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# The Effect of Combined Method Training Circuit Training Plyometric on Power and Strength

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**ABSTRACT**

***Objectives:*** *The circuit training plyometric and 2 variable bound (power and strength) methods have not been combined much in research. This research tries to combine them to improve the quality of professional futsal athletes.* ***Method:*** *This research design uses research design matching only design. This type of research uses quasi experiments. The population in this research are professional futsal athletes in Madiun City, numbering 100 people. Meanwhile, the sample used is totalling 30 people. This research is limited only to manifold samples_sex the man who has an age between 18 and 20 years. Samples are divided into 2 groups, namely group experiment plyometric and group circuit training control. The variables of this research consist of from 1 variable free (circuit training plyometric) and 2 variables bound (power and strength). The instrument test in this research used a vertical jump test and leg dynamometer. Data collection techniques were carried out first in a way carry out normality tests and homogeneity tests. Data analysis techniques were carried out using formula mean, standard deviation, variance, percentage increase, paired sample t-test, one-way test anova, and post hoc comparison.* ***Results:*** *There is a difference in power before and after giving combined method training circuit training plyometric. So you can conclude that This combined method of circuit training plyometric is a method of proper exercise_ used to improve ability motor power. Then, for variable strength, it concluded that There is a difference in strength before and after giving combined method training circuit training plyometric. So you can conclude that This combined method of circuit training plyometric is a method of proper exercise to improve ability motor strength.* ***Novelty****: The novelty in this research is combining the circuit training plyometric and 2 variable bounds (power and strength).*

## INTRODUCTION

According to (Undang-Undang (UU) Nomor 11 Tahun 2022 Tentang Keolahragaan, 2022) sport shared into 3 rooms scope, i.e., sport education, sports society, and sports performance. Segmentation of sports achievement is so Much favoured by some in society, both in Indonesia and other parts of the world. To grab achievements, of course, regular and systematic training is necessary.

According to Bompa in (Budiwanto, 2012) mention that exercise is interpreted as something activity sport being done for a long duration and carried out in a way systematic and ability that can improve in a way gradually to use give function psychological and physiological. The principle exercise proposed by (Ambakrumi, 2007; Maroto-Izquierdo et al., 2023) says that exercise must have principle overload, that is, loading excessively to use stimulating ability muscle in accepting excess voltage his habit accept. Research conducted by (Soriano et al., 2017) with the research theme "The Optimal Load for Maximal Power Production During Upper-Body Resistance Exercises: A Meta-Analysis" states that burden currently from >30% to <70 % of One repetition maximum

(1RM) appears to provide range optimal load to produce peak power during exercise bench press.

Exercise truly must consider and program athletes according to level, potential Field (Ketelhut & Ketelhut, 2020), ability Field (Sun, 2023), specialisation sports, and characteristics of athlete (Zhang, 2023). A coach must be capable of analysing the character of a good athlete's physiological and psychological field (Nicholls, 2021; Pérez, 2016; Rocha et al., 2019), which makes it easier for the trainer to complete the training program created by Coach (T. O. Bompa & Haff, 2017). Exercise must vary with the aim to overcome something monotonous and boredom_in exercise (T. Bompa & Buzzichelli, 2015; Kalra et al., 2023; Lieberman, 2015; Palermo & Rancourt, 2023). Practice method *plyometrics* was introduced for the first time in the United States in the early 1970s, it served as a phenomenon training revolutionary by Holcomb, Kleiner, and Chu in the (Hansen & Kennelly, 2017). In the world of sports right now, practice plyometrics is the principal training Power explosive for athletes of all ages and abilities (Booth & Orr, 2016; Chomani et al., 2021; Firmansyah et al., 2024; Söhnlein et al., 2014). Several researcher has shown that the method exercises *plyometrics* when combined with an exercise program strength intermittent capable impact on i.e. improvement acceleration i.e. (Booth & Orr, 2016; Krakan et al., 2020), jump vertical (Barrio et al., 2023; Makaruk et al., 2020), leg strength, strength muscles (Dallas et al., 2020, 2023), awareness joints (Sugisaki et al., 2013), and proprioceptors in a way whole. Therefore, researchers try to combine method exercise circuit training with methods exercise given plyometrics name as circuit training plyometric (CTP ) will used to improve the ability, *power* and *strength* of athletes (Booth & Orr, 2016; Ismail et al., 2010; Sidik & Rosdiana, 2023).

