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Anatomical Structure of Duck Feet and Running Exercise Intensity on the Risk of Musculoskeletal Injuries in Runners in Indonesia: Literature Review

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Abstract: The anatomical structure of the foot plays an important role in biomechanical efficiency when running. One of the anatomical variations that is often found is the duck feet condition, which is a position of the feet that points outward when walking or running. This study aims to examine the effect of duck feet and the intensity of running training on the risk of musculoskeletal injuries in runners, especially in Indonesia. The method used is a literature review of various relevant national and international journals in the last 5 years. The results of the study indicate that duck feet posture can cause biomechanical imbalances that increase pressure on the knee, ankle, and lower back joints, and contribute to the risk of recurrent injury. Meanwhile, excessive training intensity without proper control also exacerbates the risk of injury. A better understanding of the foot structure and training intensity settings is needed from coaches, physiotherapists, and runners to prevent long-term musculoskeletal injuries.

Keywords: Duck Feet, Musculoskeletal Injury, Running Intensity, Biomechanics, Indonesian Runners.

INTRODUCTION

Running has become a healthy lifestyle trend in Indonesia in recent years. Data from the Indonesian National Sports Committee (KONI) shows that public participation in running activities has increased by 35% since 2020, both through running communities, marathon events, and personal activities. Unfortunately, this increase in interest is also accompanied by a spike in musculoskeletal injury cases, especially in amateur runners who do not understand the biomechanical risks of the body when running.

One important but often overlooked risk factor is the anatomical structure of duck feet (flat feet/pes planus). This disorder is characterized by the loss of the arch of the foot, which affects the distribution of weight when standing and running. Individuals with duck feet tend to experience impaired stability and increased pressure on certain joints, which can trigger muscle and bone injuries. A study by Afshari et al. (2021) states that runners with flat feet have a higher potential for injury due to postural imbalance when running.

In addition, the intensity of running training—including frequency, duration, and speed—also plays an important role in triggering or exacerbating the risk of injury. Excessive training without supervision or proper technique can cause repeated stress on muscle tissue and joints, especially in runners with less than ideal foot conditions.

The urgency of this research lies in the importance of multidisciplinary understanding between health science, pharmacy, and sports in preventing running injuries, especially among Indonesian runners. This article examines in depth the influence of duckfoot structure and running training intensity on the risk of musculoskeletal injuries, with the aim of expanding academic understanding and encouraging more effective preventive practices.

Based on this background, the purpose of writing this article is to build a hypothesis for further research, namely to formulate: 1) The role of the anatomical structure of duckfoot on the risk of musculoskeletal injuries in runners; and 2) The role of running training intensity on the risk of musculoskeletal injuries in runners.

METHOD

The method of writing this literature review article uses the Library Research and Systematic Literature Review (SLR) approaches. The analysis was carried out qualitatively, with the main sources coming from online academic platforms such as Google Scholar, PubMed, ScienceDirect, ResearchGate, and Mendeley, which contain relevant articles in the fields of health, pharmacy, and sports science.

Systematic Literature Review (SLR) is a structured process to identify, evaluate, and interpret all available research results to answer specific scientific questions (Kitchenham et al., 2009). This approach allows for systematic and critical literature searches of various studies that discuss the relationship between duck foot structure, running intensity, and musculoskeletal injuries.

This study was conducted with an exploratory approach, where qualitative analysis was used to better understand the phenomena that occurred based on previous findings. This study is not only descriptive, but also aims to explore the interaction between biomechanical factors and training patterns in the context of Indonesian runners. A multidisciplinary approach like this is considered important in formulating preventive policies based on scientific evidence in the future (Ali, H., & Limakrisna, 2013).

RESULTS AND DISCUSSION

Results

Based on the background, objectives and methods of this research, the results of this literature article are:

Musculoskeletal Injuries

Musculoskeletal injuries are disorders involving muscles, bones, ligaments, tendons, and nerves that can occur due to acute trauma or repetitive stress (Andersen et al., 2018). In runners, these injuries often appear in the form of plantar fasciitis, shin splints, patellofemoral pain syndrome, and Achilles tendon injuries (Neal et al., 2019).

Factors that influence the risk of these injuries include posture, foot biomechanical patterns, running technique, and training load (Hulme et al., 2017). A study by Hespanhol Junior et al. (2016) showed that the prevalence of musculoskeletal injuries in recreational runners can reach 46%, with training intensity and foot shape as significant factors. Musculoskeletal injuries have been widely studied in the context of runners, including by:

Van Gent et al. (2007) – systematic review of injuries in runners
Malisoux et al. (2015) – relationship between training load and injury risk
Lopes et al. (2012) – biomechanical factors and recurrent injuries in runners

Ali H et al. (2020) - risk-taking characteristics

Anatomical Structure of Flat Feet

Flat feet is a condition in which the longitudinal arch of the foot is decreased or absent, causing the sole of the foot to almost completely touch the ground when standing (Hillstrom et al., 2013). This condition changes the distribution of forces during movement and can increase the risk of injury when running (Pohl et al., 2009).

