Gaster, 23(1) 2025, 60-72
https://journal.aiska-university.ac.id/index.php/gaster
e-ISSN: 2549-7006; p-ISSN: 1858-3385
DOI: https://doi.org/10.30787/gaster.v23i1.1648

Original Research

Comparison of Compression and Noncompression Forearm Sleeve On Grip Muscle Strength In Badminton Players

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ABSTRACT

Background: *Badminton players need good grip muscle strength to hit the ball while playing. Muscle strength can be increased by training and using forearm sleeves. There are two types of forearm sleeves, namely compression forearm sleeves and non-compression forearm sleeves. Both types differ in the materials used. The compression type has polyamide material, and the non-compression type has polyester material. Both have different elasticity. Elasticity affects the compression of the muscles. The more elastic a material is, the more it will compress.*

Purpose: *to find out whether there is a difference in the use of compression forearm sleeves and non-compression forearm sleeves on grip muscle strength in badminton players.*

Method: *This research method is quasi experimental with a two group pretest posttest design. The population in this study was 40 with a total sample of 22 players taken using purposive sampling techniques according to the predetermined inclusion and exclusion criteria.*

Results: *This test used a paired t-test and obtained a p value of 0.000 for the compression type with an average difference of 1 with an increase of 4.6%. The non-compression group used the Wilcoxon test with a p value of 0.003. Has an average difference of 0.5909 with an increase of 2%.*

Conclusion: *The use of compression forearm sleeves is better for increasing grip muscle strength in badminton players than the use of non-compression forearm sleeves.*

ARTICLE HISTORY

Received : 17 October 2024
Revised : 16 January 2025
Accepted : 21 January 2025
Avaliable Online : 20 February 2025
Published : 28 February 2025

KEYWORDS

Grip muscle strength; forearm compression sleeve; non-compression sleeves

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Cite this as: Anggriani, A. F., Ihwanul Muhlishin, R., & Sisybania. (2025). Comparison of Compression and Noncompression Forearm Sleeve On Grip Muscle Strength In Badminton Players . Gaster, 23(1), 60–72. https://doi.org/10.30787/gaster.v23i1.1648

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INTRODUCTION

Badminton is a game played by two people or two pairs facing each other. According to (Kurniadi et al., 2021) badminton is a game that is quite famous in the world. Badminton is played using equipment equipped with strings that function to hit the ball and also stretched net dividing the playing area into two which are passed by the ball called shuttlecock. In this game, participants must hit the ball (shuttlecock) using a racket to pass through the net so that it falls in the opponent's playing area that has been determined and prevent the opponent from doing the same (Ramadhan et al., nd, 2019). In this modern era, badminton can be said to be a famous sport and can be played by all levels of society. Both old, young, male or female can play this sport. This game can be played indoors or outdoors. Facts prove that there are many badminton courts in villages and in cities(Waruwu & Wiriawan, 2021). Basic techniques in badminton that need to be mastered by players include how to hold the racket, standing position, footwork, and strokes. After mastering these basic techniques, players do exercises to improve the quality of strokes. This technique training is given after doing physical training. There are 5 stroke techniques in badminton, namely lob, smash, serve, dropshot, drive. Each player must have good stroke quality to support achievements in badminton (Mangngassai et al., 2020). In producing a good and correct punch, good physical ability is needed in doing the punch. This physical ability is especially emphasized on the body parts that have an important role in doing the punch such as muscle strength and explosive power. Muscle strength plays an important role in helping a player in hitting(Sobirin & Sulastio, 2019)shuttlecock while playing. Muscle strength is the ability of muscles to contract to generate tension against a resistance (Juntara, 2019).

