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The Relationship Between Ankle Angle at Initial Contact and Shin Splints in Recreational Runners

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Abstract

Running is a sport prone to causing injuries, particularly in recreational runners. One common injury is shin splints, characterized by pain in the lower leg often caused by running activities. This study aims to analyze the relationship between ankle angle during initial contact and shin splint severity in recreational runners. A cross-sectional design with an analytical observational approach was used. The sample included 27 recreational runners meeting specific inclusion criteria. Measurements were conducted using the Shin Pain Scoring System to evaluate shin splint severity and the Apecs application to measure ankle angle at initial contact. The data analysis used is Shapiro-Wilk for normality test and Pearson for correlation. The results indicate a significant relationship between ankle angle during initial contact and shin splint severity ($p < 0.05$). These findings suggest that improper ankle angles during initial ground contact may increase the risk of shin splints in recreational runners. This study highlights the importance of proper running techniques to prevent injuries, especially shin splints.

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INTRODUCTION

Running is an athletic sport, there are three categories of running, including sprinting, middle distance running, and marathon running. Sprint running it sellf is running as fast as possible at full speed along the distance that must be traveled, also called short running because the distance traveled is short or close (Jannah et al., 2022). According to research conducted by Sithravelayuthan et al. (2019), the prevalence of injuries can vary in short-distance runners reaching 46.61%, and 54.47% in long-distance runners. the prevalence of injuries that often occur according to the location of injury includes hip 1.40%, quadriceps 3.50%, hamstring 18.18%, knee 22.38%, calf 11.19%, shin 6.29%, ankle 13.29%, foot 3.50% and others 3.50%. And of the injured group, 79% were injured during training and only 16% were injured during competition. In Deshmukh & Phansopkar's (2022) study, in India it was stated that 35% of the athlete population was affected by shin splints.

Injuries experienced by running athletes are generally injuries to the lower extremities, namely the hips to the feet. Injuries that are often experienced by runners or athletes are knee, ankle, shin, deep leg muscles and many other injuries related to the lower extremities. This is natural because running itself uses the legs to run (Vincent et al., 2014). Shin splints are referred to describe the pain (injury to the lower leg) that often occurs as a result of various sporting activities, including running. There are two types of shin splints; a) anterior shin splints, pain on the front of the os. tibia, and b) posterior shin splints, pain on the inside (medial) of the foot at the os. tibia. Shin splints are caused by very small tears in the muscles of the lower leg that are closely connected to the os. tibia. First of all, you will experience a pulling pain after running. Anterior shin splints are caused by imbalances in the leg muscles (Menéndez et al., 2020).Based on research findings from Winkelmann et al., (2016) there are several risk factors for shin splints. In 21 studies reviewed by the author, more than 100 risk factors for shin splints were found, but only nine risk factors were supported by research and with strong evidence in practice, including: body mass index (BMI), navicular drop, joint motion scope (LGS) in ankle plantar-flexion, ankle dorsiflexion, ankle eversion, ankle inversion, hip internal rotation, hip external-rotation, and quadriceps angle.

According to Deshmukh & Phansopkar (2022) several studies have found an association between initial contact and shin splints in runners. Running with initial contact or forefoot contact can cause or contribute significantly to shin splints. Initial contact is the phase when the rear foot makes initial contact with the ground. Unfortunately, there is a lack of recent research focusing on shin splints in recreational runners. Based on this background, the author is interested in raising the research title “The Relationship Between Ankle Angle at Initial Contact with Shin Splints in Recreational Runners”.

METHODS

This study used analytical observational research using the cross-sectional method. Research conducted at one specific time is called cross-sectional research. This research is only used at a certain time, and there will be no other research at a different time to compare (Kusumastuti et al., 2020). The type of analytic survey research is research that finds out the process of health phenomena that can occur. Then analyze the correlation between the two variables. In this study, the researcher wants to know

whether or not there is a relationship between the ankle angle during initial contact running and the appearance of shin splints in recreational runners at the Gasibu Field in Bandung.

Participants

Population refers to the individuals who are the subject of a study or a group of people who have certain characteristics to be studied (Roflin et al., 2021). The population in this study were 27 recreational runners.

Sampling Procedures

According to Sugiyono & Nuryanto (2007), a sample is part of the number and characteristics of a population. Meanwhile, according to Bungin (2019) the sample is representative of all strata units and so on in the population. The sample that researchers will use in the study is a population that meets the inclusion criteria of 27 people according to the results of G*Power.

