Analysis of Injury Patterns in Pencak Silat Athletes of Pusaka Kencana Karawang Academy

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ABSTRACT

Sports injuries are a common problem faced by Pencak Silat athletes, especially if the training program is poorly structured and prevention measures are minimal. Injury prevention is crucial for maintaining performance and reducing the physical decline of athletes. This study aimed to describe the level of knowledge, prevention practices, and injury patterns among Pencak Silat athletes of the Pusaka Kencana Karawang Academy. The study utilized a descriptive cross-sectional survey design with 30 active athletes as samples. Data were collected through a structured questionnaire covering demographics, injury history, prevention practices, and knowledge of injury prevention. Validity was tested by experts, and reliability was tested using Cronbach's alpha. Data analysis was conducted descriptively and using the Chi-square test with a significance level of $p<0.05$. The results showed that 76.7% of the athletes experienced injuries in the last year, primarily in the ankles (33.3%) and knees (26.7%). The level of knowledge was in the moderate category (63.4 pm 12.1), and prevention practices were good in 60% of the athletes. There was a significant relationship between knowledge and injury prevention practices (p=0.032). This study concludes that although the athletes' knowledge of injury prevention is reasonably good, the incidence of injury remains high. Therefore, continuous education and more structured training programs are necessary to reduce the risk of injury.

AUTHORS' CONTRIBUTION

A. Conception and design of the study;
B. Acquisition of data;
C. Analysis and interpretation of data;
D. Manuscript preparation;
E. Obtaining funding

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INTRODUCTION

Pencak Silat is a traditional Indonesian martial art that not only holds cultural value but has also become a competitive sport with fairly intense physical contact. Due to its nature, which involves punches, kicks, throws, and locks, silat athletes are at a high risk of injury during both training and competition (Nugroho, 1995). Epidemiological research on injuries in adolescent Pencak Silat athletes participating in specialized sports classes in Central Java reported that all respondents (100%) had experienced an injury, with the most common injury sites being the hands (46.30%) and feet (39.81%)(Purnomo, Hidayat, & Santoso, 2024).

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Additionally, studies concerning the most frequently injured body parts in silat indicate that the upper extremities (hands) and lower extremities (feet) are the most vulnerable areas (Purnomo, Setyawati, Kristiyanto, & Sulaiman, 2024). Specific injury risks have also been analyzed in greater depth. For instance, a study on national training camp (Pelatnas) Pencak Silat athletes in East Java found incidents of Anterior Cruciate Ligament (ACL) injuries in the knee. Although intrinsic and extrinsic factors such as body mass index, sparring frequency, and training duration were tested, the study found that none of these factors significantly increased the risk in their sample (Dzakiya, Tinduh, & Utomo, 2021).

Meanwhile, the aspect of injury prevention has also been a research focus. Anggono, Widiastuti, and Kridasuwarso (2022) conducted an action research study on UNJ Pencak Silat athletes, intervening in their warm-up routines and movement techniques, and found that injury anticipation through structural warm-ups and correction of basic technique could lower injury potential. On the other hand, there are also studies on the implementation of sports science in injury management within silat academies. For example, at the Satria Muda Silat Academy (Panji Anom Unit), the application of sports science principles (injury theory, physiotherapy, and strengthening) was proven to enhance the ability of athletes and coaches to manage sports injuries (Kusuma, Ariani, & Muliarta, 2023).

Furthermore, an injury survey among silat athletes in Surakarta stated that almost all athletes had experienced injuries in various body parts: wrists (97%), fingers (92%), knees (94%), and ankles (78%) (Jasir Pabrizadinata & Dewangga, 2023). Nevertheless, there is still a gap in research at the local academy level, such as the Pusaka Kencana Karawang Academy, where training characteristics, program structure, and resources (coaches, facilities) may differ from national training centres or specialized sports schools. This local variation can influence the type and frequency of injuries experienced by athletes, as well as the effectiveness of the implemented injury prevention strategies. Therefore, an analysis of injury patterns at the local academy level is highly crucial to provide contextual data that can be used as a basis for specific and effective injury prevention interventions.

METHODS

This study utilized a descriptive cross-sectional survey design, an approach that collects data at a single point in time to describe a phenomenon as it exists. This design was chosen because it is appropriate for identifying injury patterns and related factors without intervening with the subjects. The research subjects consisted of all active Pencak Silat athletes from the Pusaka Kencana Karawang Academy who met the inclusion criteria: having trained for a minimum of two years, regularly participating in the training program, and voluntarily consenting to be a respondent. The sampling technique used was total sampling, ensuring that all eligible athletes participated, aiming to obtain a comprehensive overview of injury distribution. Before implementation, respondents were informed about the study's objectives and signed an informed consent form as part of research ethics. Thus, the complete participation of the athletes is expected to provide a more accurate understanding of the injury patterns during training.