## RESEARCH METHOD

The research approach used in this research is quantitative, grounded research approach yourself in numbers and in ways think interpretive (Maksum, 2012). This type of research uses quasi-experiment or experiment pseudo. This research design uses research design matching only design. The variables of this research consist of 1 variable free (circuit training plyometric) and 2 variables bound (power and strength). The population in this research are professional futsal athletes in Madiun City, numbering 100 people; meanwhile sample used totals 30 people. This research is only specifically for various types of samples, sex men with age between 18-20 years. Samples are divided into 2 groups: group experiment plyometric and group circuit training control. The research instrument used a vertical jump test and a leg dynamometer by (Mackenzie, 2015). Data collection techniques were carried out first to carry out normality and homogeneity tests. Data analysis techniques used formula mean, standard deviation, variance, percentage increase, paired sample t-test, one-way ANOVA test, and post hoc comparison (Maksum, 2012). All of the above tests were done by analysis using software IBM SPSS computer.

## RESULTS AND DISCUSSION

### Results

Results and Discussion from this research will displayed in later data form and will narrated according to the data displayed in the form table.

***Descriptive Variable Power***

*Group Circuit Training Plyometric (CTP)*

**Table 1.** Descriptive Statistics CTP Variable Power (Joule)

| | N | Minimum | Maximum | Mean | | Std. Deviation | Variance |
|---|---|---|---|---|---|---|---|
| | Statistics | Statistics | Statistics | Statistics | Std. Error | Statistics | Statistics |
| *PreTest_Power _ Joule_CTP* | 15 | 257.83 | 392.00 | 310.4200 | 8.29184 | 32.11415 | 1031.318 |
| *PostTest_Power _ Joule_CTP* | 15 | 331.05 | 456.04 | 389.2477 | 8.22641 | 31.86073 | 1015.106 |
| *Valid N (listwise)* | 15 | | | | | | |

It is known that after being converted into unit joules, the group experiment circuit training plyometric, at the time of pre-test, showed a mark mean of 310 joules with a standard deviation of 32.1. The lowest power (minimum value) is 257.8 *joules, and the highest power (value maximum) is* 392 *joules*. Then, the post-test shows a mean of 389.2 joules by a standard deviation of 31.8. The lowest power (minimum value) is 331 *joules, and the highest power (value maximum) is* 456 *joules*. Meanwhile, the difference in average increase can be calculated use the following formula:

$$P = \frac{M_d}{M_{pre}} \times 100\%$$

$$P = \frac{M_{post-pre}}{M_{pre}} \times 100\%$$

$$P = \frac{389.2 - 310}{310} \times 100\%$$

$$P = \frac{79.2}{310} \times 100\%$$

$$P = 25.5\ \%$$

After done calculation percentage, then can concluded that there is difference in average increase in power between groups *circuit training plyometric* amounting to 25.3%.

To facilitate reading the above results , then results the will is displayed in a way clear in bar chart form like seen in the picture as following:

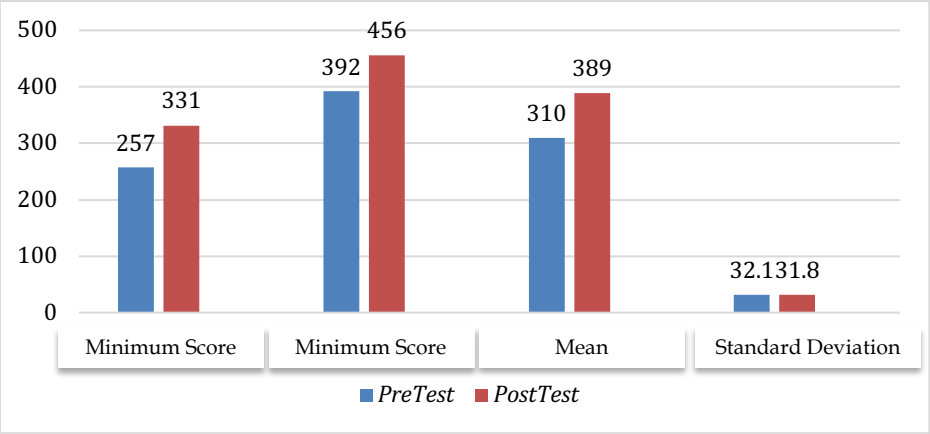



**Figure 1.** Descriptive Statistical Diagram of CTP Group Power Variables (In Joules )

Counting percentage will also is displayed in form table, to make it easy understand, calculation percentage the will displayed in a way detailed, so origin suggested percentage obtained and verification from calculation percentage above can carried out and proven. Calculation percentage the will appears in the table following:

**Table 2.** Calculation percentage

| *Mean* | **Counting Percentage** | **Percentage Yield** | **Counting Percentage** | **Enhancement Percentage** |
|---|---|---|---|---|
| *Post:Pre* | 389, 2 : 310 x 100% | 125.5% | 125.5% - 100% | **25.5%** |
| *Post:Post* | 389, 2 : 389.2 x 100% | 100% | | |

After the percentage calculations were displayed in table form, the researcher also displayed an overview of the percentages in bar chart form. The percentage bar chart is intended to facilitate quick understanding. The diagram will look as follows:

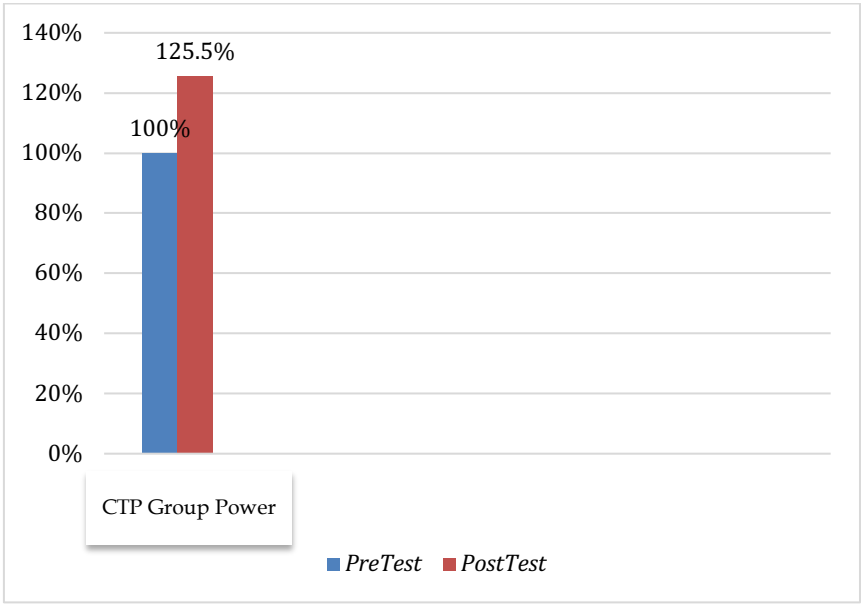



**Figure 2.** PreTest and PostTest Percentage

In the diagram above, it is very clear very show difference percentage between the *pre-test* average and *the post-test* average. So, the conclusion is, the increase in power in the CTP group was 25.3%.

*Group Control*

**Tabel 3.** Descriptive Statistics Power (Joules)

| | N | Minimum | Maximum | Mean | | Std. Deviation | Variance |
|---|---|---|---|---|---|---|---|
| | Statistics | Statistics | Statistics | Statistics | Std. Error | Statistics | Statistics |
| *PreTest_Power _ Joule_Control* | 15 | 269.85 | 345.73 | 313.1857 | 5.98388 | 23.17548 | 537.103 |
| *PostTest_Power _ Joule_Control* | 15 | 284.20 | 351.85 | 322.0019 | 6.15178 | 23.82575 | 567.666 |
| *Valid N (listwise)* | 15 | | | | | | |

Can is known that after converted into unit *joule*, group control, at the time *pre-test* show mark *mean* of 313.1 *joules* by standard deviation of 23.1. The lowest power (minimum value) is 269.8 *joules* and the highest power (value maximum) of 345.7 *joules*.

Then when *post-test* show mark *mean* of 322 *joules* by standard deviation of 23.1. The lowest power (minimum value) is 284.2 *joules* and the highest power (value maximum) of 351.8 *joules*. Meanwhile, to find out difference in average increase can calculated use formula following:

$$P = \frac{M_d}{M_{pre}} \times 100\%$$

$$P = \frac{M_{post-pre}}{M_{pre}} \times 100\%$$

$$P = \frac{322 - 313}{313} \times 100\%$$

$$P = \frac{9}{313} \times 100\%$$

$$P = 2.87\ \%$$

After done calculation percentage, then can concluded that there is difference in average increase in power between groups control amounting to 2.87%. To facilitate reading the above results, then results the will is displayed in a way clear in bar chart form like seen in the picture as following:

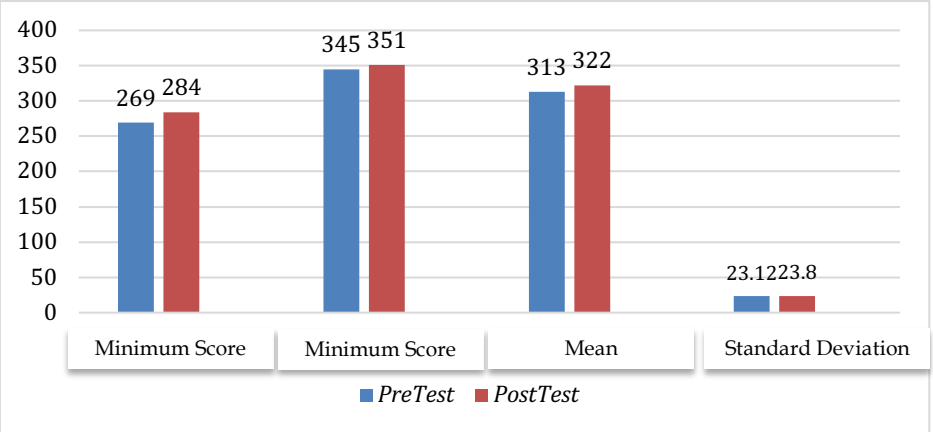



**Figure 3.** Descriptive Statistical Diagram of Control Group Power Variables (In Joules)

Counting percentage will also is displayed in form table, to make it easy understand, calculation percentage the will displayed in a way detailed, so origin suggested percentage obtained and verification from calculation percentage above can carried out and proven. Calculation percentage the will appears in the table following:

**Table 4.** Calculation Percentage

| Mean | Counting Percentage | Percentage Yield | Counting Percentage | Enhancement Percentage |
|---|---|---|---|---|
| Post:Pre | 322 : 313 x 100% | 102.87% | 102.87% - 100% | **2.87%** |
| Post:Post | 322 : 322 x 100% | 100% | | |

After the percentage calculations were displayed in table form, the researcher also displayed an overview of the percentages in bar chart form. The percentage bar chart is intended to facilitate quick understanding. The diagram will look as follows:

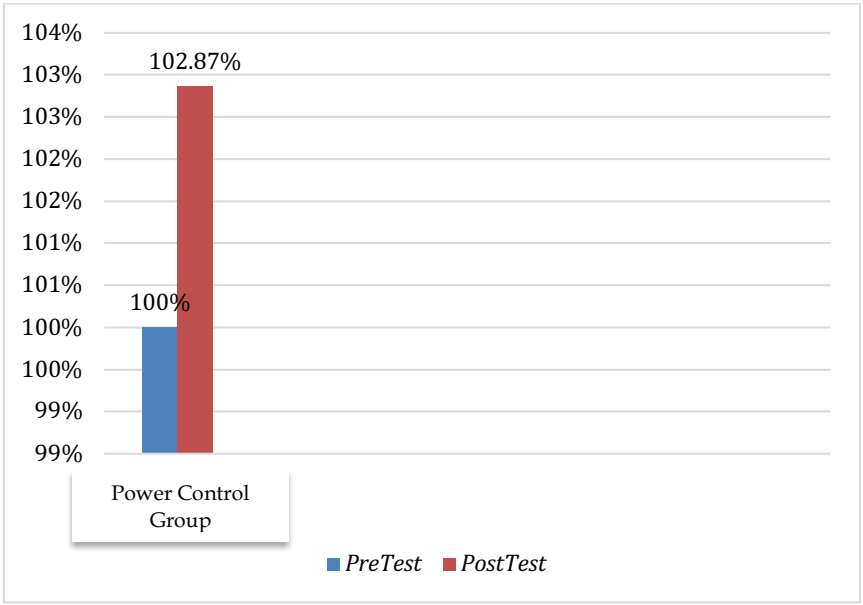



**Figure 4.** PreTest and PostTest Percentage

In the diagram above, it is very clear very show difference percentage between the *pre-test* average and *the post-test* average. So, the conclusion is, increasing power in the group control amounting to 2.87%.

