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Effects of massage therapy and exercise therapy on recovery of shin splints injury in women's long distance running athletes

Efekty masażu i terapii ćwiczeniowej w leczeniu kontuzji piszczeli u biegaczek na długie dystanse

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Abstract

The high intensity of running athletes' training to overtraining and athletes who are not optimal even forget to do stretching and cooling down causes shin splints injuries. This certainly interferes with the performance of athletes during training and competitions. This study aims to determine the effect of massage therapy and exercise therapy on the recovery of shin splint injuries in female long-distance runners in the master category. This type of research uses a quasi-experimental approach with a One-Control Group Pretest-Postest Design research design. The data collection technique used tests and measurements with a goniometer to measure the range of motion of the joints and a pain scale to determine the level of pain. The population in this study were female marathon athletes aged 42 years and over. The data analysis technique used the paired t-test after previously going through the normality test and homogeneity test. The results showed that there were significant differences in the treatment of massage therapy and exercise therapy, namely decreased pain and increased joint ROM with a value of $p = 0.000$ ($p < 0.05$).

Keywords

massage, exercise, shin splint injuries

Streszczenie

Wysoka intensywność treningów biegaczy często prowadzi do przetreningowania. Sportowcy, którzy nie są w optymalnej kondycji, a czasem nawet zapominają o rozciąganiu i schładzaniu, są podatni na kontuzje piszczeli. Kontuzje te z pewnością wpływają na ich wyniki podczas treningów i zawodów. Niniejsze badanie ma na celu określenie wpływu masażu i terapii ćwiczeniowej na leczenie kontuzji piszczeli u biegaczek na długie dystanse w kategorii mistrzowskiej. Badanie to opiera się na podejściu quasi-eksperymentalnym z jedno-kontrolną grupą w projekcie badawczym przed i po teście. Techniki zbierania danych obejmują testy i pomiary za pomocą goniometru do mierzenia zakresu ruchu stawów oraz skali bólu do określenia poziomu bólu. Populacja badania składa się z biegaczek maratońskich w wieku 42 lat i starszych. Technika analizy danych polega na parowym teście t, po uprzednim sprawdzeniu normalności i jednorodności danych. Wyniki wskazują na znaczące różnice w efektach masażu i terapii ćwiczeniowej, które charakteryzują się zmniejszeniem bólu i zwiększeniem zakresu ruchu stawów, z wartością p równą 0,000 ($p < 0,05$).

Słowa kluczowe

masaż, ćwiczenia, kontuzje piszczeli

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Introduction

Sport plays a role in maintaining people's lives so that they are immune from various diseases. Apart from being physically healthy, exercise also benefits the perpetrator's mental health. By exercising, everyone can relieve stress in their minds and make life more positive. For young people, socializing sports is in the context of finding talented candidates who can eventually be trained to become excellent athletes who will uplift the reputation of the nation and the country. In addition, sport is not only recreational but also aims to support the achievements of athletes both individually and in groups.

One of the most popular sports is running. There are several types of running events including short distance running (sprint) with distances of 100m, 200m, and 400m. Middle distance running (hurdles) with distances of 800m, 1,500m, and 3,000 m. Long-distance running (marathon) ranges from 3,000m to 42km [1]. Marathon running is a type of long-distance sport which is divided into several categories, namely: short marathon (3,000 m, 5,000 m, and 10,000 m), half marathon (21 km), full marathon (42 km), and ultramarathon (> 42 km). To become a long-distance runner, several aspects influence success such as technical, physical, and mental aspects [2]. Various events that are often organized are long-distance running competitions. Running events are often held because they are affordable, vibrant, and massive. One of the goals of long-distance running is to target all age groups, apart from achieving personal bests and providing enjoyment [3].

One of the crucial elements or factors for achieving success in sports besides mastering techniques, tactics, and mental abilities is physical condition. Its importance and its influence on achieving sporting feats depend largely on the requirements of each sport. Marathon running requires robust physical fitness. Essentially, to achieve maximum performance, athletes need structured and planned training.

During normal activity, the heart beats (heart rate) about 70-80 times per minute. When participating in sports, the heart pumps blood rapidly, supplying oxygen to produce energy. In well-trained running athletes, the heart rate can increase to 170-180 beats per minute, while in less trained runners, the rate can rise to 200 beats per minute [4].

Excessive exercise can impair insulin signaling pathways in skeletal muscle without significant changes in insulin tolerance tests. Repeated intense workouts can lead to delayed glycogen resynthesis, with the exercise-induced depletion of muscle glycogen associated with decreased performance [5]. It is not uncommon for marathon athletes to experience overtraining, which impacts their training and competition performances. The adverse effects of overtraining also affect athletes' mental health, leading to increased depression, diminished motivation, anger, and eating disorders [6]. This results in fatigue in up to 10% of athletes, manifesting as disturbed mood, low self-esteem, and depression.