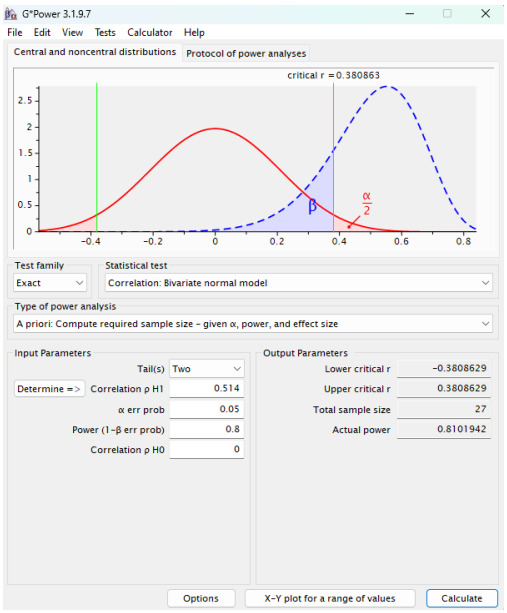

Figure 1. Results from G*Power

For the tail (s) parameter using two because the hypothesis is not unidirectional. Then the correlation parameter ρ H1 uses the results of research by Almansoof et al., (2023) there was a correlation between ankle angle and lower-limb kinetic chain function and hop test performance in male recreational athletes (rho = 0.514, 95% CI [0.092-0.779], p<0.01).

The sampling technique used in this study was random sampling, where respondents were selected from one of the running clubs in Bandung. Random sampling is the simplest technique in probability sampling methods, which is used to select a sample from a population (Kusumastuti et al., 2020).

The following inclusion criteria include: 1. Recreational runners 2. Running pace 5-8 km/h 3. Running at least 2x a week 4. Being in the productive age range of 15-64 years 5. Running time of at least 30 minutes

Exclusion: 1. Runners with ankle injury 2. Runners with cardiovascular disease 3. Runners who are not willing to participate in the study

Materials and apparatus

This study used the Shin Pain Scoring System research instrument. The Shin Pain Scoring System is a measuring tool used to measure the severity of pain associated with the condition of Shin Splints. There are 3 assessment categories, namely: Category 1 with a total score for women 0 - 5 and men with a total score of 0 - 1, Category 2 with a total score for women 6 - 16 and men with a total score of 2 - 13, Category 3 with a total score for women 17 - 29 and men with a total score of 14 – 29 (Nussbaum et al., 2019). Examination of the ankle angle is carried out using the Apecs application: Body Posture Evaluation which is a digital measuring instrument to

measure the angle of a joint that has a high reliability and validity value (ICC> 90) so that it can be used in research and makes it easier for researchers to process data because it is accompanied by images (Trovato et al., 2022). In research by Szucs & Brown (2018) the reliability and validity of the Apecs application has an ICC value of 0.71-0.99, which means that this application has strong reliability and validity.

Procedures

The procedure in the Shin Pain Scoring System aims to assess the intensity and impact of pain felt in the affected area of injuries such as Shin Splints. Here are the steps in the Shin Pain Scoring System procedure :

1. Initial assessment
   - Interview the patient regarding when the pain first appeared, what triggers or aggravates the pain, is there a history of injury or certain sports that may affect this condition.
   - Physical Examination: A physical examination is performed to assess the affected area, looking for signs of inflammation, swelling, or tension in the muscles and tissues around the tibia bone.
2. Use of rating scale
   - Pain intensity: Patients will be asked to rate how severe their pain is. A scale of 0 - 10, where 0 means that there is no pain but 10 means that the pain is severe.
   - Frequency of pain: Score 0 no pain. Scores 1 - 3 pain appears only occasionally, perhaps only after certain activities. Score 4 - 6 pain occurs frequently, for example during or after exercise. Score 7 - 9 pain occurs frequently, sometimes even at rest. Score 10 pain is very frequent, even when not moving.
   - Duration of pain: How long the pain persists after activity or whether any pain persists throughout the day. The patient is asked to assess the duration of pain on the day or after engaging in activity.
   - Effect on activity: Score 0 - 3 pain does not interfere with activity or only slightly interferes. Scores 4 - 6 pain moderately interferes with daily activities or light exercise. Score 7 - 9 pain interferes with many daily activities or inhibits sports training. Score 10 pain severely interferes with or inhibits almost all activities.
3. Determination of total score
   After evaluating the above factors, the scores given in each category will be combined to produce a total score.

Design or data analysis

Data analysis plan to be carried out: univariate data used are age, gender, BMI, occupation, running duration, shoe type, and running track type. Univariate is the analysis of research data using descriptive statistics. This analysis only uses one variable. Univariate analysis is a simplification or summarization of a collection of research data (measurement results) so that the data set turns into useful information.