***Descriptive Variable Strength***

*Group Circuit Training Plyometric (CTP)*

**Table 6.** CTP Descriptive Statistics Variable Strength (Kilograms)

| | N | Minimum | Maximum | Mean | | Std. Deviation | Variance |
|---|---|---|---|---|---|---|---|
| | Statistics | Statistics | Statistics | Statistics | Std. Error | Statistics | Statistics |
| *PreTest* _ Strength _ *CTP* | 15 | 137.00 | 155.00 | 149.4000 | 1.25281 | 4.85210 | 23.543 |
| *PostTest* _ Strength _ *CTP* | 15 | 149.00 | 167.00 | 160.7333 | 1.28162 | 4.96368 | 24.638 |
| *Valid N (listwise)* | 15 | | | | | | |

Can is known that on the group *circuit training plyometric*, at the time *pre-test* show mark *mean* as big as 149.4 kilograms by standard deviation of 4.85. Strength muscle limbs lowest (minimum value) of 137 kilograms and strength muscle limbs highest (value maximum) of 155 kilograms.

Then when *post-test* show mark *mean* as big as 160.7 kilograms by standard deviation of 4.96. Strength muscle limbs (minimum value) of 149 kilograms and strength muscle limbs (value maximum) of 167 kilograms. Meanwhile, to find out difference in average increase can calculated use formula following:

$$P = \frac{M_d}{M_{pre}} \times 100\%$$

$$P = \frac{M_{post-pre}}{M_{pre}} \times 100\%$$

$$P = \frac{160 - 149.4}{149.4} \times 100\%$$

$$P = \frac{10.6}{149.4} \times 100\%$$

$$P = 7.09\ \%$$

After done calculation percentage, then can concluded that there is difference in average increase strength muscle limbs in the group experiment *circuit training plyometric*

amounting to 7.09%. To facilitate reading the above results, then results the will is displayed in a way clear in bar chart form like seen in the picture as following:

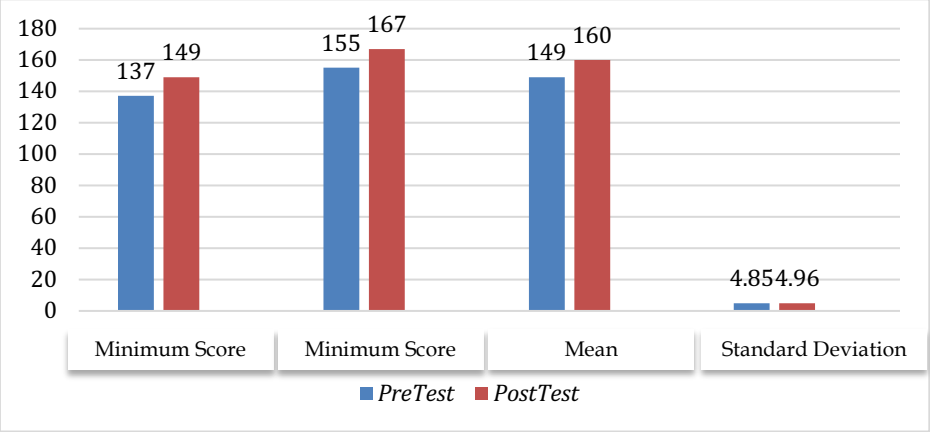



**Figure 5.** Descriptive Statistical Diagram of *CTP Group Strength Variables* (In Kg)

Counting percentage will also is displayed in form table, to make it easy understand, calculation percentage the will displayed in a way detailed, so origin suggested percentage obtained and verification from calculation percentage above can carried out and proven. Calculation percentage the will appears in the table following:

**Tabel 7.** Calculation percentage

| *Mean* | **Counting Percentage** | **Percentage Yield** | **Counting Percentage** | **Enhancement Percentage** |
|---|---|---|---|---|
| *Post:Pre* | 160 : 149.4 x 100% | 107.09% | 107.09% - 100% | **7.09%** |
| *Post:Post* | 160 : 160 x 100% | 100% | | |

After the percentage calculations were displayed in table form, the researcher also displayed an overview of the percentages in bar chart form. The percentage bar chart is intended to facilitate quick understanding. The diagram will look as follows:

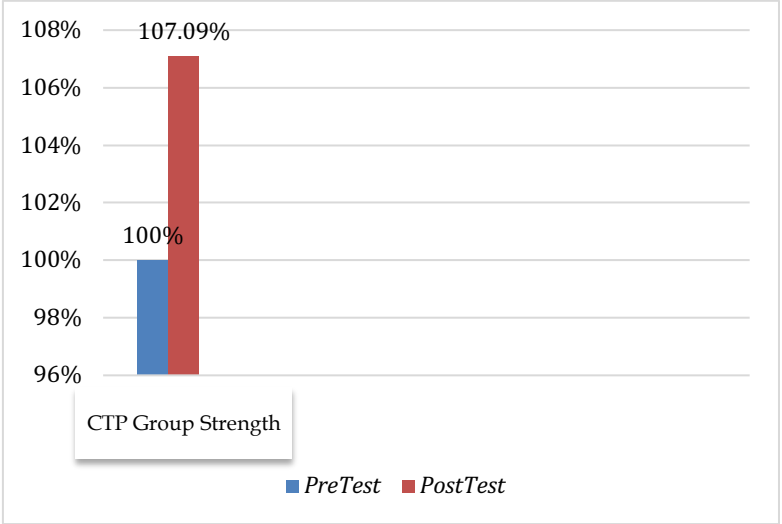



**Figure 6.** PreTest and PostTest Percentage

In the diagram above, it is very clear very show difference percentage between the *pre-test* average and *the post-test* average. So, the conclusion is, increase strength in the CTP group was 7.09%.

*Group Control*

**Tabel 8.** Descriptive Statistics Group Control Variable Strength (Kilograms)

| | N | Minimum | Maximum | Mean | | Std. Deviation | Variance |
|---|---|---|---|---|---|---|---|
| | Statistics | Statistics | Statistics | Statistics | Std. Error | Statistics | Statistics |
| *PreTest* _ Strength _ Control | 15 | 133.00 | 157.00 | 147.4667 | 1.75897 | 6.81245 | 46,410 |
| *PostTest* _ Strength _ Control | 15 | 146.00 | 159.00 | 152,0000 | .87831 | 3.40168 | 11,571 |
| *Valid N (listwise)* | 15 | | | | | | |

Can is known that on the group control, at the time *pre-test* show mark *mean* as big as 147.4 kilograms by standard deviation of 6.81. Strength muscle limbs lowest (minimum value) of 133 kilograms and strength muscle limbs highest (value maximum) of 157 kilograms.

Then when *post-test* show mark *mean* as big as 152 kilograms by standard deviation of 3.40. Strength muscle limbs (minimum value) of 146 kilograms and strength muscle limbs (value maximum) of 159 kilograms. Meanwhile, to find out difference in average increase can calculated use formula following:

$$P = \frac{M_d}{M_{pre}} \times 100\%$$

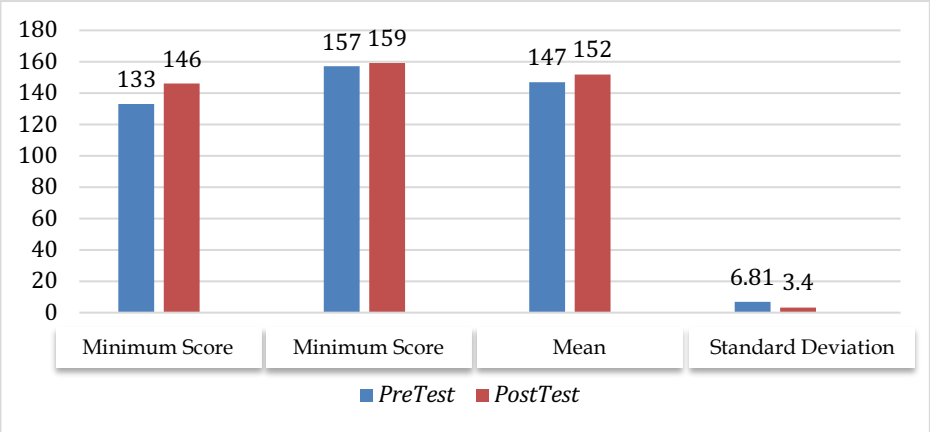
$$P = \frac{M_{post-pre}}{M_{pre}} \times 100\%$$

$$P = \frac{152 - 147.4}{147.4} \times 100\%$$

$$P = \frac{4{,}6}{147.4} \times 100\%$$

$$P = 3.12\ \%$$

After done calculation percentage, then can concluded that there is difference in average decline strength muscle limbs in the group control amounting to 3.12%. To facilitate reading the above results, then results the will is displayed in a way clear in bar chart form like seen in the picture as following:




**Picture 7.** Descriptive Statistical Diagram of Control Group Strength Variables (In Kg)

Counting percentage will also is displayed in form table, to make it easy understand, calculation percentage the will displayed in a way detailed, so origin suggested percentage obtained and verification from calculation percentage above can carried out and proven. Calculation percentage the will appears in the table following:

**Tabel 9.** Calculation percentage

| Mean | Counting Percentage | Percentage Yield | Counting Percentage | Enhancement Percentage |
|---|---|---|---|---|
| *Post:Pre* | 152 : 147.4 x 100% | 103.12% | 103.12% - 100% | **3.12%** |
| *Post:Post* | 152 : 152 x 100% | 100% | | |

After the percentage calculations were displayed in table form, the researcher also displayed an overview of the percentages in bar chart form. The percentage bar chart is intended to facilitate quick understanding. The diagram will look as follows:

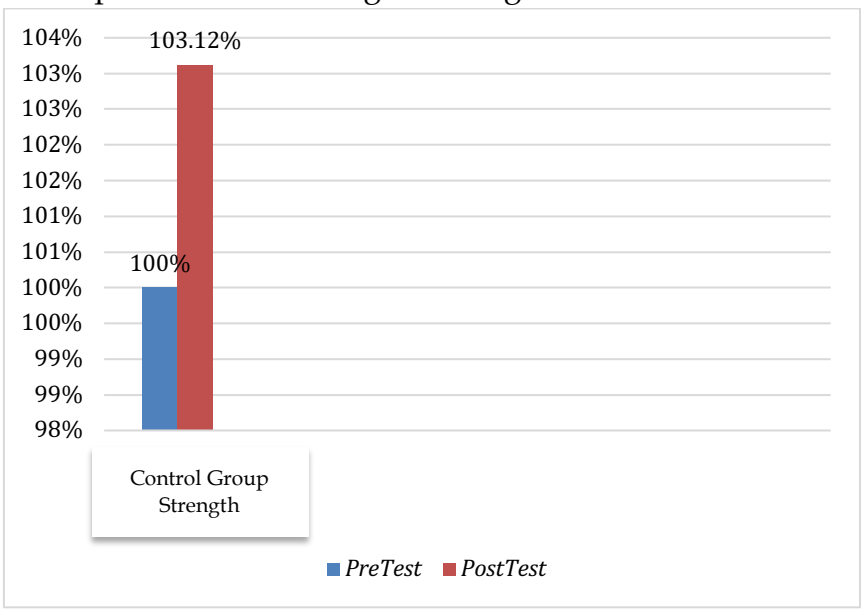



**Figure 8.** PreTest and PostTest Percentage

In the diagram above, it is very clear very show difference percentage between the *pre-test* average and *the post-test* average. So, the conclusion is, power in the group control decrease of 3.12%.

***Hypothesis Test***

*Paired Sample T Test Variable Power*

**Table 10.** Paired Samples Test (Power)

| | | Paired Differences | | | | | t | df | Sig. (2-tailed) |
|---|---|---|---|---|---|---|---|---|---|
| | | Mean | Std. Deviation | Std. Error Mean | 95% Confidence Interval of the Difference Lower | Upper | | | |
| *Pair 1* | *Pre_CTP - Post_CTP* | -78.827 | 11.429 | 2.951 | -85.157 | -72.498 | -26.71 | 14 | .000 |
| *Pair 2* | *Pre_* Control - *Post_* Control | -8.816 | 10.209 | 2.636 | -14.470 | -3.162 | -3.344 | 14 | .005 |

Taking decisions on group lines *circuit training plyometric* (CTP) based on the data above mention that mark The significance in the sig column shows 0.000 < α 0.05. That can be concluded that There is difference *power* before and after giving treatment *combined method circuit training plyometric*.

Meanwhile pick up decisions on group lines control based on the data above mention that mark The significance in the sig column shows 0.005 < α 0.05. That can be concluded that there is difference *power* without giving treatment whatever.

*Paired Sample T Test Variable Strength*

**Table 11.** Paired Samples T Test ( Strength )

| | | Paired Differences | | | | | t | df | Sig. (2-tailed) |
|---|---|---|---|---|---|---|---|---|---|
| | | Mean | Std. Deviation | Std. Error Mean | 95% Confidence Interval of the Difference Lower | Upper | | | |
| *Pair 1* | *Pre_CTP - Post_CTP* | -11.333 | 1.676 | .432 | -12.261 | -10.405 | -26.187 | 14 | .000 |
| *Pair 2* | *Pre_* Control - *Post_* Control | -4.533 | 3.943 | 1.018 | -6.717 | -2.349 | -4.452 | 14 | .001 |

Taking decisions on group lines *circuit training plyometric* (CTP) based on the data above mention that mark The significance in the sig column shows 0.000 < α 0.05. That can be concluded that There is difference *strength* before and after giving treatment *combined method circuit training plyometric*.