In badminton, every player needs muscle strength, one of which is arm muscle strength. Arm muscle strength is needed because this sport uses arm muscles to launch punches and attacks to kill the opponent's game. Arm and shoulder muscle strength is needed to support the athlete's strength when practicing or when participating in badminton matches (Sobirin & Sulastio, 2019). According to (Septianingrum, 2021) the contribution of arm muscle strength to the smash is 33.7%. So it can be concluded that arm muscle strength contributes quite significantly to the badminton player's smash. Arm muscle strength can be determined by measuring the grip strength of the hand because the muscles that contract are the muscles that cross the wrist and forearm (Andriani, 2019). In increasing arm muscle strength there are several ways including through exercise and using compression sleeves. Arm muscle training aims to increase muscle power in overcoming the load during exercise (Juntara, 2019). The use of compression sleeves aims to provide mechanical support and add compression to the arm muscles during exercise. One of the compression sleeves on the arm that can be used is the forearm sleeve. Forearm sleeve is an elastic brace used to provide mechanical pressure on the surface of the arm, thereby increasing compression on the forearm muscles. Forearm sleeves have several designs, including compression forearm sleeve and non-compression forearm sleeve designs. The compression forearm sleeve design is made of polyamide fabric. While the non-compression forearm sleeve design is made of polyester fabric (Limmer et al., 2022). Polyamide and polyester fabrics have a number of differences, especially in terms of elasticity.

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Elasticity in the fabric will be needed by badminton players to increase compression on the forearm to improve the performance of the forearm muscles (Setyawan et al., 2021).

Several studies discussing the forearm sleeve and muscle strength have been conducted and have produced results such as the research conducted by (Perpetua et al., 2019) which states that the use of forearm sleeves has a positive effect on ROM, strength, and power. However, researchers have not found any research that discusses the comparison of forearm sleeve design with muscle strength.

Based on the author's observations during June 2023 on badminton players at PB Mawardi Sukoharjo, the author found several problems including badminton players' strokes being less precise and of poor quality. As well as the use of forearm sleeves/dekers which are only used by 10 players and are less than optimal because they are rarely used and use a non-compression type that has a polyester material. So that this does not affect the strength of the arm muscles and stroke techniques of badminton players.

Therefore, researchers are interested in conducting a comparative study on the use of compression forearm sleeves with non-compression forearm sleeves on grip muscle strength in badminton players at PB Mawardi Sukoharjo.

The hypothesis in this study is the effect of using compression forearm sleeve with non-compression forearm sleeve to increase grip muscle strength in badminton players at PB Mawardi Sukoharjo.

MATERIALS AND METHOD

The type of research used by the researcher is quasi-experimental using a two-group pretest posttest design approach, namely research conducted on two different groups that receive different interventions. This research will be conducted in August 2023 and will be implemented at PB Mawardi Grogol, Sukoharjo.

The population in this study were all badminton players from PB Marwardi Sukoharjo as many as 40 people. While the research sample amounted to 22 people obtained through a sampling technique, namely purposive sampling by determining inclusion and exclusion criteria. The inclusion criteria for this study were that the subject was male, willing to use an arm during the research, and willing to cooperate and follow the researcher's process. The exclusion criteria in this study were that the research subjects had illness/injury and the subjects did muscle strengthening exercises. The research instrument used in this study was a grip strength dynamometer.

The study began by grouping players who met the inclusion and exclusion criteria and filling out and signing the agreement letter. Then the first group was the subjects who used the compression forearm sleeve intervention, while the second group was the subjects who used the non-compression forearm sleeve intervention.

Then the initial data collection was carried out. Initial data collection or pre-test was carried out when the subject first participated in the study, the researcher conducted a test on muscle strength using a grip strength dynamometer and explained the procedure for data collection. Treatment was given after the initial data collection was carried out, namely after the sample muscle strength was measured with a grip strength dynamometer then the two groups were given different interventions, namely the first group was given a compression forearm sleeve and the second group was given a non-compression forearm sleeve. After

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being given treatment for 20 minutes, the subject's muscle strength was measured again using a grip strength dynamometer.

