EFFECT OF LOW-RESISTANCE TRAINING ON PERCENT BODY FAT OF YOUNG-OLDER MALE ADULTS IN SAMARU, ZARIA, NIGERIA

BY

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Abstract

The purpose of this study was to assess the effect of low-resistance training on percent body fat (%BF) of young-older male adults in Samaru, Zaria. A repeated-measures experimental research design was used for this study. Purposive sampling technique was used to select young-oldermale adults between the ages of 60 and 69 years, who volunteered to participate in this study. The training intensity was maintained between 25 and 45% of one repetition maximum (1RM) on percent body fat. The training programme had two sessions of low-resistance per week for a duration of 12 weeks. Stop watch, stadio meter, resistance machines and body composition analyser machine were used as instruments for this study. *The participants trained at 25% of 1RM from base-line to 4th week, at 35% of 1RM from 4th to 8th, and at 45% of 1RM from 8th to 12th week.* The *%BF* was assessed at base-line, at the end of 4th, 8th and 12th week of the training. *Descriptive statistics (mean, standard deviation and standard error) were calculated while repeated-measures analysis of variance and Scheffe's post-hoc test were used to analyse the data obtained* at 0.05 level of significance. *At the end of the 12 weeks training,* the major findings from the study showed significant decrease in %BF (p = 0.000), therefore, the null hypothesis was rejected. *The* Scheffe post-hoc test further showed significant means difference in the decreasing effect *on the* %BF (p = 0.000) between base-line and 4th week, 4th and 8th week, 8th and 12th week of training. *In conclusion, low-resistance training from 25-45% of 1RM reduced%BF of the young-older male adults. It was further recommended that* young-older *male adults should train more at low-resistance intensity between 25 and 45% of 1RM to reduce percent body fat.*

Key words: *Low-resistance, ageing, percent body fat, young-older adults, male, training.*

Introduction

Ageing is a biological process and has its own dynamics, which are beyond human control. Its definitions and categorizations differ from one society to another. In most developed countries of the world, chronological age is an indicator of old age, and the age of 60 years and above is considered the beginning of old age (The United Nations Department of Economic and Social Affairs Population Division(UNDESA), (2022). Chalise (2019) maintained that chronological age is the number of years an individual has lived while biological ageing involves the loss of cells over time and stressed further that with advancing biological ageing, tissues and organs are less likely to function efficiently, as the body's ability to repair itself slows down and the immune functions decline, making the body more prone to metabolic disorders and many other infections.

The World Health Organization (WHO, 2018) reported that older adults are generally defined according to a range of characteristics including: chronological age changes in social roles and functional capabilities. It stressed that older adults are the largest and fastest growing segments of the population, which present significant challenges to every nation's health care system. They are observed to present low functional capacities affecting the physical, physiological and psychological wellbeing of individuals of this age group. These changes are normal; however, exercise participation can help older adults adjust to and compensate for these changes (Chalise, 2019).

Gerontologists described old age as a stage at which functional, mental and physical capacities decline and that older people are more prone to metabolic disorders and disabilities (Chalise, 2019; McDonald, 2019; Dionigi, 2023). Conventionally, anyone who has reached the age of 60 years is regarded as the onset of an old person. In Nigeria society, someone who has reached the age of 50 years and above can be regarded as an old person (Akanbi, Fadayomi, Wusu, Tinuola, Olagunju, Gbadebo, Adebanke & Adekola, 2015). They have stressed that an old person showed functional characteristics include frailty, inactivity, loss of strength, sickness, gait problem and inability to sustain independent work. The UNDESA (2022) rather than lumping together all people who have been defined as old, have recognized the diversity of old age by defining sub-groups and distinguished the young-old as between 60 and 69 years, the middle-old as between 70 and 79 years, and the oldest-old as from 80 years and above. However, developing world often defines old age, not by years, but by new roles, loss of previous roles, or inability to make active contributions to the society (WHO, 2020a). Therefore, for the purpose of this study the researcher is of the opinion that 60 years and above was considered as old age. And therefore, using individuals between the ages of 60 and 69 years as young-older male adults.

