

PREVALENCE OF MUSCULOSKELETAL OVERUSE INJURIES AMONG MALAYSIAN ELITE ATHLETES DURING THE PREPARATION PHASE FOR INTERNATIONAL SPORT COMPETITION

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Abstract

Intensive training with a high volume of training in preparation for the tournament may predispose athletes to overuse injuries. Therefore, this study aims to determine the prevalence of musculoskeletal overuse injuries among Malaysian athletes during the pre-competition phase. A 13-week prospective cohort study was conducted, including 100 elite athletes representing Malaysia at Commonwealth Games, Asian Games and World Championships. Data on overuse injuries were collected every second week using the Oslo Sports Trauma Research Center Overuse Injury Questionnaire. The average weekly prevalence of overuse injuries was calculated using the questionnaire results. A total of 119 cases of substantial overuse condition were reported, which were in the back (35 cases), knee (31 cases), ankle (28 cases), and shoulder (25 cases), affecting 100 athletes (100% of the cohort). About 42.5 % of the participants classified themselves as having substantial overuse problems, leading to a moderate (71%) or severe (29%) reduction in sports participation or performance or inability to participate in high-performance activities. The average weekly severity score for the back was 16, 12 cases for the shoulder, and the same score of 14 cases for the knee and ankle. Overuse injuries occurred among elite Malaysian athletes during the preparation and training phase for international competition due to the rapid intensity of the training. This study suggests that a guideline is needed for injury prevention strategies for the benefit of Malaysian athletes to prevent injuries.

Keywords: Ankle, Athlete, Injury, Overuse, Malaysia

Introduction

An overuse injury is a term used in sports medicine to describe one of the types of injuries caused by repeated microtrauma in high-intensity training or continuous high-volume load, with insufficient recovery time between sessions (1). The prevalence of overuse injuries in sports is high and varies depending on the level of sport and competition (2-7). Athletes in individual sports have a higher prevalence of overuse injuries than those in team sports (8). Studies have reported prevalence rates

ranging from 26.9% in adolescent elite orienteers (9) to 68% in runners (10). Other studies have reported high prevalence rates of overuse injuries in specific body regions, such as the lower back, knee, and shoulder in professional volleyball athletes (11), and the foot/lower leg in adolescent elite orienteers (9). The incidence and prevalence of overuse injuries and pain of the elbow and shoulder are also high in youth overhead athletes (12). This may be due to the fact that individual athletes typically train and compete at higher frequency and intensity, placing greater repetitive strain on their bodies without

the benefits of shared physical and psychological demands, resources, and recovery times provided by a team setting.

The amount of training an athlete undergoes can significantly impact their risk of an overuse injury. Athletes who train at higher training volumes, such as more than 12 hours per week, are more prone to develop overuse injuries, as their bodies are subjected to higher stress levels and strain (13, 14). Athletes often adjust their training volume to the periodization phase to prepare for high-level competitions. While this can benefit their performance, it can also lead to higher fatigue levels and an increased risk of injury. Despite the importance of this relationship between training and injury, there is a notable lack of research examining this link, particularly among elite athletes. This highlights the need for further investigation to understand better the impact of training volume on injury risk in this population.

In Malaysia, a previous study highlighting the patterns of injuries and illness among Malaysian multisport athletes was during the XVII Asian Games 2014 (15). In addition, only a few cross-sectional studies were conducted in single-sport competitions, including futsal and badminton (16, 17). However, there was a limited protective study regarding health and injury issues among elite or Olympic-level athletes, and several articles were conducted in a compressed time within the competitive period. Insufficient information on health issues during their training and preparation phases led to a massive challenge in identifying and sorting their type of illness and injuries accordingly. Therefore, this study aims to determine the prevalence of musculoskeletal injuries in Malaysian athletes during the pre-competitive phases.