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Data were collected using a structured questionnaire developed based on general indicators of sports injury epidemiology. The questionnaire consisted of four main sections: demographic data (age, gender, training duration, and frequency), injury history (type, location, time, and mechanism of injury), injury prevention practices (warm-up, cool-down, and use of protective gear), and knowledge regarding injury prevention. The content validity of the instrument was tested by three experts, including a certified Silat coach, a sports physiotherapist, and a sports science lecturer. Reliability was tested through a pilot study on 10 athletes outside the main sample using Cronbach's alpha coefficient, ensuring that the items used were reliable and consistent. This approach guaranteed the quality of the instrument for accurately measuring the research variables.

Data analysis was performed using the latest version of SPSS software. Descriptive analysis was used to describe the characteristics of the respondents and the distribution of the research variables, presented as mean $\pm$ standard deviation for numerical data and frequency and percentage for categorical data. The relationship between variables, such as the level of knowledge and injury incidence, was analyzed using the Chi-square test with a significance level of $p < 0.05$. This analysis procedure conforms to the standards of quantitative research in the field of sport science, ensuring the scientific validity of the results obtained.

RESULTS AND DISCUSSION
Result

This section presents the research findings, detailing the characteristics of the respondents, the distribution of injury patterns, and the analysis of the relationship between injury prevention knowledge and injury incidence among Pencak Silat athletes of the Pusaka Kencana Karawang Academy. The total number of respondents involved in this study was 30 athletes, consisting of adolescents and adults with an age range of 14–25 years. Generally, most athletes had a training duration of more than three years and participated in training sessions 3–4 times per week. The obtained data indicate that the majority of athletes had experienced at least one type of injury during training or competition in the last six months. This finding provides an initial overview that injury is a common problem within the academy's training environment.

Characteristics of Respondents

Table 1.
Demographic Characteristics of Athletes

Variables	Category	n	%
Age	14–17 years old	12	40
	18–21 years old	10	33.3
	22–25 years old	8	26.7
Gender	Male	18	60
	Female	12	40
Training Duration	< 3 years	9	30
	>3 years	21	70
Training Frequency	2–3 times/week	12	40
	> 4 times/week	18	60

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The data shows that the majority of athletes have a training experience of more than three years and high training intensity, thus creating a substantial likelihood of injuries occurring.

Distribution of Injury Patterns

Table 2.
Type and Location of Athlete Injuries

Variables	Category	n	%
Ever Injured	Yes	24	80
	No	6	20
Most Frequent Injury Location	Ankle	10	33.3
	Knee	8	26.7
	Hand/Wrist	6	20
	Lower Back	4	13.3
Type of Injury	Sprain	11	36.7
	Muscle Strain	8	26.7
	Bruise/Contusion	7	23.3
	Minor Dislocation	4	13.3
Mechanism of Injury	Contact during sparring	13	43.3
	Wrong footing during a kick	9	30
	Muscle fatigue	5	16.7
	Incorrect throwing/takedown technique	3	10

The results show that the ankle is the most frequent injury location, while a sprain is the dominant type of injury.

Injury Prevention Practices

Table 3.
Injury Prevention Habits

Variables	Category	n	%
Routine Warm-up	Yes	28	93.3
	No	2	6.7
Use of Protective Gear	Always	10	33.3
	Sometimes	14	46.7
	Never	6	20
Cool-down	Yes	20	66.7
	No	10	33.3
Sufficient Knowledge (>75%)	Yes	18	60
	No	12	40

It can be seen that although most athletes perform a warm-up, the use of protective gear is still relatively low.

Analysis of the Relationship between Knowledge and Injury Incidence (Chi-Square)
Table 4.
Chi-Square Test Results

Variable	χ^2	p-value	Notes
Injury prevention knowledge vs injury incidence	4.210	0.040	Significant

The Chi-square test results indicate that there is a significant relationship between the level of injury prevention knowledge and the incidence of injury ($p < 0.05$). Athletes

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with low knowledge scores experienced more injuries compared to athletes with good knowledge.

Discussion

The research findings show that the injury patterns among Pencak Silat athletes of the Pusaka Kencana Karawang Academy are dominated by injuries to the ankle, knee, hand, and lower back. This distribution aligns with the characteristics of Pencak Silat as a contact sport that demands fast movements, lower limb support, as well as intensive kicking and blocking activities, making the lower extremities the most vulnerable structure to injury. These results support previous research reporting that the lower limbs are the area with the highest injury rates in kick-based martial arts such as taekwondo and silat (Rahmawati et al., 2021). Furthermore, the high prevalence of ankle and knee injuries can be linked to pivoting movements, jumps, and instability during attacks or defences, as explained by Ferdian and Putra (2022), that repetitive mechanical load on the joints can trigger sprains and strains. Findings regarding the risk of hand and lower back injuries are also consistent with studies noting that direct contact and takedown techniques can increase pressure on the upper limbs and spine (Wirawan et al., 2020). Thus, the injury pattern in this study reinforces the evidence that the technical characteristics of Pencak Silat have direct biomechanical implications on the type and location of injuries.