Basically, ageing is the progressive decline in the function and performance of an individual with advancing years. It is the process of growing old, resulting in part from the failure of the body cells to function normally or to produce new body cells to replace those that are dead or malfunctioned (WHO, 2018; Chalise, 2019; McDonald, 2019).Ageing is, therefore, a complex process composed of several features that include an exponential increase in mortality; physiological changes that typically lead to a functional decline and the decline in physiological functions do always lead to poor gait, independent function and the manifestation of metabolic disorders (WHO, 2018; Chalise, 2019). According to the United Nations Department of Economic and Social Affairs (UNDESA, 2015), the proportion of older persons aged 60 years and above is 12.3% of the global population; and that by 2050, the proportion will rise to almost 22%. It was reported that sub-Saharan Africa is projected to see the absolute size of its older population grows by 2.3 times between 2000 and 2030 (UNDESA, 2015; Dixon, 2021).

Nigeria has the largest population in Africa, which is estimated at 200 million (Population Bureau, 2017). Nigeria ranks 24th globally among countries with the highest proportion of older persons and that by 2050, the number of people aged above 60 years is expected to increase to 25.5 million from the current 6.98 million (Mbah, 2016; National Council for Ageing, 2016; Population Bureau, 2017).The rising numbers of the older adults in Nigeria are among others factors attributed to the crude mortality rate that is gradually increasing (Adebowale, Atte, &Ayeni, 2012). Ageing in Nigeria is occurring against the background of socioeconomic hardship, widespread poverty, and the rapid transformation of the traditional extended family structure (Adebanjoko &Ugwuoke, 2014).

Body composition consists of fat and non-fat components. The fat component is called percent body fat or fat mass, while the non-fat component is termed lean body mass (Hoeger & Hoeger, 2007). Body composition has important implications for the health and functional capacity of the young-older male population. Muscle mass declines with age and is gradually replaced by fat mass. Excessive fat mass is associated with risk factors such as elevated plasma cholesterol, low density lipo-protein and very low density lipo-protein cholesterol. These are major precursors to high blood pressure, type 2 diabetes and cardiovascular disease. Visceral fat is body fat that is stored around several organs in the abdominal cavity including the liver, pancreas and intestines. The increase in fat mass (FM) distribution most specifically in the abdominal region causes metabolic disorders older persons. Higher amounts of visceral fat are associated with increased risk of various types of diseases including type 2 diabetes, insulin resistance and dyslipidemia(Anjana, Sandeep, Deepa, Vimaleswaran, Farooq & Mohan, 2004; Despres& Lemieux, 2006).

It is generally observed that ageing is associated with low functional abilities of various body systems and metabolic inefficiency, which lead to major reduction in health and physical fitness such as increase percent body fat. This is essential in the health and performance of daily activities ofyoung-older male adults in Samaru, Zaria, which help to maintain autonomy and their quality of life.It has also been observed that ageing is among the greatest known risk factors for most metabolic disorders in young-older male adults in Samaru community. In Nigeria, older adults' population (60 years and above) is estimated to increase from 9.4 million (5.1 million males and 4.3 million females) in 2020 to 11.5 million in 2025 and 26 million by 2050; that is 10% of the total Nigeria population (Tanyi, Andre, Mbah & Tong, 2018). This implies that in less than 37 years, the population of older adults in Nigeria will be more than or double the current population of some African countries. Nigeria is among countries with the highest proportion of older adults aged above 60 years, with almost all the older adults having at least a metabolic disorder and or multiple morbidities of health-related of physical fitness (Nwani & Isah, 2016). This significant change in the older adults' population requires an urgent approach in quality fitness services delivery to make the society more age-friendly. The researcher observed that young-older male adults in Samaru community are fall to sedentary lifestyles which exposed them to wellness risk factors and disorders that can be reversed with low intensity fitness programmes. Maintaining good health by older people is a thing of concern in Nigeria and there is increasing strain on the medical community to care for the ageing population. Every person in Nigeria has the opportunity to live long and healthy life. Yet, coping with access to health and social care services is a matter of serious concern to all. This raises concern on what the future holds for the older adults. By implication, Nigeria will face tremendous pressure to effectively manage its ageing population (Tanyi*et al.*, 2018).

