



Original Article

Increasing arm muscle strength and power with dumbbell exercise variations

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ABSTRACT

The problem of this research is the less exercise to increase the strength and power of the arm muscles. This research aims to determine the effect of dumbbell exercises on the strength and power of the arm muscles by involving 40 members of the Student Activity Unit named UNDIKMA Badminton. The research applied a quantitative approach, particularly a quasi-experimental (Non-equivalent Control Group Design) as the research design. It investigated the measurement of arm muscle strength through an expanding dynamometer and arm muscle power using a two-hand medicine ball put. The research result indicates a significant improvement in calculating paired T-Test for the arm muscle strength variables comprising groups 1, 2, and 3, and the sig. < 0.05. However, the result of group 4 shows sig. > 0.05, it indicates insignificant refinement. The results of the variable power involving groups 1, 2, and 3 indicate that the calculation of the paired T-Test obtained sig. < 0.05. It means a significant improvement. Meanwhile, the result of group 4 indicates the sig. > 0.05. It is assumed to be an insignificant advancement. Thus, the exercise comprising groups 1, 2, and 3 significantly improves arm muscle strength and power, but the control group or group 4 indicate an insignificant improvement.

Keywords: The Effect of Exercise, Arm Muscle Strength, Arm Muscle Power

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INTRODUCTION

Sports pedagogy is described in the sports science section and is closely related to education. Sports pedagogy is a discipline of sports science owning the potency to integrate other sports science sub-disciplines to underlie all practices in the field of sports showing the intent and purpose of educating (Mutohir, 2011; cited in [Soemardiawan, 2018](#)). Sport pedagogy is a part of sports science, a relatively young sub-discipline in Indonesia. Sports pedagogy is often associated

with various terms such as physical activity, sport education, movement education, or physical education.

Sport is a way to maintain physical fitness to keep the body in good condition. Sport plays an important role in everyday human life. In modern life, almost all humans cannot be separated from sports activities to get achievements or maintain body condition to stay fit and healthy. As stated in the Law of the Republic of Indonesia Number 3 of 2005 concerning the National Sports System, paragraph 4 of Article 1 Chapter 1 states that sport is all activities carried out systematically to encourage, foster and develop physical, spiritual and social potency.

Some literature state that campuses as educational institutions provide extracurricular programs or what is commonly called Student Activity Units to improve student abilities and achievements according to their fields, interests and talents. The activities of Student Activity Units are students' activities carried out outside class or outside campus. This Student Activity Unit is part of student organizations such as the Student Senate and Student Executive Board position at the study program, department, or university level.

In sports coaching, there must be training activities. Exercise has an essential role in improving ability and performance in sports activities. Moreover, [Soemardiawan \(2017\)](#) states that training prepares athletes for their highest performance. Similarly, Roesdiyanto and Budiyaniti (2008; cited in [Soemardiawan, 2017](#)) argue that long training gradually increases humans physiologically and psychologically. Similarly, [Daulay et al. \(2019\)](#) argue that training is the process of preparing athletes to improve their higher performance than before. According to [Jonathan \(2018\)](#), simple training can be formulated, and training is defined as all power and effort to improve the overall physical condition with a systematic and repetitive process with increasing load, time or intensity.

Physical condition is a crucial element and forms the foundation for developing techniques, tactics, strategies, and mental development ([Bafirman, 2019](#)). Meanwhile, [Sidik, Zafar, and Pesurnay & Afari \(2019\)](#) express that the physical condition is a unified whole of components that cannot be separated,

whether improving or maintaining the components of the physical condition. In physical condition, components consist of muscle endurance, general endurance, muscle strength, speed, flexibility, agility, coordination and balance. All existing components should develop physical conditions, and in carrying it out, there should be a priority to determine which components must receive greater training according to the practised sport ([Ghon Lisdiantoro, 2021](#)). Moreover, [Faridhatunnisa & Pratama \(2019\)](#) argue that a person should be able to maximize his abilities and physical components according to the needs of the sport he participates in to achieve a sporting achievement. The components of the physical condition consist of strength, speed, flexibility, agility, endurance, explosiveness, accuracy and reaction.

Besides, a player should have excellent body condition to support all aspects to achieve high performance in badminton. The branch of badminton sports has the nature of a competitive sport requiring the champion's physical, technical, tactical, mental, and maturity readiness. According to [Purnama \(2016\)](#), a badminton player should develop physical components, i.e.: (a) agility, (b) local muscle endurance, (c) strength, (d) speed, (e) cardiovascular endurance, (f) power (g) flexibility, (h) speed, and (i) body composition (to be ideal). In addition, [Anang \(2020\)](#) expresses that basic techniques are crucial to make the game more interesting. Basic techniques are the main foundation mastered by athletes to avoid injury. Moreover, the basic technique is the main key in a game.

