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<https://ejournal.upi.edu/index.php/penjas/article/view/55438>DOI: <https://doi.org/10.17509/jpjo.v8i1.55438>**Correlation between Running Distance and Iliotibial Band Syndrome among Yogyakarta Runners****Konara Budi Sudrajat*, Farid Rahman**

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Article Info*Article History :**Received February 2023**Revised March 2023**Accepted March 2023**Available online April 2023**Keywords :**distance Runner, iliotibial band syndrome***Abstract**

Running is a sport with the largest number of participants worldwide. This sport is one of the most frequently held sports. Iliotibial band syndrome (ITBS) is a common syndrome in runners. It even becomes the second most common injury occurring in 1.6% - 12% of all injuries in runners. ITBS can affect up to 10% of active runners. Excessive tension in the iliotibial band (ITB) causes infection and tissue compression, causing iliotibial band syndrome (ITBS). This research aimed to understand the relationship between running distance and the incidence of iliotibial band syndrome in runners. This study used a correlation study method with a cross-sectional approach. In this study, the authors applied the non-probability and incidental sampling techniques. The samples of the study were 80 runners who had consistently run for more than three months. The research data collection instruments included Ober's test for iliotibial band syndrome and a Google form questionnaire for the respondent history. Hypothesis testing used the Chi-Square. The data analysis on the relationship between running distance and the incidence of iliotibial band syndrome found no relationship. It indicates that running distance does not affect the incidence of iliotibial band syndrome in runners. The authors hope that this research can become a baseline or basis for developing preventive interventions for iliotibial band syndrome.

INTRODUCTION

Maintaining health is essential to do. Maintaining health is reflected in the good physical condition of a person (Sinuraya & Barus, 2020). Health is not only judged by being free from all diseases, it also includes suitable physical, mental, and social conditions. Running is a sport that is currently popular in society and has become a routine activity to adopt a healthy lifestyle (Pane, 2015).

Running is a sport that has the most participants in the world (Scheerder, Breedveld, and Borgers, 2015). The community and running events are increasingly popular and popping up, so the running ecosystem is getting alive. The world-class annual event, the Berlin Marathon, is the most popular marathon race involving 387,222 participants from 2008 to 2018 (Nikolaidis et al., 2019). The Borobudur Marathon is not less famous than the Berlin Marathon, attended by tens of thousands of participants worldwide.

Running is to make a place or forward to the front performed quickly, where the pushing force of the foot back on the soil is done by scavenging so that the second foot is floating in the air (Aristianto et al., 2013). Running is the frequency of accelerated steps so that there is a tendency to float when running. This means that, at the time of running, both feet do not touch the ground or at least one foot still touches the ground (Parwata, 2017). According to Anggraningrum (2014), the peak of increased interest in running in Indonesia occurred in 2013-2014, as evidenced by the spread of the IndoRunners community in Indonesia and abroad. IndoRunners, with the "let us run" slogan, seems to be able to anesthetize people to actively maintain their health by running. Indorunners always gets new members at every running event because this community is an excellent place to gather and socialize with other running lovers who have various backgrounds and motives.

One of Indonesia's most significant annual events is the Pocari Sweat Run 2022, with nearly 20,000 runners coming from Sabang to Merauke (Nursalam, 2022). Big names such as Ridwan Kamil, Najwa Shihab, Ganjar Pranowo, and even Sandiaga Uno, the Minister of Tourism and Creative Economy of the Republic of Indonesia, participated in enlivening this annual running event. The three running categories of the Pocari Sweat Run 2022 are 10K (10 kilometers), Half

Marathon (21 km), and Marathon (42 km).

Running is one of the most frequently held sports. Long-distance running competitions generally have several categories, namely 5 km, 10 km, 21 km (half marathon), 42 km (full marathon), and more than 42 km (Ultra Marathon) (Siregar, 2018). Participation in ultra-endurance running among young athletes is increasing, but there is no conclusive evidence that distance events are dangerous or safe (Scheer et al., 2021). Adequate medical support during running training to ultramarathons needs adjustments to environmental conditions, event size, distance, and duration during the event (Hoffman et al., 2020). When comparing the best male and female runners in an ultramarathon, the difference between the sexes was higher than 10–12% (Le Mat et al., 2023). Although men and women show differences in running biomechanics, they do not differ in running economy (Besson et al., 2022).

