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Comparative Effects of Circuit Weight Training and Interval Weight Training on the Health-Related Physical Fitness Component of Jumpers

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ABSTRACT

This study compared the effects of circuit weight training and interval weight training programmes on jumpers' health and fitness-related components. The health-related physical fitness components are body composition, cardiovascular endurance fitness, flexibility, and muscular endurance as well as muscular strength. The age of the jumpers ranged from 18 to 21 years, with a mean of 17.9 years. A ten-week training and interval weight training programme was conducted on jumpers that were randomly selected into two experimental groups and a control group. The Analysis of Covariance (ANCOVA) served as the inferential statistics that the study utilised, while the Tukey Pairwise Comparison Test served as the post hoc analysis. The findings of the study revealed that the two training programmes elicited significant changes, but their training effects were not significantly different compared to the health-related physical fitness component of jumpers. It is therefore recommended that both training programmes be utilised by trainers and coaches for conditioning and enhancing the health-related physical fitness components of jumpers for high performance.

Keywords: Comparative Effects; Circuit Weight Training; Interval Training; Health-Related Fitness; Physical Fitness.

INTRODUCTION

Attaining peak performance in athletic prowess regarding rigorous participation in sports is not an easy fit to accomplish, for it comes with serious dedication on the part of the athletes and trainer, coupled with modern scientific dictates and compliance, as well as a combination of obedience to laid-down rules and regulations (Sharkey & Gaskill, 2006). Therefore, intoxicating as the urge to excel may be, excellent performance in sports is mostly attainable through adequate training techniques coupled with the athlete's intrinsic willingness and readiness to attain the status of a champion (Oboh, 2022; Adamson, 2017).

Different training methods exist in athletic programmes across the world, and all methods of training need to be specific to the individual athlete and their components of fitness and activity (Lloyd, et al., 2015). The types of methods of sports training are continuous training, which develops cardiovascular fitness;

fartlek (speed play), which develops a range of components; interval training, which develops strength and speed muscular endurance; weight training, which develops strength and muscular endurance; and plyometric training, which develops power, as well as flexibility training, which develops flexibility. Others are circuit training and specific training techniques at high altitudes as a form of aerobic training (Levine, 2002). Weight training as a method is not a new phenomenon to practitioners of different power sports.

It is readily apparent that weight training produces an increase in muscle mass and a high degree of strength and contributes beneficially to performance in many sports (Duke & Okon, E2022). Weight training is a common type of training for developing the strength and size of skeletal muscles. It uses the force of gravity in the form of weighted bars, dumbbells, or stumbling blocks to oppose the force generated by muscles through concentric contraction. Lander (2015); Fleck and Kraemer (2014), as cited by Oboh (2022). Weight training, which provides load and repetition, is an element that is being incorporated into conditioning and fitness training programmes. It represents a reasonable approach for men and women to improve muscular strength and endurance (Arvey, 1992). The basic weight training programme is structured around one of the recognised basic contractions, which include isotonic, isometric, and isokinetic programmes. Weight training has become an important part of the training and conditioning programme of many types of athletes for sports competitions and in developing and maintaining a satisfactory level of physical fitness (More, 2015; Goodman, 2016).

In viewing weight training not as a substitute but merely an adjunct, coaches now include weight training or pulley-weight exercise for strength and muscular endurance, running stamina training, and free-standing exercise for mobility as part of their athletic programme (Simon, 2019). The method of weight training includes a circuit training programme, a circuit weight training programme, a set weight training programme, and an interval training programme. In the jumping events (high, long, triple, and pole vault), muscular power, strength, and speed are very important components during training and performance (Johnson, 2020).

Oboh (2022) did a study on the comparative effects of circuit weight training and interval weight training on the skill-related physical fitness components of jumpers, but this present study is taking a look at the comparative effects of circuit weight training and interval weight training programmes on the health-related physical fitness components of jumpers (Udofia & Alexander, 2017). The health-related physical fitness components are body composition, cardiovascular fitness, flexibility, muscular endurance, and muscular strength. Possessing a moderate amount of health-related fitness is essential to disease prevention and health promotion for jumpers.

Circuit weight training is the performance of several repetitions using a moderate amount of weight in a continuous fashion, moving from one station to another with minimal rest between stations. Circuit weight training can illicit marked improvements in muscular strength and modest improvements in body composition and cardio-respiratory endurance (Morehouse, 2016). On the other

hand, interval weight training, which was developed by OShea in 1969, is an intense type of interval work utilising a combination of athletic lifts and aerobic exercise. Interval weight training requires trainees to perform one set at every station with a minute of rest after each station or exercise before proceeding to the next circuit or round for three circuits or rounds for three circuits (three non-consecutive sets per station for three circuits or rounds (O' Shea, 2015; Asira, 2022).