Meanwhile pick up decisions on group lines control based on the data above mention that mark the significance in the sig column shows 0.001 > α 0.05. That can be concluded that it doesn't exist difference *strength* without giving treatment whatever.

*One Way Anova Test*

**Table 12.** Anova Test

| ANOVA | | | | | | |
|---|---|---|---|---|---|---|
| | | **Sum of Squares** | **df** | **Mean Square** | **F** | **Sig.** |
| Power | Between Groups | 42945.410 | 2 | 21472.705 | 22.183 | .000 |
| | Within Groups | 40655.748 | 42 | 967.994 | | |
| | Total | 83601.158 | 44 | | | |
| Strength | Between Groups | 621.911 | 2 | 310.956 | 15.685 | .000 |
| | Within Groups | 832.667 | 42 | 19.825 | | |
| | Total | 1454.578 | 44 | | | |

From the results the analysis in the table above, in the power variable, shows an F value of 22.183 at a significance of 0.000. And finally on variables *strength*, shows an F value of 15.685 at a significance of 0.000. Basis for taking his decision is, if mark significance > 0.05 then $H_0$ is accepted and $H_1$ rejected, however If mark significance < 0.05 then $H_0$ rejected and $H_1$ accepted. Thus, from the data in the table above, decisions can be made that second variable show significance 0.000 < 0.05 which means is $H_0$ rejected and $H_1$ accepted, in other words and can concluded that there is significant difference between group.

*Post Hoc Multiple Comparison*

**Table 13.** Multiple Comparisons

| Scheffe | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | | **95% Confidence Interval** | |
| **Dependent Variable** | **(I) Exercise Method** | **(J) Training Method** | **Mean Difference (IJ)** | **Std. Error** | **Sig.** | **Lower Bound** | **Upper Bound** |
| Power | CTP | Control | 67.24578 * | 11.36072 | .000 | 38.4158 | 96.0758 |
| | Control | CTP | -67.24578 * | 11.36072 | .000 | -96.0758 | -38.4158 |
| Strength | CTP | Control | 8.73333 * | 1.62585 | .000 | 4.6074 | 12.8592 |
| | Control | CTP | -8.73333 * | 1.62585 | .000 | -12.8592 | -4.6074 |

*. The mean difference is significant at the 0.05 level.

From the table above, then writer will make a number of statement related to *post hoc multiple comparisons* tests the Variable *Power*: 1) Comparison test CTP group vs. group control produce p value = 0.000 < α = 0.05; 2) Comparison test group control vs CTP group results p value = 0.000 < α = 0.05. Variable *Strength*: 1) Comparison test CTP group vs group control produce p value = 0.000 < α = 0.05; 2) Comparison test group control vs CTP group results p value = 0.000 < α = 0.05. On variables strength, of third the statement above, then can concluded that on point Firstly, there is difference between CTP group by group control, on points secondly, there is difference between group control with the CTP group.

**Discussion**

Based on all results, the exposure above has been analyzed in a way systematic, then combined method circuit training plyometric is a combination method very suitable exercise that can be used to increase the number of component bio motor Fields(Booth & Orr, 2016), in this thing is component power and strength. Still many training methods can be combined, so the term combined method training appears. This training method is method new exercises brought up by the author. By method that, it turns out the increase nature significant, in accordance with existing data displayed by the author.

So this research is also in line with this opinion from experts, as has been written in (Natera et al., 2020) with the research title the Effect of High Volume Power Training on Repeated High-Intensity Performance and the Assessment of Repeat Power Ability: A Systematic Review, states that exercise strength use resistance external, in general used to improve adaptation morphological and/or neurological in muscles order and improve intensity action muscles, with weights exercise intensity high, bigger from 80–85% 1RM (max one repetition), and range from scheme prescription and volume frequently used. So, in conclusion, this research is not inconsistent with results from research that has been carried out by experts previously.

## CONCLUSION

**Fundamental Findings:** There is a difference power before and after giving combined method training circuit training plyometric. This combined method circuit training plyometric is method proper exercise used to improve ability biomotor power. There is a difference strength before and after giving combined method training circuit training plyometric. **Implications:** This combined method circuit training plyometric is method proper exercise used to improve ability biomotor strength. **Limitation:** This research is limited to professional athletes in the city of Madiun, one of the cities in Indonesia. **Future Research:** In the future, this research can be applied to more cities, provinces and national levels throughout Indonesia.

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