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ASSESSMENT OF PAIN-REDUCTION, FUNCTIONAL ABILITY AND RANGE-OF-MOTION IN KNEE OSTEOARTHRITIS PATIENTS AT FEDERAL MEDICAL CENTRE, YOLA - NIGERIA

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ABSTRACT: The aim of this paper was to assess the effects of resistance training in the management of knee osteoarthritis among patients at Federal Medical Centre, Yola. Twenty (20) participants undergoing physiotherapy treatment at the physiotherapy department were purposively selected, each participant performed resistance training using resistance machine three (3) times in a week for twelve (12) consecutive weeks. Prior to the training and after the training pain levels were measured using visual analogue scale, functional ability was measured using Western Ontario McMaster University Orthopaedic Index (WOMAC) responses to questionnaire, flexion/extension was determined using goniometry, The data collected was analysed using descriptive statistics and hypothesis was tested using repeated measures one-way analysis of variance (ANOVA) at significance level of 0.05, through statistical package for the social sciences (IBM SPSS®) for windows version 21, (SPSS Inc., Chicago IL, USA). Findings of the study showed significant improvement in functional ability, range of motions (ROM) and pain reduction at eight (8) and twelve (12) weeks respectively, using WOMAC, visual analogue scale and goniometry compared to the functional ability, Range of motion (ROM) and pain intensity in four (4) weeks. Based on the findings of this study, it was concluded that resistance training can be used in reducing pain, improving functional ability and ROM in patients with knee osteoarthritis at Federal Medical Centre, Yola. It is therefore recommended that; resistance training can be part of the management modalities, and recommended that hospitals should include resistance training as part of treatment of knee osteoarthritis and Physicians can refer knee osteoarthritis patients to both exercise scientist and physiotherapist for the management of knee osteoarthritis.

Keywords: knee osteoarthritis, resistance training, WOMAC.

INTRODUCTION

Osteoarthritis is the most common form of joint disease (Musumeci, Szychlinska, & Mobasheri, 2015). This chronic, degenerative disorder results from the biochemical breakdown of cartilage in the synovial joints.

Its symptoms tend to develop gradually and include joint aches, stiffness and swelling (Musumeci *et al.*, 2015) According to Ayanniyi, Egwu, and Adeniyi (2017). Osteoarthritis is a leading cause of disability and has a slow, progressive course that ends with joint failure and subsequent disability. According to (Neogi, 2012) Patients suffer from chronic joint pain, restriction of motion, crepitus with motion, and joint effusions, for many years, pharmaceutical therapies have focused on it with no total treatment. The bone changes were due to secondary cartilage degeneration, and not to play a major role in the disease process (Neogi, 2012). However, it has been shown in animal studies that subchondral bone changes occur at early stages of osteoarthritis (Musumeci *et al.*, 2015). Alterations to subchondral bone can lead to cartilage degeneration (Ge, Hu, Heng, Yang, Ouyang, Lee, & Cao, 2006). Mat, Tan, Kamaruzzaman, and Ng (2014), stated that each year, one in every three adults aged sixty-five (65) and older, and almost half of those over eighty (80) years, experience at least a fall annually. The most terrifying problem of Knee osteoarthritis is that it is a leading cause of pain and functional disability among human population especially elderly people. It leads to loss of self-care, independence, reduction in quality of life, loss of employment and social engagement. It increases health care utilization and cost, causes loss of income and escalates dependency. Vincent and Vincent (2012), conducted a research on resistance training for knee osteoarthritis and found that the initiation, progression and severity of knee osteoarthritis has been associated with decreased muscular strength and alterations in joint biomechanics. Therefore, based on these little backgrounds, the study aimed to assess the effects of resistance training in the management of knee osteoarthritis among patients at Federal Medical Centre Yola – Nigeria.

METHODOLOGY

One-group pretest-posttest research design was used for this study. Approval for the study was obtained from the Ahmadu Bello University, Zaria to where the research was conducted (P16EDPE8018). Written permission to conduct the study was also obtained from the Federal Medical Centre, Yola (FMCY/HREC/18/18). Three research questions and three hypotheses were formulated and tested to ascertain the effect of resistance training on the selected variables. The participants were

subjected to pre-test at the beginning of the training and post-test after four (4), eight (8) and twelve (12) weeks of training to observe whether any possible changes in performance has occurred (Thomas, Silverman, & Nelson, 2015).