Bivariate data analysis, data analysis techniques begin with a data normality test using the shapiro-wilk test. If the 2-tailed significance value > 0.05, the data is considered normally distributed and then the Pearson product-moment analysis test can be carried out. If the 2-tailed significance value <0.05, then the data is considered not normally distributed and then the Spearman's rho test analysis is carried out.. The final stage is drawing conclusions from data analysis by looking at the reduction results and analysis

objectives. Drawing conclusions is done to find out the relationship, similarities, or differences from existing problems as a solution.

RESULT

This research was conducted with 27 respondents who are recreational runners experiencing Shin Splints, with the following characteristics:

Table 1. Characteristics of Respondents

Variabel	Value (n or mean ±SD)
Gender	
Man	21
Women	6
Age (years)	22.40 ± 0.51
BMI (kg/m2)	25.50 ± 2.32
Occupation	
Student	22
Employee	3
Freelancer	2
Running Duration (hours/week)	6.50 ± 2.10
Shoe Type	
Special Running Shoes:	18
Regular Sports Shoes:	9
Running Track Type	
Asphalt	12
Dirt	9
Treadmill	6

Source: Primary Data

Based on the data above, the majority of respondents were male 21 respondents, with an average age of 22.40 years and a BMI of 25.50. Most respondents were students, 22 respondents, with an average running duration of 6.50 hours per week. The majority used special running shoes for 18 respondents and ran on asphalt tracks for 12 respondents.

Table 2. Research of Respondents

Variabel	n	Value (mean ±SD)
Initial Contact	27	106.15 ± 8.52
Shin Pain Score System	27	23.63 ± 1.74

Source: Primary Data

Based on the data above, the average value for Initial Contact is 106.15 with a standard deviation of 8.52, based on 27 respondents. Meanwhile, the average value for the Shin Pain Score is 23.63 with a standard deviation of 1.74, also based on 27 respondents.

Table 3. Shapiro Wilk Data Normality Test

Variabel	p-value
Initial Contact	0.967
Shin Pain Score System	0.538

Source: Primary Data

Based on the Shapiro-Wilk normality test, the p-value for Initial Contact is 0.967, and for the Shin Pain Score System, it is 0.538. Since both p-values are greater than 0.05, the data for both variables can be considered normally distributed.

Table 4. Pearson Correlation Test

Variabel	p-value
Initial Contact	0.001
Shin Pain Score System	0.001

Source: Primary Data

Hypothesis:

H0: There is no significant correlation between Initial Contact and Shin Pain Score.

H1: There is a significant correlation between Initial Contact and Shin Pain Score.

Based on the Pearson correlation test, the p-value is 0.001. Since the p-value is less than 0.05, we reject the null hypothesis (H0) and conclude that there is a significant correlation between Initial Contact and Shin Pain Score.

DISCUSSION

This study shows a significant relationship between Initial Contact and Shin Pain Score in recreational runners experiencing shin splints. Using data from 27 respondents, the Pearson correlation test revealed a p-value of 0.001, indicating a significant correlation between foot strike mechanics and the severity of shin pain. This is in line with findings from a study conducted by Xu et al. (2020) stated that the ankle angle at initial contact plays an important role in the distribution of biomechanical load on the lower extremities. They found that the forefoot strike (FFS) landing pattern was associated with an increased plantarflexion angle at initial contact, followed by an increase in eccentric load, axial contact force, and negative work at the ankle joint. In contrast, rearfoot strike (RFS) tends to increase ground reaction forces and load on the knee joint. These findings suggest that variations in the ankle angle at initial contact can affect the distribution of biomechanical loads and potentially contribute to injuries such as shin splints in runners.

The article by Loudon & Reiman (2012) mentions that biomechanical factors, such as pelvic movement, hip rotation, and ankle angle at initial contact, play a crucial role in increasing the risk of shin splints. Both studies identify how lower body kinematic variables can affect the distribution of forces absorbed by the tibia, which may potentially cause or exacerbate conditions like MSP and shin splints in runners. The study by Willwacher et al. (2022) reports that shin splints are a common injury among runners related to repetitive loading on the tibia. In the review, several biomechanical factors are mentioned, such as frontal plane motion (including ankle angle), hip rotation, and knee valgus (inward knee movement), which have been found to contribute to an increased risk of injury.

CONCLUSION

Based on the results of this study there is a significant correlation between Initial Contact and Shin Pain Score in recreational runners who experience Shin Splints.

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