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COMPARATIVE EFFECTIVENESS BETWEEN HEEL RAISE EXERCISES AND RESISTANCE BAND EXERCISES ON FUNCTIONAL ABILITY IN ATHLETES WITH ANKLE INJURIES

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Abstract

Background: Ankle injuries are among the most common sports injuries, affecting athletes with symptoms such as pain, swelling, joint instability, muscle weakness, and reduced functional activity. Effective interventions, such as heel raise exercises and resistance band exercises, are crucial for managing these injuries**.. Objective**: This study aims to compare the effects of heel raise exercises and resistance b and exercises on improving functional ability in athletes with ankle injuries. **Method**: A quasi-experimental design with a pre-test and post-test two-group approach was used. The study sample consisted of 22 athletes from Nafas Bintang Barat FC, with 11 athletes assigned to the heel raise exercise group (Group I) and 11 athletes assigned to the resistance band exercise group (Group II). Participants were selected using purposive sampling. Functional ability was assessed using the Foot and Ankle Ability Measure (FAAM).. **Results**: The Paired Sample Test revealed significant improvements in functional ability within both groups, with p-values of 0.000 for Group I and 0.000 for Group II, indicating that both interventions were effective. However, the Independent Sample Test showed no significant difference between the two groups, with an average difference of 0,1816 and a p-value of 0.131, suggesting that there is no significant difference in effectiveness between heel raise exercises and resistance band exercises.. **Conclusion**: Both heel raise exercises and resistance band exercises effectively improve functional ability in athletes with ankle injuries. However, there is no significant difference in effectiveness between the two exercise modalities.

Keywords: ***heel raise exercise, resistance band exercise, Foot and Ankle Ability Measure (FAAM).***

INTRODUCTION

The most common futsal sport injury and often experienced in athletes is ankle injury (Setio Nugroho, 2019). Ankle injuries are the most common lower extremity injury in athletes and account for an incidence rate of 16-40% of all sports-related injuries (Waritsu, 2022). According to Sakti (2021) as many as 70% tend to experience recurrent injuries. In Wesam Saleh's research (2022) conveyed that 87% of ankle injuries require a 15-day rest period, so athletes who experience ankle injuries have the potential to experience decreased performance. World Health Organization (WHO) data in 2018, around 2 million cases of acute ankle occur each year. Based on Basic Health Research Data (RISKESDAS, 2018) Indonesia, the national incidence of sprained ankles was 32.8% and 68% of injuries occurred in the lower extremities. The most dislocated cases were found in the South Kalimantan region reaching 39.3%.

Based on the results of a preliminary study that aims to determine the number of injuries experienced by athletes at Nafas Bintang Barat FC in 23 athlete samples using an injury identification questionnaire from previous research written by Umar (2018). The data obtained showed that the majority of injuries occurred

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in the ankle area (91.3%), while in the head area (13.04%), shoulder (30.4%), elbow (8.7%), wrist (47.8%), waist (34.8%), spine (21.7%), knee (47.8%). From the data it is known that ankle injuries have the highest percentage experienced by athletes at Nafas Bintang Barat FC. Therefore, the authors are interested in conducting research with the title "The Difference in the Effect of Heel Raise Exercise and Resistance Band Exercise on Increasing Functional Ability in Ankle Injuries".

Physiotherapy can provide interventions in the form of heel raise exercise and resistance band exercise to improve functional ability in ankle injuries. Giving heel raise exercise is an exercise that aims to increase muscle strength, especially m.gastrocnemius and m.plantar flexor foot (Huang, 2022). Heel raise exercise causes effects on nerves and skeletal due to propioseptive stimulation to maintain a balanced position (Herawati, 2019). This exercise can be done by standing straight legs, then both heels are lifted up like tiptoes and held for a few seconds then lowered slowly. In a study conducted by Hasdianti & Rahman (2022), the provision of heel raise exercise intervention 3 times a meeting for a week showed good final results in the form of decreased pain intensity, decreased swelling, increased joint range of motion, increased muscle strength, and increased functional ability.