Some literature discusses that the physical components of strength and power are essential in badminton. It needs proper training to improve these components. In line with the concepts, in this study, the physical components of strength and power focused on the arm muscles. Ability or physical component as the dependent variable and the effect were examined through treatment using training from several existing sources and related to increasing physical components using the weight training method. According to [Andi \(2018\)](#), power is the ability of the muscles to exert maximum strength in a very fast time. Power depends on two interrelated factors, i.e., the muscles' strength and speed to contract in physical activity. Therefore, power is crucial in any sport with much physical activity.

According to Baechle (n.d.), weight training (weight training) is exercises performed against obstacles or resistance to improve the work quality of the trained muscles in someone practising to improve fitness. Similarly, [Fikriansyah et al. \(2020\)](#) express that weight training is resistance training using weights to improve physical conditions, including physical fitness and general health. If someone conducts weight training regularly and regularly, various body systems will change positively. Moreover, the muscles will become stronger, carry greater work, and show reduced fatigue with an increasing training period ([Chan, 2012](#)). Weight training can be similar to lifting weights, where weights are a training aid that aims to train strength. In this study, the types of weight training applied were dumbbell bicep curls, dumbbell fly and shoulder presses.

The sports problems at Mandalika Education University show that the Badminton Student Activity Unit members have never received the physical training needed to play badminton, especially arm exercises. The Badminton Student Activity Unit members only carry out basic technical training. Meanwhile, the members participating in Badminton Student Activity Unit need physical training to support their physical needs, especially arm strength and power.

METHOD

This study implemented a quantitative approach with experimental methods, and this type of pseudo-research is called Quasi Experiment. According to [Ali \(2020\)](#), experimental research is a method that is carried out with strict monitoring to obtain a causal relationship between one variable and another variable. Besides, this study applied the research design of a Non-equivalent Control Group Design. The research design was carried out by treating the experimental group and providing a control group as a comparison ([Sugiyono, 2017](#)).

The research instrument employed in this study is to adjust the dependent variable, i.e., 1) Arm Strength Instrument, Arm strength test instrument in this study, namely the tensile test using an expanding dynamometer, 2) Arm Power Instrument, Arm power test instrument in the study this is a two hand medicine

ball put. The population of this study were all students studying at UNDIKMA participating in the Badminton Student Activity Unit consisting of 120 college students. The sample grouping technique of this study applied ordinal pairing, and the number of samples in this study was 40 college students.

This study's first data collection technique was simple observation conducted by selecting the research sample. Having determined the research sample, the preliminary test (pre-test) was carried out to examine the strength and power of the arm muscles. The results of the pre-test were recorded and used as preliminary data. Afterwards, the treatment was conducted for 6 weeks, and the training was carried out 3 times a week, so the whole treatment was conducted for 18 meetings.

Having conducted the treatment, then the final test (post-test) examining the dependent variable, was conducted similar to the preliminary test (pre-test). The data analysis of this study employed assistance from the Microsoft Excel application program and IBM SPSS statistics version 21. Several data analysis techniques were applied, i.e.: 1) descriptive statistics, 2) data requirements test (normality test and homogeneity test), 3) analysis of differences (MANOVA test and like sample test).

RESULTS AND DISCUSSION

Results

The data obtained from the test present the results of increasing the strength and power of the arm muscles using the dumbbell training method. The results of the study are illustrated as follows:

Table 1.
Pre-test and Post-test Results of Arm Strength and Power

	<i>Strength</i>		<i>Power</i>	
	<i>Pre-test</i>	<i>Post-test</i>	<i>Pre-test</i>	<i>Post-test</i>
<i>N</i>	40	40	40	40
<i>Mean</i>	33.025	36.862	182.689	220.622
<i>Median</i>	33	37	177.012	210.844
<i>Std. Deviation</i>	5.907	6.131	38.122	51.875
<i>Minimum</i>	20	25	123.407	123.975
<i>Maximum</i>	44	50	294	324.413

The data of Table 1 described that the pre-test average on the strength variable is 33,025, the median is 33, the standard deviation is 5,907, the minimum value is 20, and the maximum value is 44. However, the average post-test is 36,862, the median is 37, the standard deviation is 6,131, the minimum value is 25, and the maximum value is 50. Meanwhile, the pre-test average on the power variable is 182,689, with a median value of 177,012, a standard deviation of 38,122, and a minimum value of 123,407 and the maximum value of 294. Meanwhile, the average post-test is 220,622; the mean value is 210,844; the standard deviation is 51,875; the minimum value is 123,975; and the maximum value is 324,413.

Table 2.
Normality Test Results

Normality Test				
Variable and Test		Sig	Ket	Status
Arm Muscle Strength	Pretest	0.785	P > 0.05	Normal
	Posttest	0.106	P > 0.05	Normal
Arm muscle power	Pretest	0.132	P > 0.05	Normal
	Posttest	0.216	P > 0.05	Normal

The data of table 2 presents the acquisition of data for the two dependent variables, i.e., arm muscle strength and arm muscle power. It means that the data is normally distributed. It is based on the significant value of each data indicating a significant level or (p) > 0.05. Thus, it is assumed that the data taken from the population is normally distributed.