Participants Characteristics

The participants for this study consist of all knee osteoarthritis patients registered less than four (< 4) weeks with physiotherapy department of Federal Medical Centre, Yola Adamawa State Nigeria. using the clinic record; 26 participants, 10 male and 16 female within the age 40 - 70 years were selected through purposive sampling technique, because only new patients who registered for Physiotherapy treatment aside medication and were willing to participate were selected. This sample size is in line with Cohen and Monia (1994) opinion, that minimum of 20 and maximum of 30 participants for experimental research would produce desirable effects. 6 participants, 2 males & 4 females were dropped out during the cause of training as a result of inconsistency, therefore only 20 participants, 8 male & 12 females met the required attendance for this research, Visual analogue scale was given to these patients in order to determine their level of pain; functional ability was measured using Western Ontario McMaster University Orthopaedic Index (WOMAC) responses to questionnaire while flexion/extension was determined using goniometry. The resistance training was carried out in a period of twelve (12) weeks three (3) times a week for two (2) hour per day. Resistance machine was used for resistance training; patients were tested before training, four (4) weeks after training, eight (8) weeks after training and twelve (12) weeks after training. The data collected were statistically analysed to test the hypothesis of the study.

Research Questions

Would resistance training reduce the pain in patients with knee osteoarthritis? Would resistance training improve functional ability in patients with knee osteoarthritis? Would resistance training improve range of range of motion (ROM) in patients with knee osteoarthritis?

Table 1: Training Procedure

Days	Month	AerobicWarm -Up Time	Load	Stretching Training Time	Reps	Resistance Training Time	Load
Tue, Thur & Sat	Jul/Aug 2018	5 Mins	50% - 55%	15 Secs	5 Reps	10 Mins	5 kg
Tue, Thur & Sat	Aug/Sep 2018	5 Mins	50% - 55%	20 Secs	8 Reps	15 Mins	10 kg
Tue, Thur & Sat	Sep/Oct 2018	5 Mins	55% - 69%	30 Secs	10 Reps	20 Mins	15 kg

Note: Aug = August, Jul = July, Mins = Minutes, Oct = October, Reps = Repetitions, Sat = Saturday, Secs = Seconds, Sept = September, Thur = Thursday, Tue = Tuesday,

Test of Hypothesis 1: There is no significant effect of resistance training in reducing pain among patients with knee osteoarthritis. To test this hypothesis, data collected at pre-test and post-test is presented in Table 2 and Figure 1. The average perception of pain for each of the participants at 0-week, 4-week, 8-week and 12-week were calculated to be 2.690 ± 0.679, 3.240 ± 0.761, 2.550 ± 0.683 and 2.080 ± 0.417 respectively.

Table 2: Perception to Pain Repeated Measures (ANOVA) Output

	Source	Type III Sum of Squares	DF	Mean Square	F	Sig.
Pain	Sphericity Assumed	13.684	3	4.561	36.743	.000
	Greenhouse-Geisser	13.684	2.728	5.016	36.743	.000
	Huynh-Feldt	13.684	3.000	4.561	36.743	.000
	Lower-bound	13.684	1.000	13.684	36.743	.000
Error (Pain)	Sphericity Assumed	7.076	57	.124		
	Greenhouse-Geisser	7.076	51.832	.137		
	Huynh-Feldt	7.076	57.000	.124		
	Lower-bound	7.076	19.000	.372		

The repeated measure analysis of variance (ANOVA) was carried out at 95% confidence level. The result revealed $F(3, 57) = 36.743$, $p < 0.05$ revealed that there is a significant effect in the perception of pain of the respondents over the course of resistance training. The *P*-value obtain was less than 0.05, this implies that there is a significant effects of resistance training on the average perception of pain of the respondent over the course of the training period. The Bonferroni pairwise comparison *post hoc* test was used to pinpoint the specific time interval(s)

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with perceptions that has significant effects from one another. The result revealed that the participants perceived a significant increase in pain from (2.690 ± 0.679) to (3.240 ± 0.761, $p < 0.05$) from week 0 to week 4, followed by a significant decrease in pain from (3.240 ± 0.761) to (2.550 ± 0.683, $p < 0.05$) week 4 to week 8 and subsequently a significant decrease of pain to (2.080 ± 0.417, $p = 0.01$).