In addition, exercises that can be given are resistance band exercises. Resistance band exercise is an exercise that uses rubber-like tools to train strength, muscle endurance, and flexibility (Al Gifari, 2017). Resistance band exercise is performed with an emphasis on isotonic contractions, performed using theraband, the purpose of this exercise is for the initial stage of rehabilitation and functional strength (Made, 2018). Giving resistance band exercise, ankle muscles which include tonic muscle types can increase vessel circulation which will increase muscle strength and contracting muscles (agonists) will activate additional motor units to achieve increased contractile strength in the muscles. According to Destya (2020) correct and regular exercise will increase the strength of the stabilizer muscles in the ankle and affect its functional activities.

METHODS

A. Research Type

The type of research conducted was quasi-experimental research with a pre-test and post-test two group design. By giving heel raise exercise treatment to group I and giving resistance band exercise treatment to group II.

B. Population and Sample

a. Population

The population in this study were all athletes at Nafas Bintang Barat FC, totaling 50 people.

b. Sample

The sample in this study were some athletes of Nafas Bintang Barat FC with ankle problems. Sampling in this study was carried out using the Slovin formula. Based on the results of calculations using the Solvin formula, namely 34 respondents.

- **Inclusion Criteria:**
  1) Futsal athletes at Nafas Bintang Barat FC Semarang.
  2) Athletes are male with an age range of 15-18 years.
  3) Athletes who have a history of ankle injury.
  4) Athletes with ankle injury conditions, grade 1 and 2.

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5) Athletes with FAAM score values: 0-85.
6) Athletes willing to be research respondents.

- **Exclusion Criteria:**
  1) Athletes have a history of fractures in the ankle area.
  2) Athletes with grade 3 ankle injury conditions.
  3) There is swelling in the athlete's ankle area.
  4) Athletes have open wounds in the ankle area.
  5) Athletes are not willing to be research respondents.

- **Drop Out Criteria:**
  1) Respondents who do not attend training 2 times, consecutively.
  2) Respondents suffered ankle injuries when outside the research activities.

C. Location and Time of Study
This research was conducted at a futsal club called Nafas Bintang Barat FC.

D. Data Analysis
The data analysis in this study utilized the Statistical Program for Social Science (SPSS). The data analyzed includes:

1. Univariate Analysis: Univariate analysis is an analysis that has the aim to know the frequency distribution in each research variable (Putra, 2021). In this study, researchers analyzed the difference in the effect of heel raise exercise and resistance band exercise on improving functional ability in ankle injuries. Researchers also identified the characteristics of respondents, as parameters in the study which will be analyzed univariately by calculating the mean (mean), median (median), mode (mode), maximum value (max), minimum value (min) and Standard Deviation (SD) to determine the percentage of frequency distribution which will then be presented in tabular form.
2. Bivariate Analysis: This analysis aims to identify the influence between two variables, the dependent variable (fine motor skills) and the independent variable (brain gym). During data analysis, the relationship between these two variables can be determined. A normality test using Shapiro-Wilk was performed because the sample size was less than 50. The normality test results showed pre- and post-treatment p-values of 0.000, indicating that the data were not normally distributed. Therefore, the hypothesis was tested using the non-parametric Wilcoxon test.

RESULT AND DISCUSSION

The research was conducted at Nafas Bintang Barat FC from June 25, 2024 to July 19, 2024, or for 4 weeks with a frequency of 2 times a week. The research method used was quasi-experimental with a pre-test and post-test two group design. Group I was given heel raise exercise treatment and group II was given resistance band exercise treatment. The purpose of this study was to determine whether there is a difference in the effect between heel raise exercise and resistance band exercise on functional ability in ankle injuries of futsal athletes. In this study, based on the inclusion and exclusion criteria, a total sample size of 26 athletes was obtained. In the process of running the research there were 4 athletes who dropped out, because they were not present during the research process 2 times in a row without any information, so the final sample size in this study was 22 athletes who met the criteria.

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A. Research Results

1. Respondent Characteristics

a. Respondent Characteristics Based on Age

Table 1. Respondent Characteristics Based on Age

Age (Years)	Heel Raise Exercise		Resistance Band Exercise	
	Number	%	Number	%
16 Years	1	9,1	0	0
17 Years	4	36,4	4	36,4
18 Years	6	54,5	7	63,6
Total	**11**	**100**	**11%**	**100**

Source: Primary data, 2024.