The ageing process brings about many changes in body composition such as increase in percent body fat, percent visceral fat and loss of muscle mass(Haff& Triplett, 2016; Fragala*et al.*, 2019). As body fat accumulates within the abdominal region, it has implications for the health and functional capacity of the older population. Excessive fat mass is associated with risk factors such as elevated plasma cholesterol, plasma glucose, and resting blood pressure, which contribute to the development of type 2 diabetes, some forms of cancer, osteoarthritis and cardiovascular disease. Excess visceral fat can increase the risk for developing several life-threatening medical conditions such asheart attack and heart disease, type 2 diabetes, stroke, colorectal cancer (WHO, 2020b).

The purpose of this study was to assess the effect of LRT on percent body fat of young-older male adults in Samaru, Zaria, Nigeria. A research question and hypothesis was stated as follows:

Research Question: Would participation in LRT programme modify the percent body fat of young-older male adults in Samaru, Zaria, Nigeria?
Hypothesis: There is no significant effect of low-resistance training on percent body fat of young-older male adults in Samaru, Zaria, Nigeria.

Methodology
A repeated measures experimental research design was used for this study. Data was obtained using low-intensity resistance training among young-older male adults at base-line, and at the end of 4^{th}, 8^{th} and 12^{th} week of training. The percent body fat was assessed in the Human Performance and Fitness Laboratory, ABU, Zaria. A sample size of 16 young-older male adults who were residents in Samaru, Zaria, participated in the training. The researcher used purposive sampling technique in selecting the participants by identifying only young-older adults by gender (male) and age (60-69 years) residing in Samaru, Zaria. Furthermore, participants that volunteered for the training were informed of the purpose of the study, completed a physical activity readiness questionnaire (PAR-Q) to identify any medical conditions and current medication that could affect their ability to perform the required training and result, and further signed a written consent form. The

following machines were used for the 12-week training: seated chest press, pulldown, biceps curl, seated dip, leg press, seated leg extension, seated leg curl and total abdominal machine. A Body Composition Monitor and Scale(OMRONHBF-514, weight capacity of 0-150kg, made in China) – was used to assess percent body fat.

Body weight, BMI and percentage body fat were measured barefooted and in light clothes with bioelectrical impedance analysis using a body composition monitor and scale (OMRON HBF-514, China).The body composition variables were assessed by first inputting the personal data (age, gender and height) of the participant into the machine by the researcher. It was done one after the other by climb the sensor scale and also gripped the contact pads or sensor with the palms. When hands and feet were placed on the electrodes or plates and low doses of current passed through the body, the monitor then automatically analyzed the data and displayed the body weight (kg), BMI (kg/m^2,percent body fat (%) and other variables on the LED screen.

Training Protocols

Table 1: Alow-intensity resistance training protocols showing different intensity levels Low-Resistance Training Protocols

Week	Repetitions	Sets	Rest between sets	Rest between exercise stations	Intensity (% 1RM)
Base-line – 4	8 – 10	2	2 mins	2 mins	25
5 – 8	10 - 12	2	$1^1/_2$mins	2 mins	35
9 – 12	10 - 12	3	1 mins	2 mins	45

*Source: self-developed training programme**Set, (Repetition), Intensity, Rest interval between sets***

***2, 3 = Number of sets, (8-10) = Number of repetitions per set, 25%-45%of 1RM = Percentage intensity of One Repetition Maximum, 1min, $1^1/_2$ min & 2min = Time of resting interval in minutes between sets and 2 min rest between exercises, respectively.**

2 training sessions per week (nonconsecutive days). Before each session, warm up exercises was performed for 5 minutes. Training lasted for 45 minutes. Participants breathe out at the beginning of the movement and breathe in as they returned to the starting position.