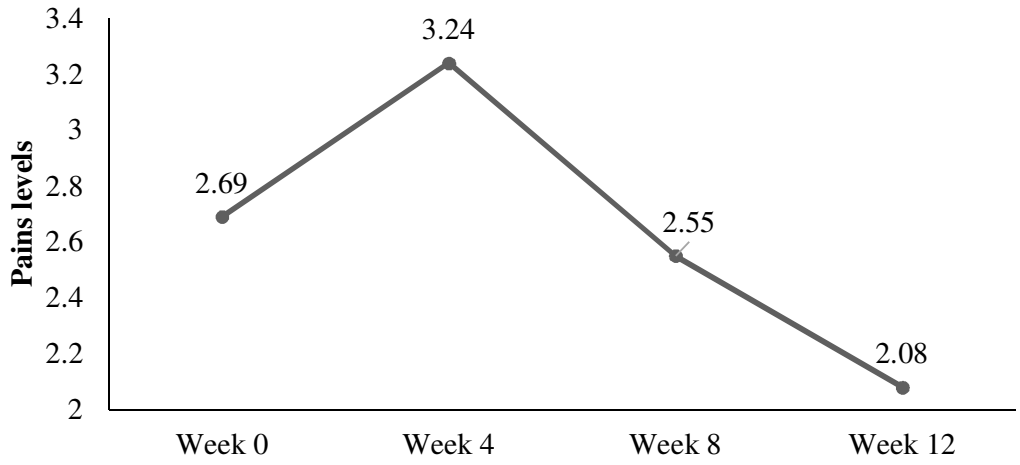

Figure 1: Pains levels vs training duration (per week) for pain reduction

Based on the research findings, the researcher rejects the null hypothesis which states that "there is no significant effect of resistance training in reducing pain among patients".

Test of Hypothesis 2: There is no significant effect of resistance training in improving functional ability among patients with knee osteoarthritis. To test this hypothesis, data collected at pre-test and post-test is presented in Table 3 and Figure 2. The average stiffness for each of the participants at 0-week, 4-week, 8-week and 12-week were calculated to be 2.950 ± 0.887, 3.3.75 ± 0.901, 2.750 ± 0.596 and 2.300 ± 0.251 respectively.

Table 3: Functional Ability (difficulty) Repeated Measure ANOVA Output

	Source	Type III Sum of Squares	DF	Mean Square	F	Sig.
Stiffness	Sphericity Assumed	11.959	3	3.986	19.797	.000
	Greenhouse-Geisser	11.959	2.354	5.079	19.797	.000
	Huynh-Feldt	11.959	2.709	4.415	19.797	.000
	Lower-bound	11.959	1.000	11.959	19.797	.000
Error (Stiffness)	Sphericity Assumed	11.478	57	.201		
	Greenhouse-Geisser	11.478	44.735	.257		
	Huynh-Feldt	11.478	51.467	.223		
	Lower-bound	11.478	19.000	.604		

A repeated measure of one-way analysis of variance test was carried out to test the null hypothesis that there is no significant effect of resistance training in improving functional ability (Difficulty in performing daily activities) of the participants over the course of the resistance training at a 95% confidence level, to test the sub hypotheses, the results of the test table returned a significant value of 0.000 (< 0.05). The *P* significance value obtained was less than 0.05 this implies that there is significant effect in the resistance training on the functional ability of the respondents over the course of the training period. The Bonferroni pairwise comparison *post hoc* test was used to identify the time intervals with stiffness that is significant effects from one another. The result revealed a significant increase in functional ability over the first 4 weeks (2.950 ± 0.887 to 3.375 ± 0.901, $p = 0.01$) this then decreased significantly to 2.750 ± 0.596 ($p = 0.01$) between week 4 to week 8 and further decreased to 2.300 ± 0.251 ($p = 0.05$).