The public has a high enthusiasm for long-distance running, both to prove themselves or to gain achievements. According to Natal (2018), long-distance running number is one of the most accomplished in the 2016 Palu Nomoni International Marathon competition on 25 September 2016, with the winner, Yayuk Sri Wahyuningsih, Revi Fayola, and Yuli Rianatasia. Injuries to runners due to overuse often occur, at least in runners with a distance of 5 km.

Increased Q-angle and poor running technique over long distances are closely related to injury (Kozinc & Šarabon, 2017). Hreljac (2004) states that the common causes of running injuries due to overuse include the amount of force and knee joint moment, the amount of active (driving) force, the amount of impact force, and the rate of impact loading. Long distances and long running times create friction and compression on the fatty pads distal to the iliotibial band, so iliotibial band syndrome often occurs.

The running-related biomechanical risk factors include kinematic and kinetic parameters derived from ground reaction forces, stress mapping, electromyography, and motion capture data (Willwacher et al., 2022). Different biomechanics of movement can create different risk factors of overuse injuries on runners (de Souza Júnior et al., 2023). Currently, there is no evidence supporting statement that switching from hindfoot to non-backfoot strikes may reduce injury risks or increase running economy (Anderson et al., 2020). Increasing

speed will reduce the load on the tibia to reduce stress on the lower extremity bones (Keast et al., 2022). There is a gap between science and best practices regarding how training principles and methods should be applied for elite middle-distance running performance (Haugen et al., 2021). Practitioners must exercise with caution when using spatial-temporal parameters to determine runner injury risks (Brindle et al., 2020).

An injury that often occurs in athletes is a sprain, an injury to the joint that results in a tear in the ligament. Sprains occur due to sudden and excessive pressure on the joint, or due to repeated overuse. Mild sprains are usually accompanied by a hematoma with some of the ligament fibers breaking, whereas in moderate sprains fluid effusion occurs which causes swelling. In severe sprains, all ligament fibers break so that they cannot be moved as usual causing severe pain, swelling, and the presence of blood in the joints (Johnson, 2008). Joint dislocations are also common in athletes, namely slipping of the joint hump from its place. If a joint has ever been dislocated, the ligaments in that joint will loosen, so that the joint can easily be dislocated again (habitual dislocation). To handle the dislocation injury in the event, immediately pulling the joint with the longitudinal axis is necessary.

According to Friede (2022), iliotibial band syndrome (ITBS) is caused by excess tension in the iliotibial band (ITB), causing inflammation and compression of the underlying tissue. Maximum friction occurs when the fibers of the posterior iliotibial band pass over the lateral femoral epicondyle during knee flexion of 20 to 30 degrees, which occurs due to repeated knee flexion and extension (Hadeed & Tapscott, 2020). According to Zein (2018), ITBS injuries can cause symptoms in the form of pain, swelling, to stiffness in the lateral area of the thigh to the knee. Usually, sufferers experience limitations in activities that involve the knee. Risk factors for ITBS include protrusion of the greater trochanter of the femur, leg-length discrepancy, excessive pronation of the feet, genu varus (O-shaped leg), weakness of the knee extensor muscles, knee flexors, and hip abductors. The causes might include neglected ITB stiffness and errors when carrying out exercises, such as distances that are too far, increasing the distance running too fast, wrong warm-up, and running on the same surface conditions (Charles & Rodgers, 2020)

The incidence of iliotibial band syndrome is com-

mon in runners, even being the second most common injury occurring with 1.6% - 12% of all injuries in runners. In contrast, according to Frederickson (2005), the incidence of ITBS in runners is estimated at 5% and 14%. Klauser (2022) says the incidence of ITBS affects up to 10% of active runners. Iliotibial band syndrome (ITBS) is an injury that refers to pain around the femoral lateral epicondyle associated with excessive activity in the lower extremities and mainly occurs in runners (Flato et al., 2017). The injury is caused by friction of the iliotibial band, which moves across the lateral epicondyles of the femur while running (Waldman, 2019). Friction occurs after the foot strike phase of the gait cycle when the knee is flexed between 20 and 30 degrees (Migliorini et al., 2020). Continued friction on the iliotibial band will cause inflammation (Waldman, 2019). ITBS causes pain on the lateral side of the knee when running or doing activities. However, when ITBS is not appropriately handled in chronic cases, pain can appear when not running or when runners have just started running (Arnold & Moody, 2018). According to Pegrum (2019), this injury causes pain and will further impact decreased performance and function of the lower extremities in runners.