The training protocol presented in the table 1 above showed the different intensities, sets, number of repetitions, resistance (intensity), rest interval between exercise stations and sets. The exercises were performed in the Human Performance & Fitness Laboratory of the Human Kinetics and Health Education department of ABU, Zaria, on 7 different exercise stations of resistance machines: seated chest press, leg pressseated dip, seated leg curls, pull down, leg extension and biceps curls, which are to be completed within 35 minutes. Using resistance machines is safer and easy because machines have variable resistance which require less time to set by quickly using a selector pin to change resistance. Static stretching exercises for the muscle groups such as triceps stretch, quadriceps stretch, side stretch, body rotation, knee-to-chest stretch, and back extension stretchwere performed during rest intervals of 2 minutes between exercises stations, before and after each training session. Each training session began with a 5-min warm-up and end with another 5-min cool-down using bike ergometer and very light resistance by completing a set of 5-10 repetitions of the exercises at a very low intensity of between 10% - 20% of 1RM.

Seven (7) resistance exercise stations were performed engaging muscle groups, with a focus on strengthening the upper-and lower-body muscles that are relevant for daily activities, which include seated leg press, seated chest press, seated leg curl, leg extension, pull down, biceps curl and seated dip. The training was structured according to recommendations of the American College of Sports Medicine and consisting of seven resistance exercises for each major muscle groups of the upper and lower limbs such as the chest, back, biceps, triceps, lower back, gluteus, quadriceps and hamstrings. The RT programme was structured based on current recommendations on the practice of RT for the older adults (Garber *et al.,* 2011, ACSM, 2020).The intensity for the training was determined by selecting a load equating to relatively 25%, 35% and 45% of their 1-RM progressively after every four weeks. The intensity was determined by calculating the percentage of one repetition maximum (% of 1RM) as follows: the low-intensity of 2 sets, 8-10 reps at 25% 1-RM max for the first 4 weeks, 2 sets of 10-12 reps at 35% in the second 4weeks and 3 sets of 10-12 reps at 45% for the last 4 weeks of the training(ACSM, 2020; Diogo, Henrique, Daniel and Mario, 2020).

As training progresses, resistance or load was gradually increased after every four weeks of training. These increments were within the range recommended by the ACSM in their relevant position stand on progression models in RT that have been used without adverseeffects in similar studies with older adults (Kraemer *et al.*, 2002). The incremental load increase first started with number of repetitions (8-10), then followed by10% 1RMincrease after every 4 weeks so that the initial training intensity was preserved throughout the 12-week training. The participants performed a total of 2 sets of 8-10 repetitions each at every exercise station, with a load corresponding to 25% of 1RM in the first 4 weeks of training. Then, the load was increased to 2 and 3 sets of 8-12 repetitions at 35% of 1RM for another 4 weeks and 45% of 1RM for the last 4 weeks, respectively.

Also, the participants pushed or pulled the same relative loads and completed the same amount of work progressively and were tested at different points (at base-line, at the end of 4^{th}, 8^{th} and 12^{th} week)of resistance training for comparison. The training sessions lasted 45 minutes for 2 alternate daysper week (Wednesday and Saturday).The resistance training exercises were performed in Human Performance and Fitness Laboratory, ABU, Zaria, between 8:00 am–10.00 noon. The low-intensity resistance training programme followed the principles of specificity, individualization, adaptation, and progression (ACSM, 2020; Fragala*et al.*, 2019; Ferraro *et al.*, 2019; Haff& Triplett, 2016). The resistance training exercises were arranged in an alternating order, working on the upper-body andlower body muscles such that while leg muscles were recovering the arms muscles were working. The sequence of the exercises were arranged in such a way that no two consecutive exercises involving same muscle groups follow each other i.e. alternating exercise for arms, legs, and between flexor and extensor muscle groups. The training also ensured muscular balance, that is, training of large muscles or multi-joints exercises first and synergists or single-joint exercises last. For example, leg press followed by seated leg curls or leg extension and chess press followed by biceps curls or seated dips. During the execution of movements, participants were instructed to breathe in during the eccentric phase and breathe out during the concentric phase using execution movement speed of a ratio 1:2 concentric/eccentric phases respectively.

The researchers assessed percent body fat at base-line and at the end of4th, 8th and 12th week. Young-older male adults in Samaru, Zaria of Kaduna state served as participants and were invited to Human Performance and Fitness Laboratory of the Department of Human Kinetics and Health Education, ABU, Zaria where the assessments and low-resistance training exercises were conducted.