Then, data analysis was carried out on the research results using the Paired Sample T-test in the compression forearm sleeve group and Wilcoxon in the non-compression forearm sleeve group.This research has obtained ethical approval from the Health Research Ethics Committee of the Semarang Ministry of Health Polytechnic with the number No. 1020/EA/KEPK/2023.

RESULTS

Before conducting the hypothesis test, the characteristics of the respondents will be explained first to find out the general description of the respondents who were the samples in this study. The characteristics of the respondents are divided based on the research group, namely the compression forearm sleeve group and the non-compression forearm sleeve group.

a. Compression Forearm Sleeve Group

1) Characteristics subjects based on age, BMI, and dominant arm

Characteristics	Frequency	Percentage
Age		
10	5	45.5%
12	3	27.3%
13	1	9.1%
14	2	18.2%
IMT		
Thin	10	90.9%
Normal	1	9.1%
Dominant arm		
Right	11	100%

Table 1. Frequency of subject characteristics based on age, BMI, and dominant arm compression forearm sleeve

Based on these characteristics, subjects were obtained with an age range of 10-14 years because the players at PB Mawardi have an age range in the teenage category. All players have a dominant arm, the hand, because all players use their right hand to do daily activities.

2) Subject characteristics based on forearm circumference

Forearm circumference	N	*Min*	*Max*	*Mean*	Std. dev
Compression Group	11	16	23.5	19.48	2.21667

Table 2. Frequency of subject characteristics based on forearm circumference

The average forearm circumference of respondents in the compression forearm sleeve group was 19.48 cm with a minimum value of 16 cm and a maximum value of 23.5 cm.

3) Frequency distribution of increased grip muscle strength with forearm sleeve compression

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The following are the results of measuring grip muscle strength before (pre) and after (post) with forearm sleeve compression intervention.

Category	Frequency	Percentage
Pre Test		
Weak	3	27.3%
Normal	7	63.6%
Strong	1	9.1%
Post Test		
Weak	3	27.3%
Normal	7	63.6%
Strong	1	9.1%

Table 3. Categories of Grip Muscle Strength before and after forearm sleeve compression intervention

In the group of respondents who used compression forearm sleeves, the muscle strength categories before and after treatment can be concluded that there was no increase in the category of grip muscle strength.

Grip muscle strength	N	Mean	Min	Max
Pre test	11	21,3909	11.60	37.30
Post test	11	22,3909	12.40	38.50

Table 4. Average value of grip muscle strength before and after forearm sleeve compression intervention

From the results of the statistical analysis above, the pre-test and post-test grip muscle strength in the group using the compression forearm sleeve intervention showed strength in the weak category in the age range of 14-19 years and the normal category in the age range of 10-13 years. This group has an average difference of 1.0.

b. Noncompression Forearm Sleeve Group

1) Subject characteristics based on age, BMI, and dominant arm

Characteristics	Frequency	Percentage
Age		
10	2	18.2%
11	2	18.2%
13	3	27.3%
14	1	9.1%
17	1	9.1%
19	2	18.2%
IMT		
Thin	6	54.5%
Normal	5	45.5%

Table 5. Frequency of subject characteristics based on age, BMI, and dominant arm non-compression forearm sleeve

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Based on these characteristics, subjects with an age range of 10-19 years were obtained because players at PB Mawardi have an age range in the teenage category. All players have a dominant arm, the hand, because all players use their right hand to do daily activities.

2) Subject characteristics based on forearm circumference

Forearm circumference	N	*Min*	*Max*	*Mean*	Std.deviation
Non Compression Group	11	18.7	27	22.22	3.24595

Table 6. Frequency of subject characteristics based on forearm circumference

The forearm circumference of the group using non-compression forearm sleeves showed an average value of 22.22 cm, respondents had the smallest forearm circumference of 18.7 cm and the largest was 27 cm.