The correct exercise method is essential to reduce the risk of injury. Some prevention methods include carrying out health checks, applying good eating and rest rules, using sports equipment to protect the body, and warming up before performing core sports (McGowan, 2015). Warming up is essential to prevent injury, but the athlete risk remains high when the warm-up is ineffective (Nurcahyo, 2015). Warming up must be carried out effectively and pleasantly to maximize the benefits (Susanto et al., 2021).

Warming up must be done before carrying out core training to prevent injuries, but if the warm-up is not practical, it can also cause injury to athletes (Nurcahyo, 2015). Therefore, the warm-up must be fun so that the benefits of the warm-up are more effective (Susanto et al., 2021).

The correlation between running distance and the incidence of iliotibial band syndrome should be studied and explored, since iliotibial band syndrome caused by excessive activity and distance often become variable in the incidence of ITBS. However, no scientific studies show a correlation between running distance and the incidence of iliotibial band syndrome. Based on the ex-

planation above, the purpose of this study is to examine the correlation between running distance and iliotibial band syndrome among Yogyakarta runners.

METHODS

This study used a correlation study with a cross-sectional approach, research emphasizing the time of observation or data measurement one at a time tested on the dependent and independent variables. This type of research is used to determine the correlation between one variable and the other variables. In this case, this research was to determine the correlation between Running Distance and Iliotibial Band Syndrome (ITBS). Running distance is the length of the track passed by a runner from the start to the finish line. Iliotibial band syndrome is an overuse injury that commonly occurs in runners and cyclists due to friction of the iliotibial band rubbing against the lateral femoral epicondyle. Overuse injuries are caused by a part that receives continuous loads in the same place. This part will eventually become vulnerable, thus overuse injuries will occur.

Overuse injury, often known as repetitive strain injury, is a term used to describe damage and pain due to a repetitive and excessive movement. These injuries impact a person muscles, nerves, ligaments, and tendons resulting from improper overuse. Symptoms of an overuse injury include pain, stiffness, or tingling in the affected area.

Participants

The population of this study were runners who were members of running communities in the Special Region of Yogyakarta and Magelang City, Central Java. The population of the study included 96 people, who were then selected following inclusion criteria, namely the respondent who consistently run during more than three months. As the result of the selection, 80 respondents were chosen as samples. The sample is part of the population studied in a study, where the results reflect the original population but not the population itself. The sample is considered representative of the population whose results represent the overall symptoms observed.

Sampling Procedures

Sampling technique is a technique used to determine the sample. So, a good study must pay attention to

and use a suitable technique in determining the sample to be taken as the research subject. The sampling technique used in this study was a non-probability sampling technique with the incidental sampling method. Random sampling is a sampling technique based on coincidence, anyone who accidentally meets the researcher can be used as the sample if it is deemed that the person met by chance is suitable as the data sources.

Data collection techniques are techniques or methods used to collect data to be studied. Data collection techniques require strategic and systematic steps to obtain valid data. The data collection technique used in this study was a questionnaire, distributed via the Google Form, and specific tests related to Iliotibial Band Syndrome (ITBS). This questionnaire was intended to find out the correlation between running distance and the incidence of Iliotibial Band Syndrome, the distance often used by runners, and the frequency of Iliotibial Band Syndrome injury experienced by runners.

Materials and Apparatus

Specific examinations were carried out to check the things needed to establish a diagnosis or the basis for the formulation of problematic goals and physiotherapy actions. A specific test is a process in which a physiotherapist examines the patient body to find clinical signs of the disease. The results of the examination are used to determine the right therapeutic method for the patient.