Oboh's (2022) research findings, which revealed that there is no significant difference between the effects of circuit weight training and interval weight training on the skill-related physical fitness components of jumpers, may put to rest the discrepancy and arguments among coaches, trainers, and jumpers about which of the two training programmes is a better training protocol for jumpers. Based on the aforementioned, this paper seeks to compare the same effects of a circuit weight training programme and an interval training programme, but this time on the health-related physical fitness components of jumpers, with a view to finding out if there will be any similarities and differences between skill-related and health-related components.

RESEARCH QUESTIONS

1. Is there any difference between the effects of circuit weight training and interval weight training programmes on jumpers' body composition?
2. Is there any difference between the effects of circuit weight training and interval weight training programmes on jumpers' cardiovascular fitness?
3. Is there any difference between the effects of circuit weight training and interval weight training programmes on jumpers' flexibility?
4. Is there any difference between the effects of circuit weight training and interval weight training programmes on jumpers' muscular endurance?
5. Is there any difference between the effects of circuit weight training and interval weight training programmes on jumpers' muscular strength?

HYPOTHESES

The following hypotheses were postulated to adequately address the problem of the study:

1. There would be no significant difference between the effects of circuit weight and interval weight training programmes on jumpers' body composition.
2. There would be no significant difference between the effects of circuit weight and interval weight training programmes on jumpers' Cardiovascular fitness.
3. There would be no significant difference between the effects of circuit weight and interval weight training programmes on jumpers' flexibility.
4. There would be no significant difference between the effects of circuit weight and interval weight training programmes on jumpers' muscular endurance.

5. There would be no significant difference between the effects of circuit weight and interval weight training programmes of jumpers' muscular strength.

METHODOLOGY

Research Design

The randomized control group pretest-posttest experimental design was used for this study.

Population of the Study

The population for this study were all male jumpers (long, high, and triple) attached to Delta State Sports commission as athletes and totaled 45.

The Sample and Sampling Techniques

This study utilized the systematic sampling technique. A sample size of thirty – six (36) male high, long and triple jumpers from Delta state sports commission were the sample size of the study. Their ages ranged between 18 to 21 with a mean of 20 years and a standard deviation of 0.6 years. The overall height of the jumpers ranged between 1.75 to 1.90 meters, with a mean height of 1.80 meters. The jumpers weight range between 60kg to 80kg, with a mean of 67.2kg. Twelve (12) jumpers in the experimental group 1 were assigned to circuit weight training, while twelve (12) others for experimental group 2 were assigned to interval weight training.

The control group was also assigned twelve (12) jumpers, and they were not subjected to any training protocol. Four (4) each of high, long and triple jumpers were randomly assigned to the two (2) experimental and control group, respectively.

Research Instrument

The following research instruments were utilized for the study:

- body mass index measurement
- 12 – minute run
- sit and reach test
- push – ups exercise
- squat exercise
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Validity of Research Instrument

The utilized research instrument was validated by experts in human kinetics and sports science, and have acquired universal acceptance and usage.

Reliability of research Instrument

In other to determine the reliability of the research instrument for e study, a pilot study was conducted on a sample size of twelve (12) male jumpers (4 each of high, long, and triple jump). They were randomly assigned to two (2) experimental groups and a control group. Pearson Moment Coefficient of

correlation statistics measured the acquired results through the test – retest pilot study, and a reliability coefficient of 0.71 was established.

Training Programme

A sequential training programme of ten (10) weeks of circuit weight and interval weight training programmes were performed for three (3) times a week (Monday, Wednesday, and Friday). The training programmes were mainly for the legs and only one for the arms. Experimental group 1 performed the circuit weight training programme, which consist of three (3) consecutive sets of six (6) stations circuits, with three (3) minutes rest between sets before proceeding to the next station. The second experimental group, performed the interval circuit weight training programme, which consist of three (3) non- consecutive sets with one (1) minute rest after each exercise / station with the same six (6) stations circuits.

The exercises and stations are as follows:

Stations	Exercise	Stations	Exercise
1.	Bench Press	4.	Split Jump
2.	Hamstring Curl	5.	Step Up
3.	Half Squat	6.	Heel Raise/lift

Order of data collection: Data for the study was carried out in two phases;

Phase 1: measurement of physical characteristics which include measurement (i) Height (ii) Weight (iii) Skinfold and body diameters. The instruments used were stadiometer, vertical height measurement, skinfold caliper, and Lange slide caliper.