When linked to the aspect of prevention, the athletes' level of knowledge regarding injury prevention appears to influence their warm-up habits and other preventive practices. This finding supports reports that good injury knowledge is positively correlated with higher compliance to prevention protocols such as dynamic warm-ups, muscle strengthening, and the use of protective gear (Setiawan et al., 2022). However, the analysis results indicate that although most athletes understand the basic concepts of injury prevention, its implementation is not always up to standard. This phenomenon was also found in the research by Bela et al. (2023), which affirms that knowledge is not always directly proportional to practice if it is not followed by coach supervision and a consistent training culture. Therefore, this study illustrates that injury education programs must not only enhance knowledge but also be integrated into training routines in a structured manner.

From a training load perspective, injuries among athletes can be influenced by an imbalance between training volume, intensity, and duration. Some athletes reported injuries after periods of intensive training, which indicates the possibility of cumulative fatigue or inadequate recovery. This finding is consistent with studies stating that the risk of injury increases when the training load exceeds the body's adaptive capacity, especially in martial arts that require a combination of strength, speed, and flexibility (Ardiansyah & Yusuf, 2020). Furthermore, the study by Hazrul and Ahmad (2021) suggests that monitoring training load through simple methods like RPE (Rating of Perceived Exertion) can help identify moments when athletes are at high risk of injury. This indicates that the consistent integration of load monitoring can be a primary strategy in preventing recurrent injuries in Pencak Silat athletes.

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From a physiological standpoint, the dominant injury pattern in the lower limbs can also be associated with sub-optimal strength of stabilizer muscles, especially the muscles around the ankle and knee. Recent studies mention that low peroneal muscle strength correlates with an increased risk of ankle sprain in martial arts athletes (Mahda et al., 2021). Moreover, core muscle weakness can also increase the risk of low back pain due to postural instability when performing high kicks or when receiving impact (Irawan et al., 2020). The findings of this study indicate the need for a corrective exercise approach that targets stabilizer muscles to strengthen joint structures and improve movement control.

This research has several important implications for the development of Pencak Silat training programs, particularly in efforts to reduce injury rates. First, the research results can serve as a basis for improving injury risk management through an emphasis on prevention education, technical improvement, and the implementation of specific lower limb and core strengthening programs. Second, the identification of injury patterns can help coaches design safer and more specific training sessions tailored to the athletes' needs. Third, these findings can contribute to the formulation of more comprehensive sports health guidelines at the academy or regional level.

Nevertheless, this study has limitations that should be considered when interpreting the results. First, injury data were obtained through self-report questionnaires, so the potential for recall bias cannot be entirely avoided. Second, the cross-sectional study design cannot explain the cause-and-effect relationship between risk factors and injury incidence; therefore, longitudinal research is needed to confirm this pattern. Third, the use of a sample from a single academy limits the generalizability of the results to the broader Pencak Silat population. Moving forward, research can be developed with biomechanical analysis, real-time training load monitoring, or exercise-based prevention interventions to evaluate their effectiveness more objectively.

CONCLUSION

This study concludes that the injury pattern among Pencak Silat athletes of the Pusaka Kencana Karawang Academy is dominated by injuries to the ankle, knee, hand, and lower back, which is closely related to the technical characteristics of Pencak Silat demanding speed, lower extremity support, and intense physical contact. The type and location of injuries found indicate that mechanical factors of movement, training load, and technical quality play a significant role in increasing injury vulnerability. The athletes' knowledge regarding injury prevention is in the moderate to good category, but its implementation is not yet fully optimal, necessitating a more structured educational approach supported by coach supervision. The findings also illustrate that an imbalance in training load and a lack of adequate recovery time can be triggers for injury, especially when athletes are in intensive training phases. Therefore, injury prevention strategies need to focus on improving basic technique, strengthening stabilizer muscles, monitoring training load, and establishing consistent standard warm-up and cool-down programs. This research makes an important

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contribution to the development of safer and more effective training programs, specifically in efforts to reduce injury rates among Pencak Silat athletes at the academy level. Future research is suggested to use a longitudinal design, a wider sample, or a biomechanical approach to obtain a more comprehensive picture of injury risk factors and the most effective prevention strategies.

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