Specific Tests in this study were carried out systematically according to the following procedure:

- the test was started from the patient position and ended with the last movement
- from the instructions obtained during the Specific Test, the physiotherapist arranged a course of therapy with doses that had been adjusted according to the severity and medical conditions causing the patient complaints
- several tests were carried out to confirm the cause
- a complete examination consisted of a self-assessment of the patient general conditions
- in practice, vital signs or temperature, pulse, and blood pressure checks, were always taken first.

Procedure

The specific test used was the Ober's test and the noble test. The Ober's test was carried out with the sub-

ject lying sideways, then one hand held (fixation) the pelvis, while the other hand abducted the leg and then slowly lowered it. When the leg stayed in the air/could not come down, it meant that the test was positive.

The noble compression test was performed to determine the condition of ITBS by the examiner by applying pressure to the individual along the iliotibial band which could be palpated, which was approximately 2 cm proximal to the lateral femoral epicondyle while passively bending (flexing) the knee from 0 to 60 degrees. The result was said to be positive when there was a pain at the time of 30-degree flexion.

Ethical Clearance (EC) or ethical eligibility is a written statement by the research ethics committee for research involving living things stating that a research proposal is feasible after fulfilling specific requirements. Any research involving humans is required to obtain ethical clearance. This ethical clearance is necessary to ensure that research meets the principles of respect for human dignity (respect for person), the principle of doing good that is beneficial (beneficence) and does not harm (non-mal-benefit), and the principle of justice (justice). Health Law No. 36 of 2009 Chapter V Article 44 states that the trial must be non-detrimental and the person being tested must have permission. This research has been approved by the Research Health Ethics Commission (KKKP) FK UMS and has received an Ethical Eligibility Letter with No. 4596/B.2/KEPK-FK UMS/XI/2022.

The implementation of sampling in this study had obtained written consent from the respondent in the form of informed consent. Informed consent (IC) in this study was a consent given consciously and freely by runners or potential research subjects to be willing to accept an experimental action or risky intervention after he/she had received relevant and sufficient information regarding the treatment he or she would received.

Data Analysis

Characteristics are signs or features that can be used as identification. Characteristics can also be interpreted as something that can distinguish one thing from another that can be used to identify data. The normality test is a test carried out to assess the distribution of data in a group of data or variables, whether the data distribution is normally distributed or not. The assumption test is one of the requirements in statistical science that

must be met in the analysis of multiple linear regression on an ordinary least squares or OLS basis. The regression analysis is not based on OLS, because it does not require the requirements of the classical assumptions. The purpose of testing this classical assumption is to provide certainty that the regression equation obtained has estimation accuracy, is not biased, and is consistent. The classical assumption is the conditions that must be met in the OLS linear regression model so that the model becomes valid as an estimator.

The data analysis technique used in this study required several stages, including knowing the characteristics of the data, conducting a data normality test, and finally testing the data assumptions, including:

1. Univariate

Univariate analysis was carried out to analyze each variable from the research results. The univariate analysis summarized the measurement data set in mean, standard deviation, and frequency, thus the data set turned into helpful information.

2. Bivariate

Bivariate analysis was used on two variables suspected to be related or correlated by chi square because the used data were nominal/categorical.

RESULT

Research results described the running distance and the incidence of iliotibial band syndrome in runners for knowing the connection between distance and the incidence of iliotibial band syndrome in runners in the running community in the Special Region of Yogyakarta, the City of Magelang, Central Java.

The samples of the study were the runners, including 96 people as the population who were then selected following inclusion criteria, namely the respondent who consistently run for more than three months. According to the selection results, 80 respondents were selected as samples.

The study was carried out in September - November 2022 using an incidental approach. Iliotibial band syndrome was measured using Ober's test and Noble test to know the tension condition on the iliotibial band. The test also helped differentiate Iliotibial band syndrome from other painful lateral knee. The data collec-

tion results can be seen in the following table and diagram.