Based on Table IV.1 shows that in group I with heel raise exercise treatment totaling 11 athletes, there are 6 athletes aged 18 years (54.5%), 4 athletes aged 17 years (36.4%), and 1 athlete aged 16 years (9.1%). In group II with resistance band exercise treatment totaling 11 athletes, there were 7 athletes aged 18 years (63.6%) and 4 athletes aged 17 years (36.4%).

b. Respondent Characteristics Based on Gender

Table 2. Respondent Characteristics Based on Gender

Gender	Heel Raise Exercise		Resistance Band Exercise	
	Number	%	Number	%
Male	11	100	11	100
Total	**11**	**100**	**11%**	**100**

Source: Primary data, 2024.

Based on Table IV.2 shows that the sample in group I with heel raise exercise treatment and in group II with resistance band exercise treatment, each group amounted to 11 athletes and were male.

c. Characteristics of Respondents Based on Weight

Tabel 3. Characteristics of Respondents Based on Weight

Weight (Kg)	Heel Raise Exercise		Resistance Band Exercise	
	Number	%	Number	%
49-55	2	18,2	1	9,1
56-62	1	9,1	0	0
63-69	3	27,3	4	36,4
70-76	2	18,2	3	27,3
77-83	3	27,3	3	27,3
Total	**11**	**100**	**11**	**100**

Source: Primary data, 2024.

Based on Table IV.3 shows that the sample in Group I amounted to 11 athletes, there were 3 athletes weighing 63-69 kg (27.3%), 3 athletes weighing 77-83 kg (27.3%), 2 athletes weighing 49-55 kg (18.2%), 2 athletes weighing 70-76 kg (18.2%), and 1 athlete weighing 56-

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62 kg (9.1%). The sample in group II amounted to 11 athletes, there were 4 athletes weighing 63-69 kg (36.4%), 3 athletes weighing 70-76 kg (27.3%), 3 athletes weighing 77-83 kg (27.3%), and 1 athlete weighing 49-55 kg (9.1%).

d. Characteristics of Respondents Based on Body Mass Index (BMI)

Tabel 4. Characteristics of Respondents Based on Body Mass Index (BMI)

Weight (Kg)	Heel Raise Exercise		Resistance Band Exercise	
	Number	%	Number	%
Normal (18,5 – 25)	5	45,5	5	45,5
Overweight (25,2 – 27)	6	54,5	6	54,5
Total	**11**	**100**	**11**	**100**

Source: Primary data, 2024

Based on Table IV.4 shows that the sample in group I amounted to 11 athletes, there were 6 athletes with Overweight BMI criteria (54.5%), and 5 athletes with Normal BMI criteria (45.5%). The sample in group II amounted to 11 athletes, there were 6 athletes with Overweight BMI criteria (54.5%), and 5 athletes with Normal BMI criteria (45.5%).

e. Distribution of Respondent Characteristics Based on Foot and Ankle Ability Measure (FAAM) Score

Table 5. Distribution of Respondent Characteristics

Score FAAM	Heel Raise Exercise				Resistance Band Exercise			
	Pretest		Posttest		Pretest		Posttest	
	N	%	N	%	N	%	N	%
51-75 (nearly normal)	**2**	**18,2**	**0**	**0**	**1**	**9,1**	**0**	**0**
76 – 100 (normal)	**9**	**81,8**	**11**	**100**	**10**	**90,9**	**11**	**100**
Total	**11**	**100**	**11**	**100**	**11**	**100**	**11**	**100**

Source: Primary data, 2024

Based on Table IV.5 shows the value of Foot and Ankle Ability Measure (FAAM), in group I, the results obtained before treatment (pre-test), there were 9 athletes with normal criteria (81.8%) and 2 athletes with nearly normal criteria (18.2%), while after treatment (post-test), there were 11 athletes with normal criteria (100%). In group II, the results obtained before treatment (pre-test), there were 10 athletes with normal criteria (90.9%) and 1 athlete with nearly normal criteria (9.1%), while after treatment (post-test), there were 11 athletes with normal criteria (100%).