Table 3. Homogeneity Test Results

Test of Homogeneity of Variances				
Variable and Test		Sig	Ket	Status
Arm Muscle Strength	Pretest	0.268	P > 0.05	Homogen
	Posttest	0.545	P > 0.05	Homogen
Arm muscle power	Pretest	0.731	P > 0.05	Homogen
	Posttest	0.935	P > 0.05	Homogen

The data of Table 3 illustrates the acquisition of data for the two dependent variables, i.e., arm muscle strength and arm muscle power, owning a homogeneous variant. It is based on the significant value of each data indicating a

significant level or $(p) > 0.05$. Therefore, it is concluded that the variance in each group is homogeneous.

Table 4.
 Test Results of Different Average Paired Samples of Arm Muscle Strength
 (Paired T-Test)

Kekuatan Otot Lengan	Sig. (2-tailed)	Keterangan
Kel 1	0.000	Signifikan
Kel 2	0.000	Signifikan
Kel 3	0.000	Signifikan
Kel 4	0.052	Tidak Signifikan

The data in Table 4 explain the calculation of the paired T-Test for the variable power comprising groups 1, 2, and 3. The results are $\text{sig} < 0.05$, so it is assumed significant enhancement. However, for group 4, the results were $\text{sig} > 0.05$. It means that there is no significant improvement.

Table 5.
 Test Results of Different Average Paired Samples of Arm Muscle Power
 (Paired T-Test)

Power Otot Lengan	Sig. (2-tailed)	Keterangan
Kel 1	0.001	Signifikan
Kel 2	0.000	Signifikan
Kel 3	0.000	Signifikan
Kel 4	0.128	Tidak Signifikan

The data illustrated in Table 5 show the calculation of the paired T-Test for the variable power involving groups 1, 2 and 3. The results are $\text{sig} < 0.05$. It means that there is a significant improvement. However, for group 4, the results were $\text{sig} > 0.05$. It is declared insignificant enhancement.

Discussion

This discussion illustrates the matters discussed and explained after collecting the data, i.e., a) Why is there an effect of Dumbbell Bicep Curl training on increasing the strength and power of the arm muscles? b) Why is there an effect of the Dumbbell Fly exercise on enhancing the strength and power of the arm muscles, c) Why is there an effect of the Shoulder Press exercise on enhancing the strength and power of the arm muscles? and d) Why is there an influence between Dumbbell Bicep Curl, Dumbbell Fly, and Shoulder Press exercises on increasing the strength and power of the arm muscles?

This discussion elaborates on the achievement value of Student Activity Unit members' strength and power ability before and after carrying out treatment

using variations of dumbbell exercises significantly increase. For group 1, the strength improvement is 21%, and the power is 19%. For group 2, the refinement is 11%, and the power is 35%. Concerning group 3, the improvement is 13%, and the power is 29%. The findings show that variations of dumbbell exercises can enhance the strength and power of the arm muscles.

The results are in line with the research conducted by [Hidayat et al. \(2019\)](#) investigating The Effect of Dumbbell Curl and Shoulder Press Training on Increasing Arm Muscle Power and Arm Muscle Strength. It has been published in Ainara Journal (Journal of Research and Community Service of Education). The results of this study recommend that shoulder press exercises are more effective for increasing arm power than dumbbell curl exercises. Similarly, research carried out by [Reiser et al. \(2017\)](#) explored The Electromyography of Dumbbell Fly Exercise Using Different Planes and Labile Surfaces. It has been published in the Journal of Exercise Physiology Online. The study results show that the dumbbell fly exercise is effective for rehabilitation or strength-strengthening. In a similar vein, the research conducted by [Ilhami \(2020\)](#) examined The Effect of Bicep Curl and Side Lateral Raise Exercises on Arm Muscle Power. It has been published in the UNESA Student Journal. The study's results propose that the side lateral raise exercise increases arm muscle power more than the bicep curl exercise. Moreover, Alfasyal et al. (n.d.) conducted a study in 2016 investigating The Effect of Dumbbell Fly Practice on Arms and Shoulders Muscle at the PELTI DUMAI TENNIS Team. It has been published in the Student Online Journal of the Faculty of Teaching and Education, University of Riau (JOM FKIP UNRI). The results of the research state that the dumbbell-fly exercise can increase the strength of the arm and shoulder muscles.

CONCLUSION

This research requires further research regarding Dumbbell Bicep Curl, Dumbbell Fly, and Shoulder Press exercises with different sample conditions and populations. As in other sports requiring arm muscle strength and power, it can be applied sports athletes in club associations or sports organizations. For trainers in preparing training programs, they must pay attention to athletes' abilities so that

athletes can carry out the training program effectively. The Dumbbell Bicep Curl, Dumbbell Fly, and Shoulder Press training methods can be recommended and applied in school extracurricular training programs to increase arm muscle strength and power.

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