Table 1. Data Characteristics

	N	Mean ± STDEV	Median ± STDEV	Mode ± STDEV
Age	80	39.01 ± 8.82	39.00 ± 8.82	34 ± 8.82
Right Fascia Latae corner	80	30.21 ± 7.47	31.00 ± 7.47	32 ± 7.47
Left Fascia Latae corner	80	28.92 ± 7.24	29.00 ± 7.24	28 ± 7.24
Right Hamstring Flexibility	80	94.73 ± 13.73	95 ± 13.73	90 ± 13.73
Left Hamstring Flexibility	80	94.18 ± 18.44	95 ± 18.44	80 ± 18.44
Right Abductor Strength	80	189.93 ± 63.22	200.00 ± 63.22	200.00 ± 63.22
Left Abductor Strength	80	195.06 ± 59.46	200.00 ± 59.46	200.00 ± 59.46

Table 2. Frequency Distribution of Research Variables

Variable	%	N
Road Runners	56%	51
Trail Runners	32%	29
<5km	31%	28
>5km	57%	52
ITBS Right	40%	32
ITBS Left	60%	48
Right Positive ITBS	46%	37
Left Positive ITBS	53%	43
Amount %/N	100	80

Table 3. Correlation Test (Chi-Square Test) CI = 95%

Variable	N	Asymp Sig	Conclusion
Running distance-ITBS(R)	80	0.899	H ₀ is accepted
Running distance-ITBS (L)	80	0.203	H ₀ is accepted

Based on Table 1, the data show that, for age, the average value was 39.01, the median value was 39.00, and the frequency value was 34. The Right Fascia Latae Angle received an average value of 30.21, a median value of 31.00, and a frequency value of 32. Meanwhile, the Left Fascia Latae Angle obtained an average value of 28.92, a median value of 29.00, and a frequent occurrence of 28. For Right Hamstring Flexibility, the average value was 94.73, the median value was 95, and the frequency value was 90.

Meanwhile, in Left Hamstring Flexibility, the average value was 94.18, the median value was 95, and the frequency value was 80. The Abductor Strength on the right gained an average value of 189.93, a median value of 200.00, and a frequency value of 200.00. Left Abductor Flexibility got an average value of 195.06, a median value of 200.00, and a frequency value of 200.00.

The results of the data collection were obtained from the questionnaire and the specific test on each

respondent. The questionnaire was distributed via Google Form link provided by the researchers. Specific

examinations were carried out to check the things needed to establish a diagnosis or the basis for formulating problematic goals and physiotherapy actions.

The specific test used was the Ober's test and the Noble test. The Ober's test was carried out with the subject lying sideways, then one hand held (fixation) the pelvis, abducted the leg, and then slowly lowered it. The test was said positive when the leg stayed in the air/could not come down. The Noble compression test was performed to determine the condition of ITBS by applying pressure to the individual along the iliotibial band which could be palpated, which was approximately 2 cm proximal to the lateral femoral epicondyle while passively bending (flexing) the knee from 0 to 60 degrees. The result was said to be positive when there was a pain at the time of 30-degree flexion. Hip abductor strength test was carried out by placing a sphygmomanometer in the abductor hip, then pumping up to 100 mm Hg as a benchmark, and keeping the valve closed to remove all folds. Hip abduction movement was performed for 5 seconds followed by giving a verbal signal "One, two, three GO" and recording the change from 100 to the maximal contraction occurring in the hip abductor (Souza et al., 2014).

According to Table 2, the frequency distribution of the research variables showed that the road runner variable gained a value of 56% and n 51. The trail runner variable got a value of 32% and n 29. The incidence of Iliotibial Band Syndrome (ITBS) was also influenced by running distance. The < 5 km distance obtained a value of 31% and n 28, whereas the > 5 km distance got a value of 57% and n 52. The Iliotibial Band Syndrome (ITBS) was divided into 2, namely positive negative right and positive negative left. The positive rights gained a value of 40% and n 32, while negative rights got a value of 60% and n 48. The positive left gained a

value of 46% and n 37, while the negative left got a value of 53% and n 43.