The participants were fully informed about the experimental procedures and the purpose of the study. The researchers explained to the participants the details concerning the 12 weeks training. Measurements were taken on four different occasions: at base-line, and at the end of 4th, 8th and 12th week of resistance training. The researchers' roles were to make sure the exercises were performed correctly, in a safe manner and also to monitor the maintenance of the load and repetitions by the participants. The researchers were present and supervised all the training sessions. The participants were also not allowed to perform other exercise programme during the training period.

The researchers used the 10-RM test to estimate the 1-RM values for each of the exercise, as proposed by Haff and Triplett (2016); Tan, Wang and Lius (2015); Klerch (2021). This protocol was employed to gauge the maximal intensity (100%) of each exercise station. Thus, the values for the training intensity (25%, 35%, and 45% of 1-RM) were calculated and then used during the training sessions. A new evaluation was conducted at the end of 4th and 8th weeks of the training to estimate the appropriated % of 1-RM values of each participant.

The researchers allowed each participant to push or pull the weight that he could performed between 6-10 repetitions. The calculation of the 1RM was done based on the total number of reps pushed or pulled while using a moderate weight(Tan, Wang & Lius, 2015; Klerch, 2021). Prior to each test, the participants were asked to complete a 5 minutes' warm-up, which consisted of cycling on a bike ergometer and 6-10 repetitions of leg press and seated chest press machine with a very light weights. A two minutes' rest was allowed after the warm-up. Then 25% of 1RM was calculated and selected as the starting load for the participants. After four weeks of training, the participants' 1RM loads was recalculated again in order to determine their loads for the next four weeks and continuously. In the training, participants performed between 8 – 12repetitions per set during the training sessions at 25%, 35% and 45% of 1RM progressively. Safety protocols were also observed such as warm-up and cool-down procedures were held constant throughout all the training sessions. Physical distancing by spacing out the resistance machines 2 meters apart, washing of hands before and after each training sessions with soap and running water were also observed as part of safety measures.

The data obtained was analyzed using descriptive statistics of mean, standard deviation and standard error and inferential statistics using repeated-measures analysis of variance, because the same group of participants were measured at four points over time (at base line, immediately after the 4th, 8th and 12th week) of training. A Scheffe post-hoc test was used to further determine where the difference in the training effect occurred or was located. All analyses were performed using the Statistical Package for the Social Sciences (SPSS) version 21. Statistical level of significance was set at 0.05.

Results

Toans wer and the research question and test the stated null hypothesis, the result is presented accordingly.

Research question: Would participation in LRT programme modify the percent body fat of young-older male adults in Samaru, Zaria, Nigeria?

Table 2: Descriptive Analysis of the Effect of LRT on Percent Body Fat (%BF) of the Participants.

Variable	Week	N	Mean	Std. Deviation	Std. Error
Percent Body Fat (%BF)	Base-line	16	24.863	6.336	1.584
	4	16	23.625	6.169	1.542
	8	16	22.025	5.657	1.414
	12	16	20.781	5.352	1.338

Source: Test conducted in 2022 by the researcher

Table 2showed the percent body fat (%BF) at base-line, at the endof 4^{th,} 8th and 12th week of LRT among young-older male adults in Samaru, Zaria. The results of %BF of the participant sat base-line, at the end of 4th, 8th and 12th week of LRT revealed mean and standard deviations scores of 24.86±6.34%, 23.63 ±6.17%, 22.03 ±5.66% and 20.78±5.35%, respectively. The results showed a progressive decline in mean %BF of the participants after every four weeks of training; which answered research question one (1). In order to test whether the declined in %BF is statistical significant, the collected data was analyzed using Repeated-measures Analysis of Variance, the results was presented in Table 3.

Hypothesis

There is no significance effect of LRT on percent body fat of young-older male adults in Samaru, Zaria.