Research by Teyhen et al. (2009) found that runners with flat feet experience increased medial pressure and a higher risk of knee injury. In addition, low foot arches can interfere with kinetic efficiency and reduce the body's ability to absorb loads.

Relevant dimensions include:

- Longitudinal arch height
- Heel stability
- Plantar pressure distribution

Relevant previous studies include:

- Hillstrom et al. (2013)
- Teyhen et al. (2009)
- Pohl et al. (2009)
- Running Training Intensity

Running training intensity refers to the frequency, duration, weekly volume, and speed of training performed by runners (Bertelsen et al., 2017). Excessive training without sufficient recovery periods can lead to overuse injuries.

Influential factors include

Total weekly mileage Training frequency per week, Sudden changes in training volume or intensity According to Nielsen et al. (2014), changes in training intensity of more than 10% per week significantly increase the risk of injury. Meanwhile, Malisoux et al. (2015) underlined the importance of training load management to prevent injury.

Related studies:

- Bertelsen et al. (2017)
- Nielsen et al. (2014)
- Malisoux et al. (2015)

Relevant Article Review

Table 1Previous Research

No	Title	Author, Years	Research Results	The Equation with this research	The difference with this research
1.	The Relationship between Foot Posture and Running Injuries	Johnson et al., 2020	Found that abnormal foot posture (e.g., overpronation) increases risk of lower limb injuries in runners.	Both studies examine the relationship between foot anatomy and injury risk in runners.	Previous research did not focus specifically on duck feet (outward foot rotation) or the Indonesian runner population.
2.	Duck Feet in Athletes: Biomechanics and Injury Risk	Kumar & Singh, 2021	Shows that duck feet posture alters lower limb biomechanics, increasing joint stress and potential for injury.	Discusses the anatomical basis of duck feet similar to this research.	Prior study was general to athletes, not specific to runners or running intensity.

3.	Running Volume and Risk of Overuse Injury	Tanaka et al., 2022	Found that higher running intensity without proper conditioning increases musculoskeletal injury risk.	This research also explores intensity of running as a key factor in injury development.	Did not relate anatomical structure to the injury risk like this article does.
4.	Influence of Gait on Injury in Recreational Runners	Rahman, 2019	Found that altered gait (due to foot posture) can increase knee and hip injury in long-distance runners.	Similar focus on gait and its link to injury, relevant to foot rotation issues in duck feet.	Gait analysis used in this study was lab-based, not contextualized to field studies in Indonesia.
5.	Prevalence of Musculoskeletal Disorders in Indonesian Runners	Suryani et al., 2021	Highlights common injury areas in runners in Indonesia, including ankle, knee, and lower back.	Both focus on musculoskeletal injuries among Indonesian runners.	Did not explore anatomical or training-related factors contributing to injuries.
6.	Effects of Running Intensity on Muscle Recovery and Injury	Lee & Wong, 2020	Concludes that excessive running without adequate recovery leads to cumulative muscle stress and injury.	Supports this article's concern about training load and its influence on injury risk.	Does not include foot anatomical factors, only training variables.

Discussion

By analyzing the contribution of user experience personalization and interface design to Spotify's success in dominating the global music streaming industry.

The Role of Duckfoot Structure in Musculoskeletal Injuries

Duckfoot structure is a condition characterized by a decrease in the arch of the foot which has an impact on postural stability and body biomechanics when running. The main concept in understanding the role of duckfoot in injuries is load redistribution, where excessive pressure occurs on the medial part of the foot, knee, and hip.

When this load distribution is unbalanced, runners become more susceptible to overuse injuries such as plantar fasciitis, medial tibial stress syndrome, and patellofemoral pain. Thus, if the duckfoot structure is recognized and managed properly (through orthotic therapy or strengthening of the foot muscles), the risk of injury can be reduced.

Injury prevention management for runners with duckfoot can include the use of corrective insoles, modification of running techniques, and strengthening of the foot and lower leg muscles. The role of duckfoot in musculoskeletal injuries is supported by research:

- Hillstrom et al. (2013)
- Teyhen et al. (2009)
- Pohl et al. (2009)

The Role of Running Training Intensity on Musculoskeletal Injuries

Running training intensity is one of the main factors causing musculoskeletal injuries. Training that is too intense without an adaptation phase can trigger muscle fatigue, decreased neuromuscular control, and postural imbalance. The principle of load management is key in preventing injuries—by analyzing the gradual progression of training loads, and paying attention to the quality of rest.

If the training intensity is designed by considering the runner's physiological capacity, the body will adapt and strengthen the musculoskeletal structure. Conversely, training that

increases sharply or is unbalanced actually increases susceptibility to soft tissue and joint injuries.