The chi-square correlation test using SPSS software version 25, tested on 80 respondents, obtained a significance score of 0.899 for correlation between distance run and incident of ITBS on the right leg and 0.203 for correlation between running distance and incident of ITBS on the left leg. According to Singgih Santoso (2014:222), the base of taking decisions in the chi-square test can be conducted by examining the value of the output table "Chi-Square Test" as the result of SPSS data processing. The Chi-Square test is one of the internal test equipments frequently used in practice. The decision was taken based on the significance score. Because the score $\text{asympt. Sig. (2-sided)} > 0.05$, H_0 is accepted and H_a is rejected. Thereby, it indicates that there is no correlation between running distance and iliotibial band syndrome in runners. It could also mean that running distance taken by the runners did not affect the incidence of iliotibial band syndrome.

DISCUSSION

This study used an incidental sampling technique involving 80 samples. Participants of the study were from run community in the special region of Yogyakarta and Magelang, Central Java, who had fulfilled inclusion criteria. Iliotibial band syndrome was measured using Ober's test instrument and the Noble test to know the condition of tension on the iliotibial band. This test this also helped differentiate iliotibial band syndrome from other general painful lateral knee.

Research results found no connection between running distance and the incidence of iliotibial band syndrome, proven by statistical test results namely correlation test resulting at score $\text{asympt. Sig. } 0.899$ for the right leg and 0.203 for the left leg. In line with (Sukmawati, 2022), injury in running parts is significantly caused by overuse of the musculoskeletal system. According to (Nielsen, 2014), errors in training is also one of the reasons of injury. Overuse injuries in runners are associated with error training, including overuse, change in rapid intensity, and sudden increased running distance. Enhancement of excessive running distance in a sudden manner could burden the ability to change and repair network.

The incidence of iliotibial band syndrome is com-

mon in runners, even being the second most common injury occurring with 1.6% - 12% of all injuries in runners. In contrast, according to Frederickson (2005), the incidence of ITBS in runners is estimated at 5% and 14%. Klauser (2022) says that the incidence of ITBS affects up to 10% of active runners. Iliotibial band syndrome (ITBS) is an injury that refers to pain around the femoral lateral epicondyle associated with excessive activity in the lower extremities and mainly occurs in runners (flato et al., 2017).

Injuries to runners due to overuse often occur in runners with at least a 5 km distance. Increased q-angle and poor running technique over long distances are closely related to injury (Kozinc & šarabon, 2017). Hreljac (2004) says that the common causes of overuse injuries in running include the amount of force and knee joint moment, the amount of active (driving) force, the amount of impact force, and the rate of impact loading. Long distances and long running times create friction and compression on the fatty pads distal to the iliotibial band, so iliotibial band syndrome often occurs. The proper exercise method is essential to reduce the risk of injury. Some of the preventions that can be done are carrying out health checks, applying good eating and rest rules, using sport equipments that can protect the body, and warming up before performing core sports (Ayu Tri Widhiyanti, 2018). Warming up is essential to prevent injury, but when the warm-up is not adequate, the risk of injury remains high for athletes (nurcahyo, 2015).

Warming up must be conducted before engaging in core training to prevent injury, but if the warm-up is not practical, it can also cause injury to athletes (nurcahyo, 2015). Collaboration between power stability and speed joints will generate power, as the ability of a muscle to do work or oppose burden in the shortest possible time (Saputra & Agus, 2021). Muscle strength in these muscle limbs will positively contribute to the achievement of speed running (Agus, Fahrizqi, & Wicaksono, 2021). Therefore, muscle strength is an essential component for increasing the whole condition, because power strength plays important roles in protecting the athlete of possible injury and enables athletes to run more quickly (Agus & Fahrizqi, 2020). The limitations of this study are laid in its implementation. It did not use kinematic, biomechanical, and gold standards in its evaluation. Further research is suggested to use gold

standards in the sample measurements and involve recreational and professional runners.

CONCLUSION

Based on the result, this study concludes that running distance and the incidence of iliotibial band syndrome in runners do not have correlation. However, the result of the research could become a reference or step for developing further study related to the correlation between running distance and the incidence of iliotibial band syndrome. Further research is suggest to to use the gold test standard, kinematic standards, and biomechanical standards. Samples must include recreational and professional runners.

CONFLICT OF INTEREST

The authors declared no conflict of interest.

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