2. Frequency of Research Data

Table 6. Frequensy of Research Data

Treatment	Grup I (Heel Raise Exercise)			Grup II (Resistance Band Exercise)		
	Pretest	Posttest	Difference	Pretest	Posttest	Difference

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Minimun	**71,2**	**88,4**	**17,2**	**71,4**	**88,4**	**17**
Maximum	**83,9**	**93,1**	**9,2**	**83,9**	**96,9**	**12,8**
Mean	**78,9**	**90,8**	**12,2**	**78,1**	**92.8**	**14,7**
SD	**3,8**	**1,5**	**2,3**	**3,2**	**3,1**	**0,1**

Source: Primary data, 2024

Based on Table IV.6 shows the value of Foot and Ankle Ability Measure (FAAM), it is known that in group I with heel raise exercise treatment, before treatment (pre-test) obtained the minimum value (71.2), maximum (83.9), mean (78.6), and SD (3.8), while after treatment (post-test) obtained the minimum value (88.4), maximum (93.1), mean (90.8), and SD (1.5). From the pre-test and post-test in group I, the results obtained the minimum difference value (17.2), maximum (9.2), mean (12.2), and SD (2.3). In group II with resistance band exercise treatment, before treatment (pre-test) obtained the minimum value (71.4), maximum (83.9), mean (78.1), and SD (3.2), while after treatment (post-test) obtained the minimum value (88.4), maximum (96.9), mean (92.8), and SD (3.1). In group II, the minimum (17), maximum (12.8), mean (14.7), and SD (0.1) difference values were obtained.

3. Normality Test of Data

Table 7. Normality Test of Data

Normality Test of Data				
Score FAAM	**Heel Raise Exercise**		**Resistance Band Exercise**	
	p	**Description**	**p**	**Description**
Pretest	**0,0660**	**Normal**	**0,169**	**Normal**
Post test	**0,795**	**Normal**	**0,211**	**Normal**

Source: Primary data, 2024

Based on Table IV.7 shows that the results of the normality test results using Shapiro Wilk, in group I, before treatment (pre-test) obtained p value (0.660) and after treatment (post-test) obtained p value (0.795). In group II, before treatment (pre-test), the p value was obtained (0.169) and after treatment (post-test), the p value was obtained (0.211). From the data above, it is known that the p value is> 0.05, so the data is said to be normal.

1. Hypothesis Testing

Table 8. Hypothesis Testing

Group	**Hypothesis Testing**			
	Mean		**p**	**Description**
	Pretest	**Posttest**		
Heel Raise Exercise	**78,6**	**90,8**	**0,0000**	**There is an EffectClick to apply**
Resistance Band Exerice	**78,1**	**92.8**		

Source: Primary data, 2024

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Based on Table IV.8 shows that the results of the effect test using the Paired Sample Test, in group I, obtained the results of the p value (0.000) and group II, obtained the results of the p value (0.000). From the data above, it is known that the p value is <0.05, so the data is said to have an effect.

B. Discussion

1. Respondent Characteristics

a. Characteristics Based on Age

Based on Table IV.1, it is known that the number of samples is mostly 18 years old and the least is 16 years old. According to Waldman (2019), teenagers are more susceptible to ankle injuries because at that age, bones and muscles are still in a stage of rapid growth and development. This has an impact on body structures, including muscles, bones and ligaments that are not yet fully mature.

The imbalance between bone and muscle growth can make adolescents susceptible to ankle injuries when engaging in frequent physical activity. In addition, at this age, body stability and coordination are not yet fully established, which can also increase the risk of ankle injury (Sumartiningsih, 2022).

b. Characteristics Based on Gender

The relationship between gender and factors affecting ankle injuries is where male adolescent athletes with unstable psychological conditions of adolescence have higher emotional levels than women. Men with violent and very temperamental behavior, tend to get injured both injuries to themselves and their opponents, thus causing men to have a greater risk than women (Setiawan, 2021).

Men tend to be more susceptible to ankle injuries than women due to differences in body structure and physical activity. Men generally have bigger and stronger muscles than women, but men tend to have lower flexibility. This can lead to muscle imbalances and ankle strain, which can increase the risk of injury especially to the ankle. In addition, men also tend to be more often involved in physical activities that require a lot of movement, especially in futsal such as jumping, turning suddenly, which can also increase the risk of ankle injuries (Ulfa Kumala, 2022).

c. Characteristics Based on Weight

Weight can be a risk factor for ankle injuries due to the additional stress placed on the ankle joint. People who are overweight tend to place a greater load on their joints, including the ankle. This can lead to increased pressure and stress on ligaments, tendons and other ankle structures, ultimately increasing the risk of injury (Martinez-Riaza, 2017).