Phase 2: Field measurement which include:

1. Body mass index
2. 12 minutes Run
3. Sit and Reach
4. Push-ups Exercise
5. Jump Squat Exercise

Oboh (2022) and Landers 2015 reported that the above field tests have been validated and researchers found their reliability co-efficient acceptable and recommended them for research usage.

Method of data Analysis

The inferential statistical analysis of Analysis of Covariance (ANCOVA) was utilized in analyzing the obtained data for the study, while Tukey Pairwise-comparison Test was the post-hoc analysis used to determine the specific treatment group(s) that significantly contributed to the rejection of the null hypothesis, hence the obtained difference.

FINDINGS AND DISCUSSIONS

Table 1: Analysis of Co-Variance (ANCOVA) for Jumpers Body Composition

Source	Sum of Squares	DF	Mean Square	F
Group	0.40	**2**	0.2	**20***
Error	0.62	33	0.01	
Total Residual	1.0235			
36 cases were processed: 24 exp, i.e. 12 for circuit weight training, 12 for interval weight training and 12 for the control group.				

The calculated F-ratio of **20** at the 0.05 level of significance is greater than the F-critical value of 3.30. This was found statistically significant, which indicates that there is significant difference between the effects of circuit weight training and interval weight training programmes on jumpers' body composition, but not comparatively. The null hypothesis of no significance was therefore rejected. Tukey Pairwise-Comparison Test was used as post-hoc analysis to further determine the sources of the significance.

Table 2: Summary of Tukey Pair-Comparisons Test Results for Jumpers' Body Composition

Means compared	Mean Differences	r	
$\overline{X}1 - X\,2 = 10.54 - 10.50 =$	4	<	3.1
$\overline{X}1 - X3 = 10.54 - 10.46 =$	8	>**3.1***	
$\overline{X}2 - X3 = 10.50 - 10.46 =$	4	>**3.1***	

*** Significant at 0.05 level: r = 3.1**

The results in table 2 show that the paired means representing groups 1 & 3 and 2 & 3 were significant at 0.05 level. The implication is that both circuit weight and interval weight training programmes had substantial training effects of jumpers' body composition.

Table 3: Analysis of Co-Variance (ANCOVA) for Jumpers' Cardiovascular Endurance

Source	Sum of Squares	DF	Mean Square	F
Group	8.6	2	43	**14***
Error	101.6	33	3.1	
Total Residual	110.2	35		
36 cases were processed: 24 exp, i.e. 12 for circuit weight training, 12 for interval weight training and 12 for the control group.				

***** Significant at 0.05 level.

The calculated F-ratio of 14 at the 0.05 level of significance is greater than the F-critical value of 3.30. This was found statistically significance, which indicates that there is significant difference between the effects of circuit weight training and interval weight training on jumpers' cardiovascular endurance, but not comparatively. The null hypothesis of no significance was therefore rejected. Turkey Pairwise-Comparison Test was used as a post-hoc analysis to further determine the source of the significance.

Table 4: Summary of Turkey Pair-Comparisons Test Results for Jumpers' Cardiovascular Endurance.

Means compared	**Mean Differences**		**r**
$\overline{X}1 - X\ 2 = 36.4 - 34.1 =$	2.3	<	4.0
$\overline{X}1 - X3 = 36.4 - 30.1 =$	6.3	>**4.0***	
$\overline{X}2 - X3 = 34.4 - 30.1 =$	4.3	>**4.0***	

*** Significant at 0.05 level: r = 4.0.**

The results in table 4 showed that the paired means representing circuit weight training and interval weight training programmes were responsible for the significant difference. This is an indication of their effectiveness in developing jumpers' cardiovascular endurance.

Table 5: Analysis of Co-Variance (ANCOVA) for Jumpers' Flexibility

Source	Sum of Squares	DF	Mean Square	F
Group	14.6	2	7.3	**13.03***
Error	18.7	33	0.56	
Total Residual	33.3	35		
36 cases were processed: 24 exp, i.e. 12 for circuit weight training, 12 for interval weight training and 12 for the control group.				

***Significant of 0.05 level** the calculated F-ratio of 13.03 at the 0.05 level of significance as shown in table 5 is greater than the F- critical of 3.30, and this was found to be significantly significant, thereby indicating substantial effects of circuit weight and interval weight training programmes training techniques on jumpers' flexibility, but not comparatively. The summary result for post-hoc analysis is presented in table 6.

Table 6: Summary of Turkey-Comparisons Test Results for Jumpers' Flexibility.

