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# Injury risk potential and flexibility level: An analysis of amateur team sport athletes

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**ABSTRACT**

**Background Problems**: Sports injuries are a severe problem that can affect an athlete's career, including those active in team sports such as basketball, volleyball, and futsal. **Research Objectives**: This study aims to analyse the potential risk of injury and the level of flexibility of amateur athletes at Universitas Negeri Semarang. **Methods**: This research is a quantitative descriptive study using the sampling technique, namely purposive sampling, to obtain a total sample of 90 athletes. Instruments to measure the potential risk of injury use the functional movement screen (FMS) and the level of flexibility using the sit-and-reach test. The data analysis techniques use descriptive statistical analysis. **Findings and Results**: The results of the FMS analysis showed that most male and female amateur athletes had a low level of injury risk. Flexibility measurements show that most male and female amateur athletes have good flexibility. This study contributes to understanding the potential risk of injury and the level of flexibility in amateur team sport athletes. **Conclusion**: The findings can assist coaches and teams in designing more effective training programmes to improve athletes' physical health and performance. Further research is recommended to analyse other physical condition component variables, as well as research subjects from different age groups. In addition, it is also recommended that more research samples from various levels of athletes be examined.

**Keywords:** Injury risk; flexibility; functional movement screen; team sport

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**Authors' Contribution**: a – Study Design; b – Data Collection; c – Statistical Analysis; d – Manuscript Preparation; e – Funds Collection

## INTRODUCTION

Sports injury is a problem that arises in a person after doing physical activity or sports, both in practicing and competing (Kurniati et al., 2022). Sports injuries can happen to anyone, whether amateur athletes or professional athletes. Sports injuries experienced by a person will cause pain caused by damage to the structure or function of the body, such as bones, joints, ligaments, and muscles, both in the form of closed and open injuries (Emery & Pasanen, 2019). Increased flexibility can minimise injuries (Anam et al., 2023; Anam et al., 2022). Flexibility is essential because it affects the body's ability to move freely, and flexible muscles are more resistant to stress and strain.

The risk of injury in sports varies greatly and can be influenced by various factors (Close et al., 2019). Factors causing injury in sports are categorized into external and internal factors (Anam et al., 2022). External

factors are caused by physical contact, such as collisions, blows, or collisions, the use of inadequate equipment, and less-than-ideal field conditions (Leitão et al., 2019). Meanwhile, internal factors such as errors in training movements and weak physical conditions can increase the risk of injury (Soligard et al., 2016). Ports injuries can be avoided by paying attention to several things when exercising: warming up before exercising, using appropriate equipment, and maintaining physical condition (Cornelissen et al., 2023). At the same time, physical conditions include speed, agility, endurance, power, and flexibility (Altmann et al., 2019). Flexibility is the ability of tissues or muscles to stretch maximally, allowing the body to move freely. A body that can move freely is needed to minimise sports injuries (Nuruhidin et al., 2023).

Minimising sports injuries can be done by predicting them using the Functional Movement Screen (FMS) method, a quantitative assessment tool (Anam et al., 2024; Cook et al., 2014; Leeder et al., 2016). The FMS system has three assessment points that can determine functional movement ability and assess the risk of movement errors that can cause injury during sports activities (Warren et al., 2018). This FMS method can be assessed by performing seven functional movements consisting of functional abilities of the upper limbs and lower limbs (Davis et al., 2020). The movements included in the FMS method consist of hip hinge, squat, gait, push, pull, and rotation (Cook et al., 2014). FMS analysis can also help identify potential points for an athlete when an injury is indicated (Dorrel et al., 2018).

Based on observation, the Student Activity Unit conducts training sessions at night, usually from 7.00 PM until 10.00 PM. The training schedule often causes players to feel tired after training at night. Night training and an unhealthy lifestyle can negatively impact their performance as muscles become tense, reducing flexibility and increasing the risk of injury (Milewski et al., 2014; Nielsen et al., 2018). Sometimes, they struggle to maintain a healthy sleep pattern, hindering and prolonging the post-workout recovery process. This is also motivated by the fact that most amateur athletes active in campus activities are students who migrate from outside the area, so they live in boarding houses. The lifestyle of those who live in boarding houses is demanding that they be monitored appropriately. This lifestyle is related to eating and sleeping patterns that are not well scheduled. When their bodies are exhausted, the habit of staying up late and eating late, resulting in the provision of nutrients into the body, is not optimal. Other factors aggravate their condition and cause them to recover immediately (Charest & Grandner, 2022).