In addition, excessive body weight can also reduce overall body stability, thus affecting balance and coordination of movement, because the ankle area is the base of support (BOS) of the body, when we stand, walk, or run, which can increase the risk of ankle injury (Rizki Amallia, 2020).

d. Characteristics Based on Body Mass Index (BMI)

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Based on Table IV.5 regarding the characteristics of respondents based on Body Mass Index (IMT) in a total sample of 22 athletes, the results showed that the number of athletes with Normal IMT criteria amounted to 10 athletes and athletes with Overweight criteria as many as 12 athletes. From these data it can be seen that athletes with the most IMT criteria are athletes with Overweight IMT criteria.

Body Mass Index (BMI) is one of the factors that determine ankle injuries in futsal players. However, some researchers say BMI values are not useful when assessing athletes' body composition because they cannot distinguish whether weight gain is due to increased muscle mass or fat (Martinez-Riaza, 2017). According to Gusvina (2021), height and weight greatly affect ankle injuries, this can occur because height does not increase while weight increases past normal limits, which can increase emphasis on bones, muscles, and ligaments. Excessive pressure on bones, muscles, and ligaments, will cause damage to the structure of the ankle or ankle.

e. Characteristics of Respondents Based on Foot and Ankle Ability Score Measure (FAAM)

Table IV.5 and Table IV.6 show the results of the Foot and Ankle Ability Measure (FAAM) value. Foot and Ankle Ability Measure (FAAM) is a self-report instrument modified and developed by Martin et al in 2005, a report containing the most appropriate patient assessment to measure functional disability in patients with ankle instability containing 29 items divided by 2 subscales, namely the Activity Daily Living (ADL) scale of 21 items, and the Sport scale of 8 items.

The Sport subscale assesses the more difficult tasks that are important designed specifically for athletes (Widi & Sons, 2014). specifically designed for athletes (Widi & Herista, 2024). In the Foot and Ankle Ability Measure (FAAM) assessment, it is not only seen from the Sport scale assessment, but the Activity Daily Living (ADL) scale assessment. Low Foot and Ankle Ability Measure (FAAM) scores in athletes can also be caused by a number of factors, mainly related to injuries or musculoskeletal disorders in the foot and ankle, which cause muscle weakness, as well as age, gender, weight, and Body Mass Index (BMI) factors that can affect their functional activities both in everyday life and when doing sports.

2. The Effect of Heel Raise Exercise and Resistance Band Exercise on Functional Ability in Ankle Injuries

Based on Table IV.8, it shows that the results of the influence test using the Paired Sample Test, in group I, with heel raise exercise treatment, obtained a p value (0.000) where if $p < 0.05$, this means that there is an effect of heel raise exercise on functional ability in ankle injuries of Nafas Bintang Barat FC futsal athletes. While the results of the influence test in group II, with resistance band exercise treatment, obtained a p value (0.000) where if $p < 0.05$, this means that there is an effect of resistance band exercise on functional ability in ankle injuries of Nafas Bintang Barat FC futsal athletes. From the data above, it is known that the provision of heel raise exercise in group I and the provision of resistance band exercise in group II, obtained influential results which means that the provision of both interventions can increase functional ability in ankle injuries of Nafas Bintang Barat FC futsal athletes.

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Heel raise exercise causes physiological effects on the nerves and skeleton due to proprioceptive stimulation to maintain a balanced position, which causes the body to adjust so that the center of gravity remains above the base of support (Huang, 2022). In line with research conducted by Hasdianti & Rahman (2022), the provision of heel raise exercise intervention in cases of ankle sprains showed good final results in the form of decreased pain intensity, decreased swelling, increased range of motion of the joints, increased muscle strength, and increased functional ability.

Providing resistance band exercises, on the ankle muscles which are included in the tonic muscle type can increase blood vessel circulation so that muscle strength increases and the contracting muscles (agonists) will activate additional motor units to achieve increased contractile strength in the muscles, so that the muscles work optimally which are depolarized during exercise, producing great strength (Made, 2018). In Arifin's research (2023) explains that resistance band exercise is endurance training, to increase the potential of muscle energy which causes an increase in overall strength in the muscles while practical training with resistance bands improves accurate muscle control and harmonization.

CONCLUSION

Both heel raise exercises and resistance band exercises effectively improve functional ability in athletes with ankle injuries. However, there is no significant difference in effectiveness between the two exercise modalities.

AUTHOR CONTRIBUTION

The writer made a full contribution to this research.

CONFLICT OF INTEREST

This research was conducted without any commercial relationships or sponsorship involvement.

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