Means compared	Mean Differences		r
$\overline{X}1 - X\ 2 = 19.6 - 19.4 =$	0.2	<	0.3
$\overline{X}1 - X3 = 19.6 - 19.4 =$	0.6	>**0.3***	

$\overline{X}2 - X3 = 19.4 - 19.0 =$	0.4	>**0.3***

*** Significant at 0.05 level: r = 0.3**

As indicated in table 6, the paired means representing both experimented groups were responsible for the significant difference, which indicated their efficacy as useful tools for enhancing jumpers' Flexibility.

Table 7: Analysis of Co-Variance (ANCOVA) for Jumpers' Muscular Endurance

Source	Sum of Squares	DF	Mean Square	F
Group	20.2	2	10.1	**11.34***
Error	29.4	33	0.89	
Total Residual	49.6	35		
36 cases were processed: 24 exp, i.e. 12 for circuit weight training, 12 for interval weight training and 12 for the control group.				

***Significant at 0.05 level.**

The calculated F-ratio of 11.34 is greater than the F-critical value of 3.30 at the 0.05 level of significance. The null hypothesis was therefore rejected, indicating significant difference between the effects of circuit weight training and interval weight training programme on jumpers' muscular endurance, but not comparatively. The summary result for the post-hoc analysis is presented in table 8.

Table 8: Summary of Turkey Pairwise-Comparisons Test Results for Jumpers' Muscular Endurance

Means compared	Mean Differences		r
$\overline{X}1 - X\ 2 = 56.1 - 54.6 =$	1.5	<	3.9
$\overline{X}1 - X3 = 56.1 - 50.4 =$	5.7	>**3.9***	
$\overline{X}2 - X3 = 54.6 - 50.4 =$	4.2	>**3.9***	

***Significant at 0.05 level: r= 3.9**

As indicated in table 8, circuit weight training and interval weight training programmes had significant impact on jumpers' muscular endurance based on the compared means.

Table 9: Analysis of Co-Variance (ANCOVA) for jumpers' Muscular Strength

Source	Sum of Squares	DF	Mean Square	F
Group	2.67	2	1.34	**4.2***
Error	10.6	33	0.32	
Total Residual	12.73			
36 cases were processed: 24 exp, i.e. 12 for circuit weight training, 12 for interval weight				

training and 12 for the control group.

***Significant at 0.05 level of significant**

The calculated F-ratio of 4.2 at the 0.05 level of significant is greater than the F-critical value of 3.30. There was an indication that, there is significant difference between the effects of circuit weight training and interval weight training programmes on jumpers' speed of muscular strength, but not comparatively. The result of the post-hoc analysis is reflected in table 10 below.

Table 10: Summary of Turkey Pairwise- Comparisons Test Results for Jumpers' Muscular Strength

Means compared	Mean Differences		r
$\overline{X}1 - X\ 2 = 25.I - 21.4 =$	3.7	<	3.8
$\overline{X}1 - X3 = 25.1 - 17.56 =$	7.56	>	3.8
$\overline{X}2 - X3 = 21.4 - 17.56 =$	3.84	>	3.8

***Significant at 0.05 level: r = 3.8**

The above result reveals that both circuit weight training and interval weight training programmes significantly improved the jumpers' muscular strength.

DISCUSSION AND FINDINGS

Body Composition: The null hypothesis of no significant difference was rejected according to the analysis of co-variance results, therefore revealing that there is no difference between the effects of circuit weight and interval weight training programmes on jumpers' body composition (Body Mass Index), comparatively. This finding is in conformity with those of Morehouse (2016) and Wilmore (2017), who reported no significant effects in similar studies.

Cardiovascular Fitness: Analysis of the co-variance result reflected no significant difference between the effects of circuit weight and interval weight training programmes on jumpers' cardiovascular fitness, comparatively. The findings of this study tallied with those of Oboh (2022), Nobel (2017), and Smith (2018), who reported significant effects in athletes' cardiovascular fitness using almost the same parameters.

Flexibility: The result of the analysis of co-variance led to the rejection of the null hypothesis of no significant difference between the effects of circuit weight and interval weight training programmes on jumpers' flexibility, comparatively. This finding was collaborated with those of Luke (2019) and Miller (2016), when they conducted a similar study on sprinters.

Muscular Endurance: The Results of the Analysis of co-variance indicated that there was no significant difference between the effects of circuit weight and interval weight training programmes on jumpers' muscular endurance,

comparatively. The research findings of Adamson (2017) reported a similar result in a similar study.

Muscular Strength: There was no significant difference between the effects of circuit weight and interval weight training programmes on jumpers' muscular strength, comparatively, according to the analysis of co-variance results. Johnson (2020) agreed with the findings of this study in his own study.