3) Frequency distribution of increased grip muscle strength with forearm sleeve compression

The following are the results of measuring grip muscle strength before (pre) and after (post) with non-compression forearm sleeve intervention.

Category	Frequency	Percentage
Pre Test		
Normal	10	90.9%
Strong	1	9.1%
Post Test		
Normal	10	90.9%
Strong	1	9.1%

Table 7. Categories of grip muscle strength before and after non-compression forearm sleeve intervention

Category	Frequency	Percentage
Pre test		
Normal	10	90.9%
Strong	1	9.1%
Post test		
Normal	10	90.9%
Strong	1	9.1%

Table 8. Categories of grip muscle strength before and after non-compression forearm sleeve intervention

The table above shows the muscle strength categories before and after treatment. There was no increase in the grip muscle strength category in badminton players who used the non-compression forearm sleeve intervention.

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Grip muscle strength	N	Mean	Min	Max
Pretest	11	29,2818	15.80	46.50
Post test	11	29,8727	16.30	47.20

Table 9. Average value of grip muscle strength before and after non-compression forearm sleeve intervention

From the results of the statistical analysis above, the pre-test and post-test grip muscle strength in the group of subjects using non-compression forearm sleeve intervention showed muscle strength in the weak category in the age range of 16-19 years, normal in the age range of 12-15 years, and strong in the age range of 10-11 years. This group has a difference in average results in the post-test and pre-test of 0.5909.

Then statistical analysis is carried out based on the data that has been obtained, namely the normality test and hypothesis test. Data normality in this study is used to determine whether the data is normally distributed or not so that it will determine the type of statistics to be used.

Variables	Statistics	Sig	Information
Pre compression	.890	.140	Normal
Post compression	.890	.138	Normal

Table 10. Shapiro wilk normality test (n=11) compression forearm sleeve

The results of the normality test using Shapiro Wilk on the compression forearm sleeve variable before and after the intervention. A significance value of 0.140 was obtained on the pre-test score and a significance value of 0.138 on the post-test score. Based on these results, it can be concluded that the pre and post data on the compression forearm sleeve variable are normally distributed because the significance value or p> 0.05.

Variables	Statistics	Sig	Information
Pre Non Compression Post	.847	.039	Abnormal
Non Compression	.847	.038	Abnormal

Table 11. Shapiro wilk normality test (n=11) non compression forearm sleeve

The results of the normality test for the non-compression forearm sleeve variable showed a significant result on the pre score of 0.039 and on the post score of 0.038. Based on these results, it can be concluded that the pre and post data on the non-compression forearm sleeve variable are not normally distributed because the p value <0.05.

After the normality test was conducted, a hypothesis test was conducted to test the magnitude of the influence of the use of compression forearm sleeve and non-compression forearm sleeve on grip muscle strength in badminton players at PB Mawardi Sukoharjo.

After normalizing the data, the next step is to test the hypothesis.

a. Hypothesis test grip muscle strength with compression forearm sleeve

Based on the normality test that has been carried out, the data

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obtained on the variable of increasing grip muscle strength with compression forearm sleeve is normally distributed and is paired data so that a paired sample t-test is used.

	Sig (2-tailed)
Pre Post	.000

Table 12. Paired sample t-test results

The results of the analysis of the effect of using compression forearm sleeves on grip muscle strength in badminton players with a paired sample t-test showed a p value of (0.000), where the p value <0.05 so it can be concluded that there is a significant effect of using compression forearm sleeves on grip muscle strength in badminton players. From the results of the hypothesis, it can be concluded through a percentage, with the following formula:

$$\%\text{increase} = \frac{\text{post-pre mean difference value}}{\text{mean pre value}} \times 100$$

$$\%\text{increase} = \frac{22.3909 - 21.3909}{21,3909} \times 100$$

$$\%\text{increase} = \frac{1}{21,3909} \times 100$$

$$\%\text{increase} = 4.6\%$$

Based on the formula above, it was found that the results of increasing grip muscle strength with the use of compression forearm sleeves had an effect of 4.6% on increasing grip muscle strength in badminton players.

b. Hypothesis test grip muscle strength with non compression forearm sleeve

Based on the normality test that has been carried out, the data obtained on the variable of increasing grip muscle strength with non-compression forearm sleeve is not normally distributed and is paired data so that the Wilcoxon test is used.

