (0.251) of PRE, MIAE and Control on WEIGHT which can affect the significance of this finding.

4. CONCLUSION

The findings of this study have shown that PRE had more effect on BMD than MIAE within the period of 6 weeks and such result was anticipated due to the fact that bone grows through modeling and remodeling processes which are stimulated by stressing the skeletal bone through physical activity especially PRE leading to generation of more BMD. However, PRE and MIAE on BMD of people living with HIV/AIDS revealed that there is no significant difference after 6 weeks’. Furthermore, the findings show that the PRE group had more effect on weight within the period of 6 weeks than subjects in the MIAE group. Though, the non-intervention group had higher mean difference of weight compared to participants in the MIAE Group. The findings further revealed that there is a significant difference after 6 weeks based on comparison of MIAE and PRE on WEIGHT of people living with HIV/AIDS for tests between subjects’ effect. These findings were not surprising because abnormal weight gain or body fat accumulations (lipohypertrophy) and overweight highly prevalent in HIV-infected persons with high CD4 cell counts; who are on ART or HAART for over 24 months is effectively reduced by MIAE in PLWHA. The result also shows that there is a positive low effect size of PRE, MIAE and Control on WEIGHT, meaning that the rate at which it affects the subjects of each group in this study is low.

5. LIMITATIONS OF THE STUDY

1. Refusal of many subjects to participate results in a few number of subjects.
2. The economic situation of the country led to financial difficulties for both intervention groups and the researchers.

6. RECOMMENDATIONS

The followings are the recommendations based on the findings of the study:

1. Continuous awareness should be created on the adjunct role and greater effect of progressive resistance exercise in the management and prevention of bone diseases (osteopenia and osteoporosis) as a result of its positive effects on BMD.
2. Health educators and health care givers should encourage PLWHA who are obese with abnormal fat distribution to take part in aerobic exercise as it may help them in weight reduction.
3. The effects of PRE and MIAE discovered in this study are of great importance to individuals living with HIV/AIDS because such exercises reduce their risk of osteoporosis which they are predisposed to by ART/HAART.

7. SUGGESTIONS FOR FURTHER STUDY

1. The study duration should be increased for best outcome in further studies.
2. Equipment that should monitor physiological, psychological and immunological responses of PRE and MIAE on BMD and Weight should be introduced to conduct another study in order to appreciate the mechanism of actions.

CONSENT AND ETHICAL APPROVAL

The intervention was supervised by the Research and Ethics Committee (REC) of AE-FUTHA. Ethical approval was sought and obtained from the Research and Ethics Committee (REC) of AE-FUTHA. Participants' privacy and confidentiality were maintained using code numbers instead of names and ensured 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 Nuremberg declarations code [24] on the protection of the right of subjects while conducting human experimental research was strictly observed. 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.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES


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