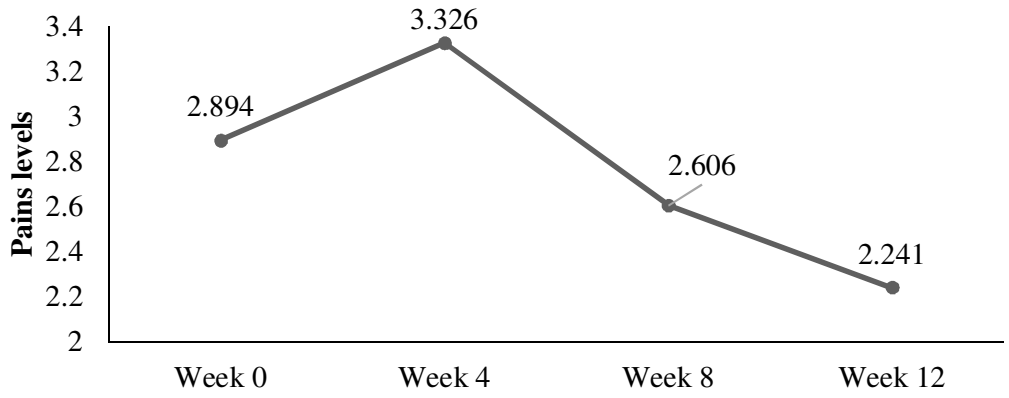

Figure 2: Pains levels vs training duration (per week) for functional ability (difficulty)

Based on the research findings, the researcher rejects the null hypothesis states that "there is no significant effect of resistance in improving functional ability (difficulty in performing daily activities) among patients with knee osteoarthritis at Federal Medical Centre, Yola - Nigeria" and conclude that resistance training does have a significant in improving functional ability among patients suffering from knee osteoarthritis at Federal Medical Centre, Yola – Nigeria.

Test of Hypothesis 3: There is no significant effect of resistance training in improving ROM among patients with knee osteoarthritis. To test this hypothesis, data collected at pre-test and post-test is presented in Table 4 and Figure 3. The average stiffness level for each of the participants at 0-week, 4-week, 8-week and 12-week were calculated to be 2.894 ± 0.760, 3.326 ± 0.762, 2.606 ± 0.609 and 2.241 ± 0.389 respectively.

Table 4: Range of Motion (Stiffness) Repeated Measures ANOVA Output

	Source	Type III Sum of Squares	DF	Mean Square	F	Sig.
Movability	Sphericity Assumed	12.632	3	4.211	46.521	.000
	Greenhouse-Geisser	12.632	2.490	5.072	46.521	.000
	Huynh-Feldt	12.632	2.896	4.362	46.521	.000
	Lower-bound	12.632	1.000	12.632	46.521	.000
Error (Movability)	Sphericity Assumed	5.159	57	.091		
	Greenhouse-Geisser	5.159	47.319	.109		
	Huynh-Feldt	5.159	55.022	.094		
	Lower-bound	5.159	19.000	.272		

A repeated measure one-way analysis of variance was carried out to test the null hypothesis that there is no significant effect in improving ROM (Stiffness) over the course of the resistance training programme, at a 95% confidence level. The result disclosed $F(3, 57) = 46.521$, $p < 0.05$ revealed that there is a significant effect in improving ROM (Stiffness) of the respondents. The *P*-value obtain was less than 0.05, this implies that there is a significant effects of resistance training on the average perception of (Stiffness) of the respondent over the course of the training period. In order to identify the time interval, pair(s) with stiffness that has significant effects from one another, the Bonferroni pairwise comparison *post hoc* test was employed. The result revealed that the

perceived improving ROM (Stiffness) increased significantly from 2.894 ± 0.760 to 3.326 ± 0.762 ($p = 0.01$) within week 0 to week 4. This then decreased to 2.606 ± 0.609 ($p < 0.05$) between week 4 to week 8 and then further decreased significantly to 2.241 ± 0.389 ($p < 0.05$).