The problem requires research to determine the potential risk of sports injuries among amateur team sports athletes undergoing intensive activities. Lack of attention to this issue risks compromising the physical health of amateur athletes and negatively affecting their performance. This kind of research has been carried out by previous research studies (Ransdell & Murray, 2016), for example, the use of FMS as a test for post-injury athletes (Rustiawan et al., 2019) and FMS associated with core stabilisation training in young basketball athletes (Doğan et al., 2018). However, previous studies have only examined FMS focused on professional athletes (Pfirrmann et al., 2016), and none have sampled amateur team sport athletes. This study is novel regarding research subjects, where the research subjects are amateur college athletes from team sports. This study used functional movement screening tools, an instrument still rarely used by researchers in Indonesia (Anam, Nurrachmad, et al., 2022).

The urgency of this research is that some amateur athletes in team sports do not know the potential risk of injury that may be experienced, so it is hazardous to train carelessly. This research is essential because it will guide coaches or teachers on campus in considering the training load or portion of the learning material to be given. This study aims to analyse the risk of injury in amateur team sport athletes using functional movement screening tools. Therefore, this research question is how to analyse the risk of injury and the level of flexibility in amateur team sports athletes.

## METHOD

This type of research is descriptive-quantitative. The variables in the study were the potential risk of injury and the level of flexibility. The sample used in this study amounted to 90 amateur athletes from basketball, volleyball, and futsal. The sample consisted of 31 female amateur athletes and 59 male amateur athletes. The sampling technique used was the purposive sampling technique.

**Table 1. Demographics of the Study Group (n=90)**

| | N | Weight (Kg) | Hight (Cm) | BMI |
|---|---|---|---|---|
| | | Mean ± SD | Mean ± SD | Mean ± SD |
| Female | 31 | 58.3 ± 7.0 | 159.3 ± 4.7 | 22.3 ± 4.7 |
| Male | 59 | 62.1 ± 13.4 | 170.6 ± 6.8 | 21.4 ± 3.9 |

Note. BMI = Body Mass Index, SD = Standard deviation, N = Number of samples

The instruments in this study were the Functional Movement Screen (FMS) to measure potential injury risk and the sit-and-reach test to measure flexibility (Cook et al., 2014; Teyhen et al., 2012).

**Table 2. Norm of Functional Movement Screen**

| No. | Points FMS | Risk Category |
|---|---|---|
| 1 | ≤ 14 | High |
| 2 | 15-18 | Medium |
| 3 | 19-21 | Low |

Note. FSM = Functional Movement Screen (Farrell et al., 2021)

Table 2 above presents three categories of FMS norms used to assess FMS scores. The three categories are high-injury risk, medium-injury risk, and low-injury risk. If the FMS score is 14 points or below, it falls into the high-injury risk category. If the FMS score is 15-18 points, it falls into the medium-injury risk category. If the FMS score is 19-20 points, it falls into the low-injury risk category.

**Table 3. Norm of Sit-and-Reach Test**

| No. | Category | Male | Female |
|---|---|---|---|
| 1 | Excellent | ≥ 17.25 | ≥ 17.00 |
| 2 | Good | 15.25-17.00 | 16.00-16.75 |
| 3 | Fair | 13.75-15,00 | 14.75-15.75 |
| 4 | Less | 11.75-13.50 | 12.75-14.50 |
| 5 | Very Poor | ≤ 11.50 | ≤ 12.50 |

Table 3 above presents the sit-and-reach test norms between the male and female genders. This assessment consists of 5 categories: excellent, good, fair, less, and very poor. The limitations of the results in each category can be seen in Table 3 above. The researcher analysed data using a computerised Microsoft Excel programme and IBM SPSS v.25.0 statistics. This research data analysis technique uses descriptive statistics.

## RESULTS AND DISCUSSION

The results of this study were obtained from field measurements related to the potential risk of injury measured using the FMS score and the level of flexibility measured using the sit-and-reach test in amateur team sports athletes. The research sample amounted to 90 amateur team sports athletes, consisting of 59 male amateur athletes and 31 female amateur athletes. Team sports include basketball, volleyball, and futsal. The results of this research data are presented in descriptive statistics and then analysed using existing research norms (Cook et al., 2014; Teyhen et al., 2012). Table 4 below is a statistical description displayed based on the research data.