Table 3: Repeated-measures Analysis of Variance on Percent Body Fat of the participants

Source		Sum of squares	Df	Mean square	F	Sig.
%BF	Sphericity assumed	153.733	3	51.244	38.757	.000
	Greenhouse-Geisser	153.733	1.370	112.217	38.757	.000
	Huynh-Feldt	153.733	1.461	105.193	38.757	.000
	Lower-bound	153.733	1.000	153.733	38.757	.000
Error(%BF)	Sphericity assumed	59.500	45	1.322		
	Greenhouse-Geisser	59.500	20.549	2.895		
	Huynh-Feldt	59.500	21.922	2.714		
	Lower-bound	59.500	15.000	3.967		

Source: SPSS data analysis output(p = 0.05)

Table 3above showed the results of repeated-measures ANOVA on the %BF of the participants used in this study. The result showed that LRT caused significant reduction on %BF (p = 0.000) of the participants at the end of 4th, 8th and 12th week of training. Therefore, the null hypothesis which states that there is no significance effect of low-resistance training on percent body fat of young-older male adults in Samaru, Zaria was rejected.

To identify where the significant effect occurred, the Scheffe Post-hoc analysis was carried out and presented in Table 9.

Table 4:Summary of Scheffe's Post-hoc test Results for Differences in the Effect on the Percent Body Fat of the Participants

(I) week	(J) week	Mean Difference	Std. Error	Sig.^{b}	95% confidence interval for difference^{b} Lower Bound	Upper Bound
Base-line	Week4	1.238*	.234	.000	.739	1.736
	Week8	2.838*	.458	.000	1.862	3.813
	Week12	4.081*	.575	.000	2.855	6.308
Week4	Base-line	-1.238*	.234	.000	-1.736	-.739
	Week8	1.600*	.353	.000	.847	2.353
	Week12	2.844*	.470	.000	1.843	3.845
Week8	Base-line	-2.838*	.458	.000	-3.813	-1.862
	Week4	-1.600*	.353	.000	-2.353	-.847
	Week12	1.244*	.226	.000	.762	1.725
Week12	Base-line	-4.081*	.575	.000	-5.308	-2.855
	Week4	-2.844*	.470	.000	-3.845	-1.843
	Week8	-1.244*	.226	.000	-1.725	-.762

Source: SPSS data analysis output. *The mean difference is significant at the 0.05 alpha level.

The Scheffe's Post-hoc analysis on percent body fat of the participants in Table 4aboverevealed significant decreasein %BF (p = 0.000) with means reduction difference of -1.24*, -1.60* and -1.24* between base-line and 4thweek, 4th and 8th week, 8th and 12th week respectively. The result showed significant decreased at the end of every 4 weeks of training. The highest decreasing effect was between 4th and 8th week (-1.60*). Therefore, the null hypothesis was rejected.

Discussion

The purpose of this study was to assess the effect of LRT on percent body fat of young-older male adults in Samaru, Zaria. The result showed that LRT significantly decreased %BF of the participants at the end of 4th, 8th and 12th week of training. The significant decrease may be attributed to the increasedutilization of stored fat to provide energy (Lopez, Taaffe, Galvao, Newton, Nonemacher, Wendt *et al.*, 2022).

This finding was in line with an earlier study of Hunter, Wetzstein, Fields, Brown and Bamman (2002), who assessed the effect of low-moderate resistance training on fat distribution in 14 young-older male adults, aged 61 and above. They found decreased fat mass (FM) of 1.8 kg among the participants. The result was also similar to the findings of Shaw, Shaw and Mamen (2010); De Labra *et al.* (2015) and Martins*et al.* (2015),who found significant decrease in percent body fat after 12 weeks of LRT among young-older male adults.One of the outstanding benefits of low-resistance exercise,as it related to fat loss, is the positive impact of increasing energy expenditure during training and recovery (after-burn effect or excess post-exercise oxygen consumption), which increased resting metabolism (RMR). More energy is used after exercise to replenish depleted energy stored. As the muscle become metabolically active with LRT, more calories are burned even at rest with fat as the body's preferred energy source (Martins*et al.,*2015; El-Zayat, Sibali&Shamy, 2019).

Conclusion

On the basis of this results, it was concluded that low-resistance training at 25-45% of 1RM reduced percent body fat of the young-older male adults in Samaru, Zaria.

Recommendations

The researchers recommended that young-older male adults should participate in low-resistance training between 25 and 45 % of 1RM to reduce percent body fat.

The researchers further recommend the need to expose young-older male adultsto low-resistance training as a means of prevention and management of excess body fat (weight).

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