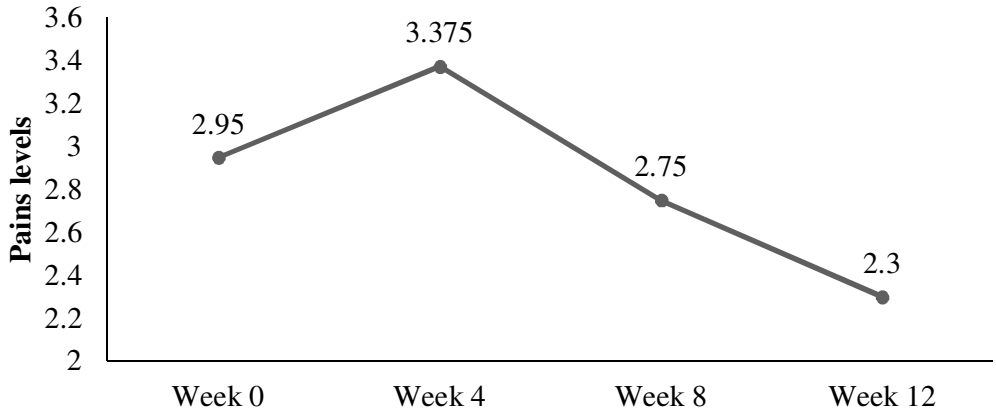

Figure 3: Pains levels vs training duration (per week) for range of motion (ROM)

Based on the research findings, the null hypothesis states that there is no significant effect of resistance training in improving ROM (Stiffness) among patients with knee osteoarthritis attending Federal Medical Centre, Yola, Nigeria was rejected and conclude that resistance training does have a significant effect in improving ROM among patients suffering from knee osteoarthritis at Federal Medical Centre, Yola, Nigeria.

DISCUSSION

This study was conducted on the assumption that knee osteoarthritis patients with pain, stiffness and difficulty in taking part in physical activities of daily living. Based on the above assumption, pain became a predictor of functional disability leading to reduced ROM and strength which lead to patients seeking medical attention. Porter (2013) stated that pain is the indirect consequence of cartilage damage and osteophyte formation stretching ligaments. A study by Bennell, Wrigley, Hunt, Lim, and Hinman (2013) assessed twice a week patients were trained for balance, fitness, co-ordination and muscle strength, result showed pain reduction after one year follow up. A similar study by Bennell, Hunt, Wrigley, Hunter, and Hinman (2007) assessing strength of hip adductors

shows reduction on knee-pain and function which support the outcome of this study which revealed pain reduction, improved function and range of motion after 16 weeks of exercise training. Both null hypotheses were rejected by the results of the present study: the aerobic, stretching and resistance training used in this study are found to reduce pain, joint tenderness and improve muscle strength.

According to Bardoloi, Bhutia, Bhatia, and Paul (2017) there was strong evidence for the benefit of isometric and isotonic exercises in relieving pain and improving functional status of patients, disability is a major medical consequence of knee osteoarthritis and impact of such disability is very high, and comorbidity is negativity associated with limitation in activities and pain. Pain was the most predictor of reduced functional ability and the higher the pain, the higher the disability because pain lead to avoidance of physical activity which causes muscle wasting (Creamer, Lethbridge-Cejku, & Hochberg, 2000). He further reported disability increases in the presence of knee-pain and there is a strong correlation between pain severity and disability. Pain lead to avoidance of physical activity resulting in inactivity and muscle wasting (Creamer *et al.*, 2000). Akinpelu *et al.* (2011) reported that factor associated with functional disability in knee osteoarthritis includes increasing age, obesity, female gender, comorbidity, quadriceps weakness and low educational status.

Akinpelu *et al.* (2011) also reported a finding in which overweight and obese with knee osteoarthritis underwent modest dietary weight loss and moderate exercise three (3) times in a week that brings about more improvement in functional ability than non- physical exercise intervention alone. Bellamy (2008) reported a study in which experimental group undergo manual and exercise therapy with control group undergoing ultrasound therapy, result shows improved WOMAC scores and walking distance after one (1) year follow up. Dallari, Stagni, Rani, Sabbioni, Pelotti, Torricelli, Tschon, and Giavaresi (2016) reported improved function and increased walking distance in six (6) minutes in control group, which underwent exercise therapy compared to placebo treatment of ultrasound therapy at sub-therapeutic intensity in experimental group and the above findings support the finding of the present study. The knees are particularly prone to osteoarthritis which are

assumed to be posture related and obesity has been said to predispose to knee osteoarthritis (Otieno, Moots, Oyoo, Meltzer, Price, Omar, Musau, Ibrahim-Sayo, Ogola, & Ilovi, 2017) though this study did not involve obese subject but exercise as an intervention earlier can be encourage in isolation or combination with other treatment. The result shows that exercises when combined maximize clinical outcomes and appears to be a safer intervention with relatively few contraindications. Hurley and Scott (1998) earlier reported that physical exercise can be associated with improvement in function with patients reporting reduction in disability from severe to moderate, and these changes are similar to those reported in drug trials studies which have significant impact on patient's personal independence and quality of life and can delay or even avoid need for surgical intervention. Another study reported by Abbott, Robertson, McKenzie, Baxter, Theis, and Campbell (2009) compared manual therapy with exercise therapy and the result was superior improvement in those undergoing manual therapy.