**Table 4. Descriptive Statistics of Research Data (n=90)**

| Statistics | Variables | | | |
|---|---|---|---|---|
| | Injury Risk | | Flexibility | |
| | Male | Female | Male | Female |
| N | 59 | 31 | 59 | 31 |
| Min. | 15 | 17 | 18 | 24 |
| Max. | 21 | 21 | 49 | 45 |
| Mean | 19.46 | 19.16 | 36.48 | 34.68 |
| SD | 1.41 | 1,16 | 8.02 | 5.97 |
| **Classification** | **Low** | **Low** | **Excellent** | **Excellent** |

Note. SD = Standard deviation, N = Number of samples, Min. = minimum value, Max. = maximum value

The descriptive statistics in Table 4 above provide an overview of two variables, injury risk and flexibility, divided by gender, namely male and female. For the injury risk variable in the male group, the range of values ranged from 15 to 21. While in the female group, the range of values was 17 to 21. The flexibility variable in the male group had a range of values between 18 and 49, while in the female group, the range was 24 and 45.

Regarding averages, the risk of injury in the men's group had an average value of 19.46. Meanwhile, the women's group's value was slightly lower at 19.16. As for the flexibility variable in the men's group, it has an average of around 36.48. At the same time, the women's group has an average of 34.68. The risk of injury has a standard deviation of 1.16 to 1.41. At the same time, flexibility has a standard deviation between 5.97 and 8.02. Based on the classification given, the risk of injury in both groups was classified as "low", while flexibility was classified as "excellent" in both male and female groups.

**Table 5. Frequency Distribution of Male Injury Risk Assessment (n=59)**

| No. | Points | Risk Category | Frequency | Percentage (%) |
|---|---|---|---|---|
| 1 | ≤ 14 | High | 0 | 0 |
| 2 | 15-18 | Medium | 13 | 22.03 |
| 3 | 19-21 | Low | 46 | 77.97 |
| **Total** | | | **59** | **100** |

Table 5 above results from calculations obtained from measurements of 59 male amateur athletes. The table above shows that the number of points less than 14 is a high-risk category in which none of the athletes are in that category with a percentage of 0%. Then, the number of points 15-18 is a medium-risk category with 13 male amateur athletes and a frequency of 22.03%. The last number of points was 19-21, with the low-risk category frequency of 46 male amateur athletes at a percentage of 77.97%.

**Table 6. Frequency Distribution of Female Injury Risk Assessment (n=31)**

| No. | Points | Risk Category | Frequency | Percentage (%) |
|---|---|---|---|---|
| 1 | ≤ 14 | High | 0 | 0 |
| 2 | 15-18 | Medium | 8 | 25.81 |
| 3 | 19-21 | Low | 23 | 74.19 |
| **Total** | | | **31** | **100** |

Table 6 above is the result obtained by measuring 31 female athletes from amateur athletes in volleyball and basketball; the table shows that the number of points more significant than 14 is in the high-risk category with a frequency value of 0 and a percentage of 0%. The number of points 15-18 is in the medium-risk category with a frequency of 8 and a percentage of 25.81%, and the last number of points 19-21 is in the low-risk category with a frequency of 23 and 74.19%. For more details, see the frequency distribution diagram in Figure 1.