Grip strength	Z	*p value*
Pre- test non *Post-test non*	-2,956	0.003

Table 13. Wilcoxon statistical test

The results of the analysis of the use of non-compression forearm sleeves on the strength of the grip muscles in badminton players with the Wilcoxon test showed that all 11 players experienced an increase in grip muscle strength. The Sign test analysis showed a Z value of -2.956 with a p value of 0.003 where the p value <0.05 so it can be concluded that there is

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a statistical effect of the use of non-compression forearm sleeves on the strength of the grip muscles of badminton players.

From the results of the hypothesis, it can be concluded through a percentage with the following formula:

$$\%increase = \frac{\text{post-pre mean difference value}}{\text{mean pre value}} \times 100$$

$$\%increase = \frac{29.8727 - 29.2818}{29,2818} \times 100$$

$$\%increase = \frac{0.5909}{29,2818} \times 100$$

$$\%increase = 2\%$$

Based on the formula above, the results obtained showed an increase in grip muscle strength with the use of non-compression forearm sleeves of 2%, so it can be concluded that there is an effect of using non-compression forearm sleeves on grip muscle strength in badminton players.

In the data analysis test above, it can be concluded that the group using the compression forearm sleeve intervention has an average difference of 1 with a p value of 0.000 indicating an effect on increasing muscle strength by a percentage of 4.6%. The group using the non-compression forearm sleeve intervention has an average difference of 0.5909 with a p value of 0.003 indicating an effect on increasing muscle strength by a percentage of 2%.

DISCUSSION

This study aims to determine the comparison of the effects of compression forearm sleeve and non-compression forearm sleeve on grip muscle strength in badminton players. According to (Bustos et al., 2020; Elisa et al., 2020) strength is a component of physical fitness that is no less important than other components of physical fitness when carrying out a particular job or activity.

The subjects used were badminton players who were included in the inclusion and exclusion categories, then 22 subjects were obtained who were divided into two groups with different interventions. Both groups of subjects then conducted pre-tests and post-tests after receiving treatment. In this study, the first group received intervention in the form of a compression forearm sleeve and the second group received a non-compression forearm sleeve intervention. Both groups were given intervention for 20 minutes.

The use of intervention tools for 20 minutes has been proven to increase grip muscle strength in badminton players. Muscle strength is very much needed by badminton players to increase the quality of strokes performed during the match so that good muscle strength will increase the player's performance in terms of strokes (Juntara, 2019).

Based on the research, the subjects were male. According to (Juntara,

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2019) men have better muscle development than women because men have the hormone testosterone which can help increase muscle growth and enlargement. The subjects were aged between 10-19 years. This is because muscle strength in men will peak in their 20s. According to (Elisa et al., 2020)12-21 years is the age of the teenage phase. The teenage phase or puberty is the phase where every child will begin their physical development.

Other characteristics of respondents mostly have a Body Mass Index (BMI) in the thin category. This affects muscle strength because a person's grip muscle strength will be maximal when they are at a normal BMI and tends not to be maximal when the BMI is in the thin category (Savitri, 2020).The size of the forearm circumference of the players in this study in the compression group had an average value of 19.28 cm while in the non-compression group it had an average value of 22.22 cm. The larger the forearm circumference, the greater the grip strength. The dominant arm obtained in this study was that all players used the right hand as the dominant arm.