Materials and Methods

Study design and participants

This prospective cross-sectional study was conducted in four sports complexes: i) Bukit Jalil, which includes sports facilities for hockey, squash, gymnastics, rugby and netball; ii) Bukit Kiara for badminton, iii) Keramat for sepak takraw; iv) overseas training centre in Melbourne, Australia for cycling. Participants in this study were selected using a systematic sampling method. The required number of participants was 100 based on the expected proportion of prevalence as 0.2 and the confidence level as 95%. The starting point was a comprehensive list of sports representing Malaysia in the Commonwealth Games, Asian Games, and World Championships obtained from the National Sports Council of Malaysia. From this list, eight sports were selected based on their corresponding numbers and choosing every even number. The same procedure was then used to select participants from athletes who participated in the selected sports events.

The following are the inclusion criteria for participants: (i) a registered athlete with a national sports association, (ii) between 18 and 35 years old, (iii) an athlete who will participate in Commonwealth Games and Asian Games and

qualify for World Championship Events in 2018, (iv) able to understand the English language. Before the data collection phase, participants were excluded from this study if they had a musculoskeletal injury, such as a fracture, chronic cardiovascular disease, or medical disease. Athletes who underwent treatment before the data collection phase or were under 17 were also excluded. Informed written consent was obtained from all individual participants included in the study. Before conducting this study, ethical approval was obtained from the Research Ethics Committee of Universiti Teknologi MARA (UiTM) on 30 April 2018 with reference number: REC/40/18/600-IRM 5/1/6.

Outcome measures

Data were recorded on age, gender, type of sport (team sports and individual sports), duration of the training session (session), session per day (hour), training per week (days), and medical history of the participants. These data were obtained through the participants, medical personnel, and coaching staff by consent or interviewing them.

This study used the self-administered Oslo Sports Trauma Research Center (OSTRC) Overuse Injury Questionnaire as the latest standard method to monitor overuse injuries (18). The questionnaire had high internal consistency, with Cronbach's α 0.91 (18). This questionnaire captures a small percentage of the problems of overuse that affect athletes at all levels, leading to time loss from training or participation in competitions. The questionnaire was divided into four sections to gather information from athletes about overuse injuries, including participation, reduced training volume, reduced performance, and pain scale. Each section has a different number of questions, ranging from 2 to 7.

Testing procedures

All selected participants were informed and explained the purpose of the study. Participants must participate in data collection for 13 weeks by answering a weekly online questionnaire. On Friday nights, participants received an email containing a link to access and complete the questionnaire. In order to maximize response rates, reminders were promptly sent to non-responders after two days had passed. It is worth noting that all participants consistently demonstrated a high level of engagement, as they completed the questionnaire within 1-2 days after receiving the reminder. It is crucial to highlight that all participants were free to withdraw from the study without incurring any adverse consequences. Each week, the responses to the questionnaire were exported from the survey software to a custom Microsoft Excel database (Microsoft Excel 2010 by Microsoft Corporation in Redmond, USA).

Overuse problems were calculated for each anatomical area weekly by dividing the number of athletes who reported any issue by the total number of respondents to the questionnaire. Weekly prevalence was plotted over time to identify trends throughout the study, and

the average weekly prevalence of overuse problems was calculated for each anatomical area and athlete group. The inclusion of all physical complaints, regardless of their impact on participation or performance during training or competition, is consistent with the recommendations of the methodological consensus statements of various sports. All information was kept confidential and stored in secure online properties such as encrypted databases or password-protected platforms, ensuring that sensitive athlete data remained protected from unauthorized access.

Prevalence of overuse injury: Collecting data on the prevalence of problems requires calculating the number of athletes who report problems in each anatomical area weekly. This is achieved by dividing the number of athletes who report problems by the number of respondents to the questionnaire. The weekly prevalence must be plotted, and the average prevalence must be calculated weekly for each anatomical area and the group of athletes to determine the trend of overuse problems. Furthermore, all physical complaints of participants must be recorded, including their impact on sport participation or performance, with injury definition consistent with the recommendations of methodological consensus statements from various sports.

Prevalence Substantial Measures: The second prevalence measure, the prevalence of a substantial overuse problem, was calculated from the number of athletes who reported moderate or severe reductions in training volume, sports performance, or complete inability to participate in training or sports. This was done by classifying their responses, which were given as answers 3, 4, or 5 in questions 2 or 3, to filter out minor overuse problems from the prevalence measure (18).