Another study evaluated effectiveness of exercise therapy in knee osteoarthritis compared with alternative programmes such as health education and the result emphasized the benefit of exercise therapy over alternative therapy (Hurley & Scott, 1998). According to Creamer *et al.* (2000) reduce in range of motion is attributed to capsular contracture and muscle spasm which shows significant reduction with exercise training which supported outcome of this study. He further stated that ROM to be significantly related to disability and disability is secondary to restricted ROM. The majority of patients with knee osteoarthritis were middle age, fifty (50) years and above and this supports the facts that osteoarthritis is regarded as disease of the middle age and old people (Carneiro, Ribeiro, Nascimento, Gobbo, Schoenfeld, Júnior, Gobbi, Oliveira, & Cyrino, 2015). Studies previously carried our related to osteoarthritis to be disease of the middle age and elderly with negative correlation between age and muscle strength due to decline in muscle function and less physical activity (Bellamy, 2008). Base on the above discussion, the present study supports the previous findings as most of the participants were middle age patients, exercise therapy cantered on quadriceps muscles which appear not to be optimal choice for all patients.

Bennell *et al.* (2007) reported that most researches on resistance training focused on quadriceps strengthening and little attention was paid to other muscles. This study incorporated both quadriceps and hamstrings. Bennell *et al.* (2007) reported greater number of women with compared to men and the present study is in agreement with the findings. The female to male ratio of 3:1 support the fact that hospital-based studies of knee osteoarthritis is more common among females and it is a reflection of what is obtained in the overall population which attributes it to women showing greater concern over the men. Therefore, this study showed significant improvement in functional ability and range of extension after eight (8) and twelve (12) weeks, and showed significant pain reduction after eight (8) and twelve (12) and increased range of motion after eight (8) weeks and twelve (12) weeks of participating in aerobic stretching and resistance training three (3) times in a week for twelve (12) weeks. The study is also in support of similar findings by Abbott *et al.* (2009) which studied the effect of manual therapy and exercise therapy using WOMAC in managing knee osteoarthritis. The finding of the study was also in agreement with Bennell, Egerton, Martin, Abbott, Metcalf, McManus, Sims, Pua, Wrigley, and Forbes (2014) who found reduction in pain and improvement in function following administration of aerobic and strengthening exercise training. In a study reported by Roddy, Zhang, Doherty, Arden, Barlow, Birrell, Carr, Chakravarty, Dickson, and Hay (2004) they shows that resistance training appears to be superior to aerobics in short term related outcomes, aerobics appears to be more effective in functional outcome over long term and the present study used both resistance and aerobics which shows improvement in less pain and better functional ability. Based on the findings of this study and previous studies, resistance training should be part of the management modalities of knee osteoarthritis patients.

CONCLUSION

Based on the results of the study, the researchers concluded that, knee pain is one of the predictors of reduced functional ability causing avoidance of movement and activities of daily living, functional ability is associated with increased in age, obesity, female gender and comorbidity, range of motion and functional disability are directly related and reflect a more severe form of disease outcome, the burden of knee osteoarthritis is

high in Nigeria and resistance training is effective modalities in the managements, resistance exercise improves condition of knee osteoarthritis patients if continue for at least 8-12 weeks. Finally, the results obtained in this study show that both aerobic, stretching and resistance training improve body function, reduces pain and increase ROM in knee osteoarthritis patients.

RECOMMENDATION

The researchers therefore recommendations that: The use of resistance training should be included in the management of knee osteoarthritis patients. Exercise Scientist and Physiotherapist should be monitoring achievement frequently so as to determine the actual modes and frequencies of exertion levels and loads. Future studies should address contraindications to resistance training and how best to deliver the intervention. Further research should consider longer duration of training and larger sample size.

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