Besides overtraining, another detrimental factor is the habit of neglecting to stretch and cool down after exercise. Cooling down is a crucial step post-exercise. It offers numerous benefits, such as helping blood pressure and body temperature return to normal, aiding muscle relaxation, reducing muscle fatigue, improving flexibility, preventing injury, relieving joint tension, and minimizing the risk of cramps [7].

All components and aspects of training support must be applied to achieve optimal results. This includes knowledge about training periodization. Many athletes, especially those without formal sports coaching backgrounds, possess limited knowledge about training periodization. They only aim for the podium without considering training components like frequency, intensity, and duration.

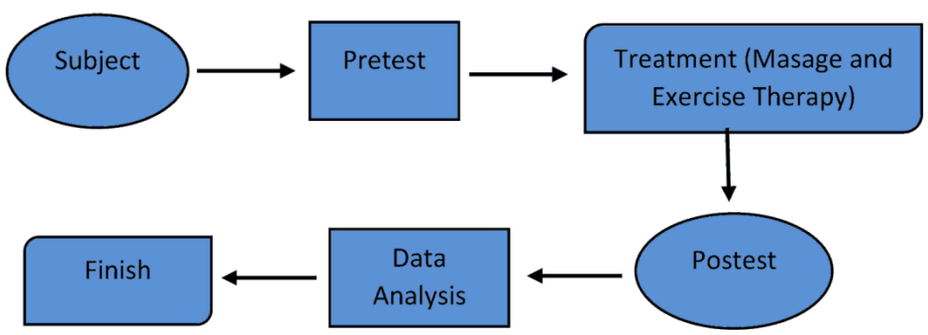
Undertraining or overtraining without structured resistance and strength training affects performance [8]. Overtraining in any form leads to reduced performance and potential injuries. Weight training encompasses various goals, from fitness, muscle building, and weight loss to rehabilitation after an injury. Each training goal is tailored to individual capabilities [9,10].

The accumulation of lactate in the blood hampers physical performance as it induces fatigue and reduces capabilities. Fatigue is a body's natural signal indicating a shift from optimal to suboptimal conditions due to exertion [11]. Muscles, when forced to continue working, experience fatigue caused by the buildup of lactic acid in the muscles and bloodstream. Without proper management, the consequences can be dire [12].

Suboptimal recovery is a significant cause of lactic acid buildup. Lactic acid, a byproduct of carbohydrate metabolism occurring without oxygen (anaerobic metabolism) [13], accumulates when cellular oxygen supply can't support energy production. This acid build-up can result in fatigue during and post-exercise and even cause muscle cramps during activities. It accumulates continuously during sustained activities, leading to pronounced fatigue. Thus, immediate recovery is essential to rejuvenate the body [14, 15].

Material and method

This type of research uses a quasi-experimental approach with a One-Control Group Pretest-Postest Design research design, meaning that this research only uses one group in which there is a pretest before being given treatment or treatment to measure the ability to move the sample, and a posttest after being given treatment to measure final ability after applying the model [16].



Picture 1. Research Flowchart
Source : developed by the author

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The research sample consisted of 8 people with the same case who were included in the master category in running events, namely aged 40 years and over. The sampling technique used was purposive sampling, namely women aged 40 years and over who regularly take part in running training and regularly participate in 10-42 km running events at least twice a month and are willing to take part in the treatment from the researcher.
Samples were taken from pre-test data after which they were given treatment 16 times, and after that, a post-test was carried out again. The instrument used is a goniometer to measure the angle of movement of the ankle joint during flexion and extension, and a pain scale to measure the level of pain.

Results and discussion

In this study, the effects of massage therapy and exercise therapy were observed in reducing pain and increasing the range of motion of joints including plantarflexion and dorsiflexion. The research data were obtained from the pretest and posttest of the respondents. The results of the descriptive analysis on the research data are as follows. The table of the frequency distribution of the pretest and posttest pain scales is in Table 1.

Table 1. Pain scale frequency distribution

Data	Mean	Stdandard Deviation
Pre-test plantar flexion pain	5.38	2.560
Post-test plantar flexion pain	1.75	1.035
Pre-test dorsiflexion pain	7.63	1.768
Post-test dorsiflexion pain	1.75	1.832

From table 1 it is known that the average pre-test pain was 5.38 and decreased in the post-test to 1.75 on plantarflexion. Meanwhile, in the dorsiflexion movement, the pre-test average was 7.63, which decreased to 1.75.