Severity measure:

The severity score of the Oslo Sports Trauma Research Center Overuse Injury Questionnaire is calculated by adding the scores of four questions related to the athlete's current level of pain, function, activity modification, and participation restriction (19). Each question is scored on a Likert scale from 0 to 25, with 0 indicating no problems and 25 indicating severe problems. The severity score ranges from 0 to 100, with higher scores indicating greater severity of the overuse injury.

Statistical analysis

Data were analyzed using SPSS statistical software (SPSS V.20 by IBM Corporation in New York, USA). The mean and standard deviations (SD) were calculated to describe continuous data. For categorical variables, frequencies and percentages were used.

Results

Participant characteristics

The participant characteristics are summarized in Table 1. During the 13-week study period, all participants completed a questionnaire, resulting in a 100% response rate.

Table 1: Characteristics of the participants

Characteristic	Athelete n (%)
Age (years)	24.56 (\pm 3.97)
Duration of the training session	2.91 (\pm 0.71)
Number of training hours sessions per day (hours)	2.17 (\pm 0.49)
Number of training session perweek (days)	2.65 (\pm 0.52)
Gender	Male: 52 (52%) Female: 48 (48%)
Team Sport	Hockey: 28 (28%) Rugby: 9 (28%) Speak Takraw: 9 (9%) Netball: 7 (7%)
Individual sport	Badminton: 14 (14%) Cycling: 13 (13%) Squash: 10 (10%) Gymnastic: 10 (10%)

Prevalence of overuse and substantial overuse injuries

The most frequently reported problematic areas were the back, ankle, knee, and shoulder. In the first week of data collection, more than 30% of cases were reported in all anatomical areas, but the number decreased in the following weeks. In week six, there was an increase in the number of cases of overuse reported in all anatomical areas, with the highest percentage reported in the ankle (50%) followed by the back (41%), shoulder (40%) and knee (35%). At the end of the 13th week, all anatomical areas reported more than 25% of cases of overuse, the highest being in the ankle (42%), followed by the back (34%), knee (29%) and shoulder (26%).

This study identified 119 substantial cases of overuse, affecting 100 athletes. The highest number of cases were recorded in the back followed by the knee, ankle and shoulder. About 42.5% of the participants were found to have substantial overuse problems, leading to moderate or severe reductions in participation or performance. The results of all 13 weeks of the prevalence of overuse and substantial overuse problems are shown in Figure 1.