RECOMMENDATIONS

The following recommendations were made as a result of the findings from this study:

1) For high performance, circuit weight training and interval weight training programmes should be used together.
2) Coaches and trainers who are not permitted to use weighted equipment should seek alternative means (plyometrics).
3) Weight equipment should not be used by children under the age of 13.
4) This study recommends using throwers for further studies.

CONCLUSION

Collectively and individually, circuit weight and interval weight training programmes had training effects on jumpers' body composition, cardiovascular fitness, flexibility, muscular endurance, and muscular strength, but there was no significant difference between them comparatively. Both weight training programmes were found to be very useful in conditioning and maintaining jumpers' health-related physical fitness programmes, which are needed to maintain the status quo.

High performance in athletic training cannot be accomplished when the necessary expertise, training facilities, and equipment are lacking. Even when the needed facilities and equipment are on hand, without developing the skills and health-related physical fitness of athletes, the expected performance will be a mirage. Therefore, it is expected that for high performance in explosive sports apart from jumpers, circuit weight and interval weight training programmes should be introduced and utilised collectively.

REFERENCES

Adamson, C.T. (2017). *Circuit training*. London: Bell and Sons.

Arvey, R. D., Landon, T. E., Nutting, S. M., & Maxwell, S. E. (1992). Development of physical ability tests for police officers: a construct validation approach. *Journal of Applied Psychology*, *77*(6), 996.

Asira, A. E. (2022). Nigeria's Millennium Development Goals Policy Initiatives: Performance and Future Prospects. *Alkebulan: A Journal of West and East African Studies*, *1*(1), 20–30.

Duke, E. O., & Okon, E. J. (2022). Biomedical Ethics: Organ Donation and Its Religo-Cultural Perspectives - A Nigerian Experience. *Alkebulan: A Journal of West and East African Studies*, *1*(2), 21–34.

Fleck, S. J. & Kraemer, W. J. (2014) *Designing resistance training programme*. (4th ed.) Leeds: Human Kinetics.

Goodman, T. J. (2016). *Effective endurance training for power sports: A preliminary trainer*. London: Freeman Publishers.

Hunter, J. P. & Marshall, R. N. (2017). Effects of power and flexibility training on vertical jump technique. *Medicine and Science in Sports and Exercise 35*(4): 460-468.

Jenken, C. R. (2016). *Scientific basis of athletic conditioning*. Philadelphia: Lea and John Smith.

Johnson, H. (2020*). The efficacy of fitness programmes on athletic programmes*. Kelsey Media Ltd.

Landers, B. C. (2015). *Recovery fast after aerobic training exercise: The role of the* Febiger

Levine, B. D. (2002). Intermittent hypoxic training: fact and fancy. *High altitude medicine & biology*, *3*(2), 177-193.

Lloyd, R. S., Oliver, J. L., Faigenbaum, A. D., Howard, R., Croix, M. B. D. S., Williams, C. A., ... & Myer, G. D. (2015). Long-term athletic development-part 1: a pathway for all youth. *The Journal of Strength & Conditioning Research*, *29*(5), 1439-1450.

Luke, G. (2019*). Work your entire body with the dumbbell workout: Men's fitness view*. NJ: Kinetics Books.

Miller, L. (2016). *Advanced inline skating*. McGraw Hill.

More, C. (2015). *Anaerobic fitness exercise for power athletics events*. Hunter Press.

Morehouse, L. E. (2016). Principles of weight training in weight training in sports and physical education. *The American Association for Health and physical education, and Recreation, 50*(7):4 –65.

Nobel, S. (2017). Voluntary strength and fatigue. *J. Physiol. 300*(333): 874-890.

O'Shea, P. (2015). *Principles and Measurement of Circuit weight training*. Frank Publishers .

Oboh, P. O. (2022). Comparative effects of circuit weight and interval weight raining on the skill-related physical fitness of jumpers. *University of Delta Journal of Contemporary Studies in Education (UDJCSE*) December.

Sharkey, B. J., & Gaskill, S. E. (2006). *Sport physiology for coaches* (Vol. 10). Human Kinetics.

Smith, P. (2018). *Main benefits of weight training in the gym*. Human Kinetics Books.

Udofia, D., & Alexander, C. (2017). Leadership in the Health Sector: A Discourse of the Leadesrhip Model of Utilitarianism. *Journal of Health Ethics*, *13*(1), 6.

Wilmore, J. H. (2016). *Physical conditioning with weight training for fitness*. Prentice Hall.