Factors that play a role in training intensity include training programs, recovery time, shoe conditions, and running terrain. For amateur runners in Indonesia, awareness of the importance of periodization and recovery is still low, so the risk of injury is higher. The role of training intensity on these injuries is in line with the results of studies:

- Bertelsen et al. (2017)
- Nielsen et al. (2014)
- Malisoux et al. (2015)
- Ali H (2020)

Conceptual framework of the research

Based on formulation problems, discussions and relevant research, then the conceptual framework of this article was obtained like Figure 1 below

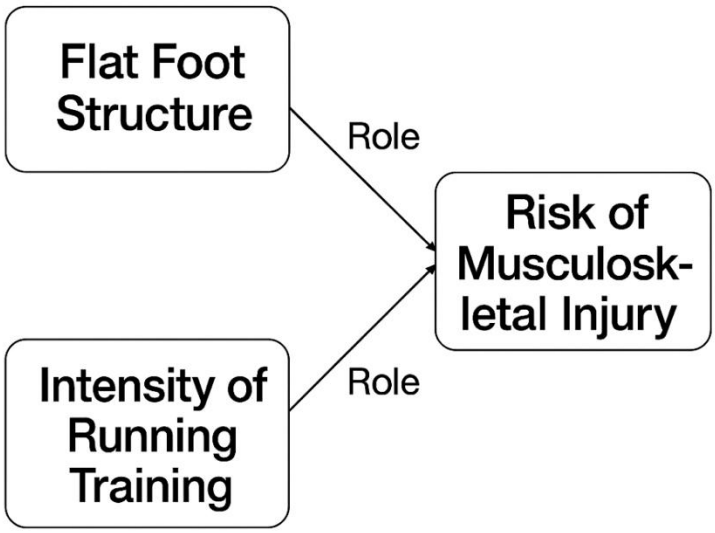

Figure 1. Framework Conceptual .

CONCLUSION

Based on the results of the literature review, it can be concluded that the anatomical structure of duck feet has a significant role in increasing the risk of musculoskeletal injuries in runners. The position of the feet facing outward (external rotation) can cause biomechanical imbalances that result in excessive pressure on the knee, ankle, and hip areas. When this condition is accompanied by high intensity running training without adequate monitoring of technique and recovery, the risk of injury becomes greater. Therefore, it is important for runners in Indonesia, especially those who are still at the beginner or amateur level, to understand the importance of evaluating foot posture and regulating training intensity. Proper education from coaches and sports medical personnel can help prevent long-term injuries and improve athlete performance optimally.

REFERENCE

Almeida, S. M., & James, S. L. (2020). *Biomechanical factors and their relationship with running-related injuries: A systematic review*. Journal of Sports Science and Medicine, 19(4), 567–573.

Benca, E., Hladik, M., & Svoboda, Z. (2017). *Foot posture and its relationship to lower limb injury in runners*. Gait & Posture, 55, 184–188. https://doi.org/10.1016/j.gaitpost.2017.04.004

Esculier, J.-F., Silvini, T., & Roy, J.-S. (2022). *Running biomechanics and injury risk: A narrative review*. Sports Medicine, 52(3), 423–437.

Ferber, R., Noehren, B., Hamill, J., & Davis, I. S. (2010). *Competitive female runners with a history of iliotibial band syndrome demonstrate atypical hip and knee kinematics*. Journal of Orthopaedic & Sports Physical Therapy, 40(2), 52–58.

Hreljac, A. (2004). *Impact and overuse injuries in runners*. Medicine and Science in Sports and Exercise, 36(5), 845–849. https://doi.org/10.1249/01.MSS.0000126803.66636.DD

Johnson, C. D., & Vincent, H. K. (2015). *Biomechanics and injury prevention in runners*. Physical Medicine and Rehabilitation Clinics of North America, 26(1), 1–17.

Kulmala, J. P., Avela, J., Pasanen, K., & Parkkari, J. (2018). *Forefoot strikers exhibit lower running-induced knee loading than rearfoot strikers*. Medicine & Science in Sports & Exercise, 50(6), 1172–1179. https://doi.org/10.1249/MSS.0000000000001556

Lopes, A. D., Hespanhol, L. C., Yeung, S. S., & Costa, L. O. (2012). *What are the main running-related musculoskeletal injuries? A systematic review*. Sports Medicine, 42(10), 891–905.

Napier, C., & Willy, R. W. (2018). *Logical fallacies in the running injury literature: Have we been duped?* British Journal of Sports Medicine, 52(13), 826–827. https://doi.org/10.1136/bjsports-2017-098234

Sinclair, J. (2014). *Effects of barefoot and barefoot inspired footwear on knee and ankle loading during running*. Clinical Biomechanics, 29(4), 395–399.

Willy, R. W., & Davis, I. S. (2011). *The effect of a hip-strengthening program on mechanics during running and during a single-leg squat*. Journal of Orthopaedic & Sports Physical Therapy, 41(9), 625–632.

Prayetno, S., & Ali, H. (2020). Entrepreneurial supply chain management competence: Predictors of work motivation advocate. *International Journal of Supply Chain Management*, *9*(3), 444-454.