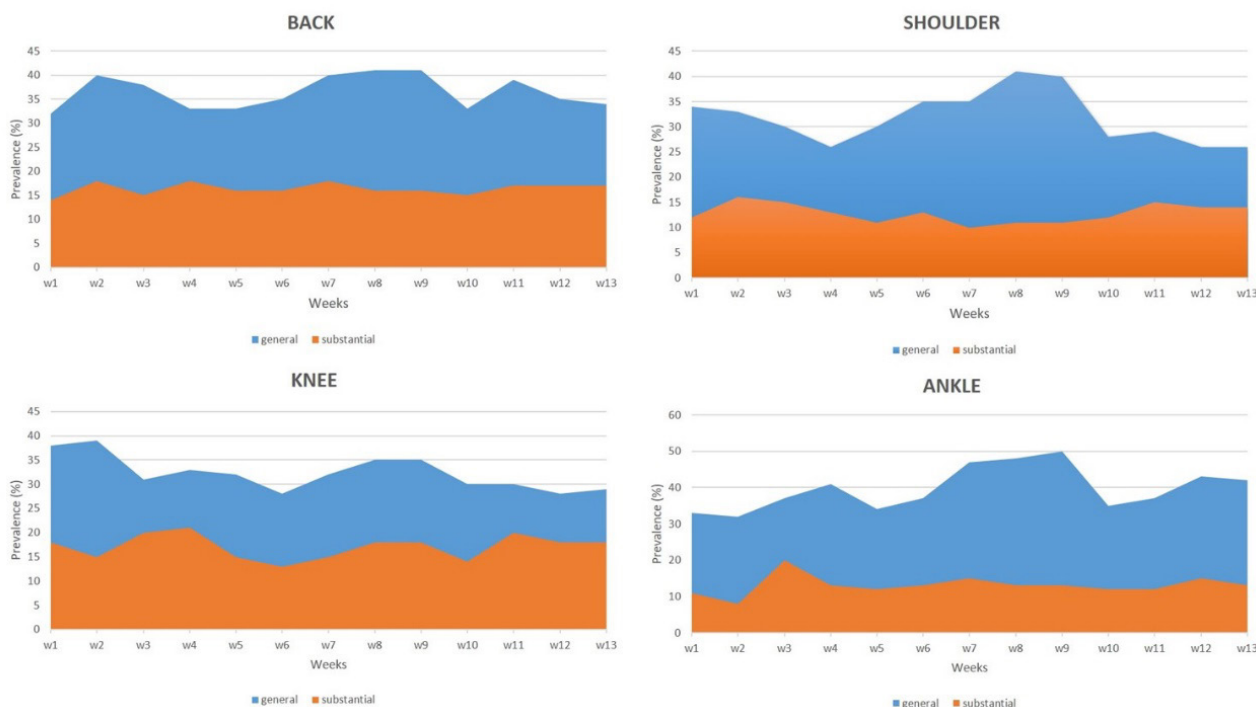


Figure 1: Prevalence of all overuse problems and substantial overuse problems of the five sports over 13 weeks.

Average weekly prevalence of overuse injury

During 13 weeks, the total number of reported cases of overuse injuries was recorded, and the average number of cases per week was calculated. The highest reported area of injury was the ankle, with 516 total cases and an average of 40 cases per week. The second highest was back, with 474 cases and an average of 36 cases per week. The knee reported 420 cases with an average of 32 cases per week, and the shoulder reported 413 cases with an average of 32 cases per week.

Average weekly prevalence of substantial overuse problem

In 13 weeks, 773 cases of substantial prevalence were recorded. The average number of cases per week was calculated, and it was found that for substantial knee overuse problems, there were 223 cases, with an average of 17 cases per week. For back problems, the total report was 213 cases, with an average of 16 cases per week. For ankle problems, 170 cases were reported, with an average of 13 cases per week; for shoulder problems, 167 cases were reported, with an average of 13 cases per week.

The range of cases reported for substantial overuse in the knee was between 13 and 21. For the back area, it

was between 14 and 18. For the ankle, it was between 8 and 20 and for the shoulder, it was between 10 and 16. The weekly average of all anatomical areas in prevalence overuse problems is depicted, and it is evident that knee problems have the highest reported cases in average prevalence overuse problems, with 17 cases per week.

Severity score

Figure 2 illustrates that in week two, there was an increase in the scoring rate for the back and shoulder, while the knee and ankle experienced a decrease. However, the ankle and knee scoring rates increased in week three, while the back and shoulder scoring rates decreased. Overall, during the 13 weeks, the scoring scores for all anatomical areas remained relatively stable, except for a slight increase in the knee area in week 11. The mean weekly severity measurement was calculated for each anatomical area for the 13 weeks. The back was found to have the highest average score of 16, followed by the knee and ankle with 14 and the shoulder with 12. The average severity score per week for the back was 16 cases, for the shoulder 12 cases, and for the knee and ankle, it was 14 cases.



Figure 2: Severity score for average 13 weeks in each anatomical area.

Discussion

This research aims to identify the prevalence of musculoskeletal overuse injuries among Malaysian athletes during the pre-competition phase as they prepare for the Commonwealth Games, Asian Games, and World Championships 2018. All athletes who participated in this study qualified for the tournament. The study was designed using the surveillance method, the Oslo Sports Trauma Research Center Overuse Injury Questionnaire (18). The survey had to be completed within 13 weeks, and data were collected from April to September 2018.

This study presents epidemiological data on the prevalence of overuse injuries among national athletes during their preparation for international competitions. The results indicate that the highest overuse injuries may be due to high-frequency training and friendly competitions. The study found that 56.8% of athletes reported problems with overuse within 13 weeks, which was lower compared to a previous study (20). Rapid changes in training workload increase the risk of injury from overuse, particularly if the workload level suddenly increases from low to high (21). However, athletes continue to train even when they experience discomfort or pain due to ongoing overuse injury symptoms.