This study produced an average of compression forearm sleeve and non-compression forearm sleeve on the grip muscle strength of badminton players. This can be seen through the pre and post values of both groups. The group using compression forearm sleeve had an average pre of 21.3909 and an average post of 22.3909 which had a difference of 1.0. With the percentage formula, the compression forearm sleeve had a percentage of 4.6%. In the group using non-compression forearm sleeve, the average pre value was 29.2818 and the average post value was 29.8727 with a difference of 0.5909. With the percentage formula, non-compression forearm sleeve resulted in a 2% increase in muscle strength.

The results of this study indicate the effect of compression forearm sleeve on the grip muscle strength of badminton players. In this group, the p value was 0.000, indicating an increase in grip muscle strength. This study is in line with research (Limmer et al., 2022) about the effect of using compression forearm sleeves on muscle strength in rock climbers with results stating that using compression forearm sleeves can increase blood flow thereby increasing muscle strength with a p value of 0.049.

For the second group, it shows the effect of intervention in the form of non-compression forearm sleeve on the grip muscle strength of badminton players. A p value of 0.003 was obtained, so it can be concluded that the use of non-compression forearm sleeve can increase grip muscle strength. This is in line with research conducted (Limmer et al., 2022) with a p value of 0.049 which states that the use of non-compression forearm sleeves can increase blood flow so that it can increase muscle strength.

The use of compression forearm sleeves and non-compression forearm sleeves can increase grip muscle strength in badminton players with a compression mechanism that is useful for improving blood circulation (Limmer et al., 2022). According to research (Bustos et al., 2020) the forearm sleeve can be used to trigger the muscles to contract more during normal training sessions to improve the user's ability while playing.

The comparison between compression forearm sleeve and non-compression forearm sleeve is in the materials used. The compression type uses dominant polyamide material and the non-compression type has polyester material. Both of these tools can be used for sports activities because they can

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compress the lower arm.

Compression forearm sleeves are predominantly made of polyamide or nylon (Limmer et al., 2022). This material has higher elasticity characteristics, which can return to its original shape by 97% after being pulled by 16%. Non-compression forearm sleeve has polyester material which has lower elasticity characteristics than polyamide fabric. Polyester fabric can return to its original shape by 80% after being pulled by 8%.

Compression forearm sleeve and non compression forearm sleeve have differences in the elasticity of the material used. Elasticity is the ability of the fabric to return to its original shape (Nurmayanti et al, 2024). The elasticity of the fabric in the material used by both types of forearm sleeves is something that affects compression. This is in accordance with the statement (Setyawan et al., 2021) which states that the elasticity of compression clothing fabric is very much needed by the body that is compressed. The higher the elasticity level of compression clothing fabric, the more the compression clothing will be able to return to its original shape or can compress more maximally.

CONCLUSION

This study discusses and analyzes the effectiveness of using compression forearm sleeves and non-compression forearm sleeves on grip muscle strength in badminton players at PB Mawardi Sukoharjo which was conducted in August 2023, obtaining samples that met the inclusion and exclusion criteria totaling 22 people who were divided into two groups.

The results of the hypothesis test stated that the use of compression forearm sleeves is better for increasing grip muscle strength in adolescent badminton players than the use of non-compression forearm sleeves. This can be seen from the significance value and percentage resulting from the increase in grip muscle strength after using both devices. Compression forearm sleeves have a p value of 0.000 and can increase muscle strength by 4.6%. Non-compression forearm sleeves have a p value of 0.003 and can increase muscle strength by 2%. However, in this study there was no increase in the grip muscle strength category in badminton players at PB Mawardi Sukoharjo.

ACKNOWLEDGEMENT

The authors would like to express their deepest gratitude to PB Moewardi for providing access to the research population and the necessary facilities. The cooperation and support of the management and all players who participated in this study were invaluable to the success of this study.

Furthermore, the researcher would like to express his appreciation to the Orthotic Prosthetics Department of the Surakarta Ministry of Health Polytechnic for providing the facilities and support needed to complete this research.

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