Table 2. Distribution of pain effectiveness

Data	Pretest	Posttest	Difference	Effectiveness
Plantar flexion	5.38	1.75	3.63	67.47%
Dorsiflexion	7.63	1.75	5.88	77.06%

From the above results, it can be concluded that massage therapy and exercise therapy can reduce the pain scale in plantarflexion by 67.47% and dorsiflexion by 77.06%.
From table 3, it is known that the average range of motion (ROM) pre-test was 29.00 and increased in the post-test to 35.13 in plantarflexion. Whereas in the dorsiflexion movement, the pre-test average was 10.13, increasing to 16.75.

Table 3. Range of motion (ROM) frequency distribution

Data collection	Mean	Stdandard Deviation
Pre-test ROM plantar flexion	5.38	2.560
Post-test ROM plantar flexion	1.75	1.035
Pre-test ROM dorsiflexion	7.63	1.768
Post-test ROM dorsiflexion	1.75	1.832

Table 4. ROM Effectiveness distribution

Data	Pretest	Posttest	Difference	Effectiveness
Plantar flexion	29.00	35.13	6.13	21.13%
Dorsiflexion	10.13	16.75	6.62	65.35%

From the above results, it can be concluded that massage therapy and exercise therapy can increase ROM in plantarflexion by 21.13% and dorsiflexion by 65.35%.

From table 5, it is known that all data is greater than 0.05, so the data is normally distributed.

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Table 5. Data normality test results

	Movement	Meeting	Significanc	Description
Pain	Plantar flexion	Prestest	0.631	Normal
		Postest	0.408	Normal
	Dorsiflexion	Prestest	0.476	Normal
		Posttest	0.202	Normal
ROM	Plantar flexion	Prestest	0.945	Normal
		Posttest	0.879	Normal
	Dorsiflexion	Prestest	0.196	Normal
		Posttest	0.623	Normal

Table 6. Pain paired sample test results

Data retrieval	Sig.
Pre-test and Post-test Plantar flexion pain	0.018
Pre-test and Post-test Dorsiflexion pain	0.008
Pre-test and Post-test Plantar flexion ROM	0.001
Pre-test and Post-test Dorsiflexion ROM	0.002

From table 6, it is known that data < 0.05, then H_0 is rejected and H_a is accepted, meaning that there is an average difference between the pretest and posttest in the treatment of massage therapy and exercise therapy in the recovery of shin splits injuries.

In Figure 2 can be seen that each meeting of the sample treatment experienced an increase in joint range of motion with an average increase of around 1.5-2.5 cm.
In Figure 3 can be seen that there was a decrease in pain after being given massage therapy and exercise therapy.

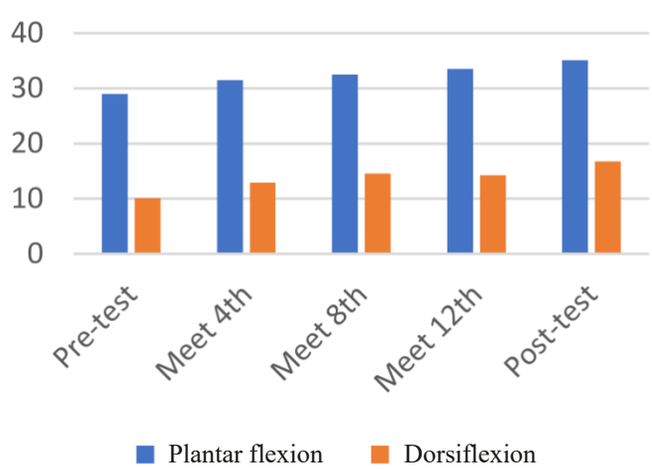

Figure 2. ROM increase

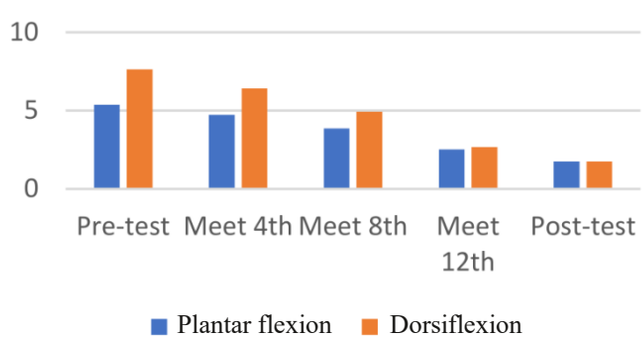

Figure 3. Pain reduction

The occurrence of an impact that exceeds the load limit and damage to soft or hard tissue due to technical errors is a definition of injury. Injury can also be referred to as a disorder in the body that causes pain, heat, peacock (likely meant to be another term), swelling, which cannot function properly in muscles, tendons, ligaments, joints, or bones due to excessive motion or an accident. There are several types of sports injuries including: Bruises (contusion), Sprain (injury to the ligament), Strain (injury to the muscle or tendon), Dislocation (detachment of the joint from its position), Fracture (fracture), Muscle Cramps, Bleeding, Fainting (loss of consciousness), and Wounds [17]. Of the several types of injuries, the most common injury experienced by marathon runners is shin splints [18].
The incidence of MTSS ranges from 13.6% to 20% in runners and up to 35% in military recruits. In dancers, it is present in