Approximately 43.2% of the cases reported in this study were due to substantial overuse injuries caused by partial or complete absence from regular training sessions, resulting in significant time loss from sports participation for athletes. It was reported in four anatomical areas: the back, shoulder, knee, and ankle. The highest reported area was the ankle, followed by the back, knee, and shoulder.

This result is similar to previous studies, which found that the ankle and back were the most frequently affected by overuse injuries (16, 20). These anatomical areas are subjected to high load during athletic activities during training and competition, making them susceptible to injury.

The results of the study show that there was a higher rate of overuse injury among athletes in team events compared to those in individual events. Different types of sports exhibit varying levels of intensity and training requirements, including individual skill demands, physical exertion, and competitive standards. Therefore, this diversity often leads to distinct injury patterns and outcomes. The two highest team sports were sepak takraw (62.8%) and hockey (61%), while the two highest individual sports were gymnastics (57%) and badminton (48%). A similar trend in sports injuries was observed and analyzed during the 2008 Summer Olympic Games (22). This can be attributed to the differing training characteristics and the sport itself. In team sports, player-to-player contact is more likely than in individual sports (23). Although caution must be taken when making comparisons, these results are consistent with other literature suggesting a higher risk of injury in team sports events compared to individual sports events (24, 25).

The ankle injury was the highest reported in this study, with an average of 40 cases per week reported. It has been shown that there are many mechanisms involved in this area. This result was supported by a previous systematic review, which found that ankle problems are more serious than other joint problems, especially in high training or competition levels and certain sports (26). These problems

occur regularly and can cause significant disability and time for athletes (27). Therefore, 40% of reported injuries are ankle problems, mainly ankle sprains, in all sports, especially those requiring athletes to run more during training or competition (28).

The back area is commonly affected in the thoracolumbar region, where injuries are prevalent due to biomechanical factors such as physiological curves of the spine (29). Low back problems are common among athletes due to excessive loading, leading to a higher prevalence of structural pathology among high-level athletes compared to non-athletes (29). This can also impact the intervertebral disk, apophyses, and end plates, causing degenerative changes. Studies have shown that back problems are more prevalent among female athletes in the past 3 months and 7 days than male athletes (30). Furthermore, the thoracolumbar region is also prone to muscle strains and sprains, which can occur from sudden movements, overuse, or poor posture during exercise. Athletes who participate in sports that require repetitive trunk rotation, such as golf or baseball, are at a higher risk of developing these types of injuries. The thoracolumbar junction is a common site of stress fractures, especially among athletes participating in high-impact sports such as gymnastics and dance.

Although this study has provided valuable information on the prevalence of overuse injuries among national athletes, it is important to note its limitations. The use of a systemic random sampling method and a small sample size of only 100 participants may limit the generalizability of the findings to other populations. Additionally, the limited study duration, only a few months, may not fully capture the long-term effects of overuse injuries. Another potential weakness of the study was the reliance on self-reported data, which may not accurately reflect the extent or severity of injuries. Future research should aim to improve the precision of data collection by incorporating proper training evaluations and medical documentation from authorized personnel. By addressing these limitations, future studies can build on this research and provide a more comprehensive understanding of athlete overuse injuries.

Conclusion

This study will inform athletes and coaching staff about the importance of understanding overuse injuries. This will help them plan their training to maximize potential and performance without injury during international tournaments. The findings of this report will also provide medical personnel with a clear understanding of the anatomical areas at high risk for overuse injuries. Lastly, athletes must know their body's limits to adapt to training loads and recognize the symptoms of overuse injuries.

Acknowledgement

The authors thank Universiti Teknologi MARA for funding the research project through the Geran Insentif Penyelidikan [600-RMC/GIP 5/3 (058/2022)]

Competing Interests

The authors declare that they have no competing interests.

Ethical clearance

ethical approval was obtained from the Research Ethics Committee of Universiti Teknologi MARA (UiTM) on 30 April 2018 with reference number: REC/40/18/600-IRM 5/1/6.

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