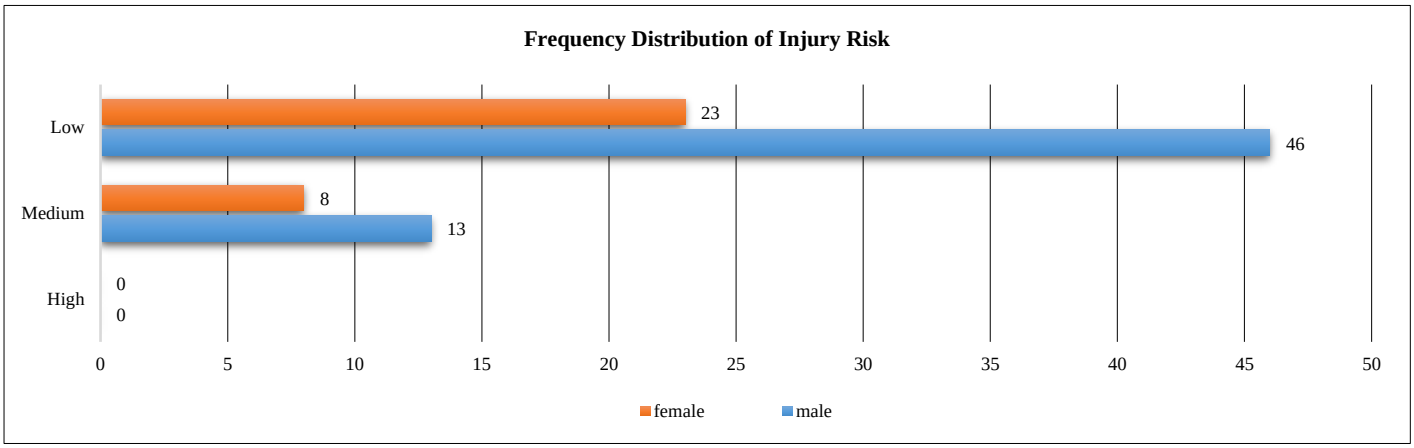


**Figure 1. Frequency Distribution Diagram of Injury Risk**

Figure 1 above clearly presents the frequency distribution of injury risk. Figure 1 shows 69 athletes in the low-injury risk category (male = 46, female = 23), 21 in the medium-injury-risk category (male = 13, female = 8), and none in the high-injury-risk category.

**Table 7. Frequency Distribution of Male Flexibility (n=59)**

| No. | Points | Category | Frequency | Percentage (%) |
|---|---|---|---|---|
| 1 | ≤11.50 | Very Poor | 0 | 0 |
| 2 | 11.75 – 13.50 | Less | 0 | 0 |
| 3 | 13.75 – 15.00 | Fair | 0 | 0 |
| 4 | 15.25 – 17.00 | Good | 0 | 0 |
| 5 | ≥17.25 | Excellent | 59 | 100 |
| **Total** | | | **59** | **100** |

The data in Table 7 above results from measurements involving 59 male athletes. The results show that the entire male sample, with a frequency of 59 athletes, has a level of risk categorised as "excellent" and a percentage of 100%.

**Table 8. Frequency Distribution of Female Flexibility (n=31)**

| No. | Points | Category | Frequency | Percentage (%) |
|---|---|---|---|---|
| 1 | ≤12.50 | Very Poor | 1 | 3,23 |
| 2 | 12.75-14.50 | Less | 0 | 0,00 |
| 3 | 14.75-15.75 | Fair | 0 | 0,00 |
| 4 | 16.00 – 16.75 | Good | 0 | 0,00 |
| 5 | ≥17.00 | Excellent | 30 | 96,77 |
| **Total** | | | **31** | **100** |

Table 8 above shows the results of measurements involving 31 female athletes. The results show that the athletes' level is in the excellent category. Most athletes have an excellent category, which is as many as 30 athletes, which indicates that the athletes have an excellent level of flexibility. None fell into the less or fair categories. However, one athlete still fell into the inferior category. For more details, see the frequency distribution diagram in Figure 2.