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20% of the population, and up to 35% of new recruit runners and dancers will develop it. Shin splints are a painful inflammation of the tibial periosteum most commonly induced by repetitive physical exercise. There are 2 types of shin splints namely; a) Anterior Shin Splints, which is pain that occurs on the front (anterior) of the shin bone (tibia). b) Posterior Shin Splints, the pain is felt on the inside (medial) of the foot on the tibia bone [19].

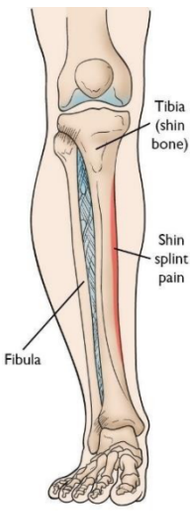

Figure 4. Shin splits injury

In general, injuries are caused by direct physical impact or excessive physical exercise that causes tissue damage. Injuries are usually characterized by inflammatory signs such as rubor, rumor, dolor, fungsilesia [20]. According to the Nomenclature of Athletic Injuries of the American Medical Association, shin splints are pain and discomfort in the foot caused by repeated jogging on hard surfaces or violent, extensive use of the foot flexors [21].

Shin splints often occur after a sudden change in physical activity. This can be a change in frequency, such as increasing the number of days you exercise each week. Changes in duration and intensity, such as running long distances or on an incline, can also lead to shin splints. The pathophysiological process resulting in MTSS is related to the accumulation of unrepaired micro-damage in the cortical bone of the distal tibia. Shin splints can be caused by a variety of factors, including uneven running surfaces, an athlete's level of conditioning, frequent changes in activity level, musculoskeletal abnormalities, running style, and footwear [22]. Running with forefoot contact can be a contributing factor to shin splints or contribute significantly to developing shin splint symptoms. The forefoot, not the heel, makes initial contact when running.

Shin splints injuries can be treated in a number of general ways including ice, rest, stretching, and strengthening. In addition, athletes should avoid running on hard or uneven surfaces and use the right shoes and good footwear. The following is a program conducted by researchers to overcome shin splints injuries (Table 7.).

Table 7. Massage and exercise therapy program

	Meeting 1-4	Meeting 5-8	Meeting 9-12	Meeting 13-16
Masage Therapy	• Efflurage movement 8-12 reps. Intensity 50%, • tapotement Movement 50% in the plantar fascia.	• Efflurage Movemnet 8-10 reps.. Intensitas 60%, • petrisage movement 7-8 reps. intensity 50%.	• Efflurage movement 6-10 reps.. Intensity 70%, • petrisage movement 5-6 reps. Intensity 60%.	• Efflurage movement4-8 reps.. Intensity 80%, • Using Foam roller stick by rolling at under the achilles tendon.
Exercise Theraphy	Pasive and active stretching: 1. Seated calf stretch 8-10 seconds, intensity: 30–50%. 2. Standing quad stretch and reach 8-10 seconds, intensity: 30–50%. 3-way shin stretch 8-10 seconds, intensity: 30–50%.	Body weight exercises: 1. Calf Raises 8-10 reps, intensity: 50–60% 2. Lunges 8-10 reps, intensity: 50–60% Squat 8-10 reps, intensity: 50–60% Weight training with elastic band in combination with PNF.	Weight training with dumbbell: 1. Lunges 10–12 reps, intensity: 60–70% 2. Back lunges 10–12 reps, intensity: 60–70% 3. Side lunges 10–12 reps, intensity: 60–70% 4. Sumo squat 10–12 reps, Intensity: 60–70%	Weight training with weights according to your usual portion: 1. Snatch 8-10 reps, intensity: 50-60% 2. Deadlift 8-10 reps, intensity: 50-60% 3. Stiff deadlift 8-10 reps, intensity: 50-60%

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Conclusion

Based on the results of the study, it can be concluded that the treatment of massage therapy and exercise therapy has an effect on the recovery of shin splints injuries in female running athletes. Massage treatment with effleurage motion and exercise therapy in the form of stretching exercises, PNF, and gradual weight training. The effect that occurred was a decrease in the pain scale of plantarflexion motion by 67.47% and dorsiflexion motion by 77.06% and increased the range of motion joints after treatment by 21.13% in plantarflexion motion and 65.35% in dorsiflexion motion.

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