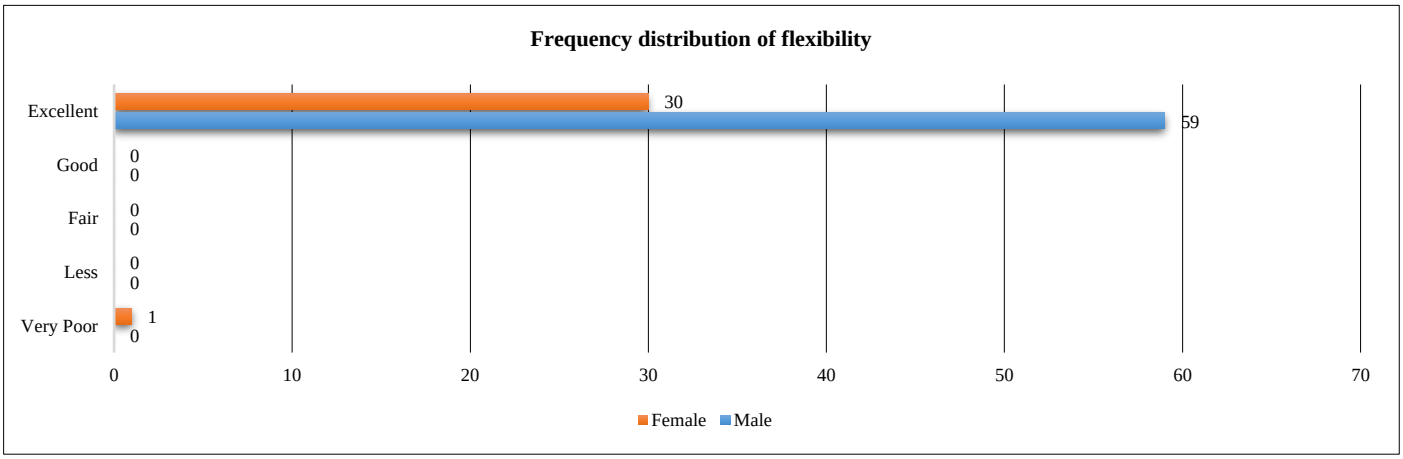


**Figure 2. Frequency Distribution Diagram of Flexibility**

Figure 2 above clearly displays the frequency distribution of amateur athletes' flexibility levels between males and females. Almost all male or female amateur athletes fall into the excellent category of flexibility level. Based on the data analysis of the research results, it is concluded that the risk of injury in men is lower than in females. This result can be seen from the percentage of injury risk in the medium category of men (22.03%) and women (24.81%). The percentage of injury risk in the low category of men is 77.97%, and that of women is 74.19%. The results of this data analysis are important to use as a guide during the training

process, how to treat male and female athletes in training. This needs to be considered because the risk of injury for women is higher than for men.

Previous research also states that females' average risk for whiplash injury-related impairment was 1.5 times higher compared to the male average for rear-end impacts on other seats and ten times higher for proximal femur fractures in pedestrian impacts for one of the two vehicle forms evaluated (Klug et al., 2023). Research on athletes' readiness to return to sport has also shown that female athletes have lower readiness than male athletes (Klug et al., 2023). In addition, another study also mentioned that overall injuries indicated significantly more injuries in male players than in female players. In contrast, injury location showed higher injury rates in male athletes than female athletes for upper extremity, hip/hip, thigh, and foot injuries. Female players had a significantly higher rate of anterior cruciate ligament injuries than male players (Zech et al., 2022).

This study aims to determine the level of flexibility and the injury history of amateur athletes in the Universitas Negeri Semarang student activity unit. Physical condition is essential for every athlete and plays a role in determining the risk factors for athlete injury (Anam et al., 2022; González et al., 2022). Power, speed, flexibility, and agility are some physical conditions that affect sports injuries. Athletes with good or excellent physical condition will have a small risk of injury; otherwise, the risk of injury is greater if the athlete has an impaired physical condition (Puspitasari, 2019). To determine the risk of injury, the tool used is Functional Movement Screening (FMS), which involves observing functional movements in sports activities (Chang et al., 2020).

Functional Movement Screening (FMS) identifies potential risk factors associated with injury in people who exercise or participate in sporting activities (Coogan et al., 2020). The test in FMS includes seven movements, namely inline lunge, hurdle step, deep squat, shoulder mobility, active straight leg raise, trunk stability push-up, and rotary stability (Cook et al., 2014). The seven basic movements in FMS are designed to test a person's physical abilities in the upper and lower extremities that accommodate efficient bodywork. The measurements taken in FMS use a functional approach based on the principles of proprioceptive neuromuscular facilitation (PNF), muscle performance, and motor learning (Minthorn et al., 2015). FMS also helps to identify muscles and joints that lack flexibility (Fallahasady et al., 2022).

Good flexibility has many benefits, including increasing muscle elasticity and providing an excellent range of motion in the joints (Nuruhidin et al., 2023). This allows the body to provide movement more easily and freely. The ability to change the direction of movement quickly and agilely depends on the level of flexibility in the body or body parts involved in a particular activity (Wan et al., 2021). A lack of flexibility can lead to excessive muscle tension and injury (Haryani, 2019). Flexibility is also essential in sports, as athletes with good flexibility tend to get injured less often and have a better chance of achieving maximum results in training and competition (Alonso-Fernández et al., 2022). Several studies have shown that flexibility limitations affect technique mastery and athlete performance (Torres-Pareja et al., 2019).

This study still needs to improve the number of research samples, limited to 90 amateur athletes in team sports, namely basketball, volleyball, and futsal. Many more team sports have yet to be included in this study, so the study's results are still limited to certain team sports. Future researchers should add more research subjects and take research subjects from various team sports. In addition, it is more focused on other physical condition components such as strength, endurance, speed, agility, and others.

## CONCLUSION

Based on the data analysis of the research results, it is concluded that the risk of injury in men is lower than in females. This result can be seen from the percentage of injury risk in the medium category of men (22.03%) and women (24.81%). The percentage of injury risk in the low category of men is 77.97%, and that of women is 74.19%. These findings can be used as a guide for training male and female athletes with different training portions. Further research is recommended to analyse other physical condition component variables as well as research subjects from different age groups. In addition, it is also recommended that more research samples from various levels of athletes be examined.

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**CONFLICT OF INTEREST**

All authors in this manuscript have declared no conflict of interest in this research.

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