Research article

Injury incidence in U18 female basketball players of FEMISUR-Chile League

Incidencia de lesiones en basquetbolistas femeninas U18 de Liga FEMISUR-Chile

Incidência de lesões em jogadoras de basquete sub-18 da Liga FEMISUR-Chile

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ABSTRACT

The objective of this study is to determine the incidence density of injuries and their characteristics, according to the STROBE-SIIS proposal, in the under-18 basketball players participating in the Southern Women's Basketball League (FEMISUR) in its 2023 season. A type of study with a positivist, observational, descriptive, longitudinal, prospective approach was used, with a non-probabilistic, intentional selection sample. Forms designed according to STROBE-SIIS were emailed to 59 players from 12 clubs over 22 weeks. The incidence density was calculated by dividing the number of lesions by the number of hours of exposure, normalizing by 1000 hours. To describe the characteristics of the injuries, absolute and relative frequency was determined according to onset, mechanism, tissue, anatomical area and severity. 108 injuries occurred, with an incidence of 36.21 injuries/1000 hours of exposure. The highest frequency was sudden acute onset (n=77; 71.3%), non-contact mechanism (n=46; 42.6%), muscle/tendon (n=61; 45.5%), ligament articular/capsular (n=19; 14.2%) and bones (n=14; 10.4%); and ankle (n=55; 27.1%), leg (n=40; 19.7%) and knee (n=34; 16.7%). Minor injuries were more frequent (n=68; 63%). A high incidence of injuries was found in the under-18 basketball players participating in the FEMISUR League. The most frequent injuries being those of sudden acute onset, non-contact mechanism, in muscle/tendon, ankle and mild severity. This information will benefit multidisciplinary teams that work with under-18 basketball players, in order to implement a prevention plan or perform comparative analyses.

Key words: Basketball; Athletic Injuries; Adolescent.

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RESUMEN

El objetivo de este estudio es determinar la densidad de incidencia de lesiones y sus características, según la propuesta STROBE-SIIS, en las basquetbolistas sub-18 participantes de la Liga de Básquetbol Femenino del Sur (FEMISUR) en su temporada 2023. Se utilizó un tipo de estudio con enfoque positivista observacional descriptivo de tipo longitudinal prospectivo, con una muestra no probabilística, de selección intencional. Se enviaron por correo electrónico formularios diseñados según STROBE-SIIS a 59 jugadoras de 12 clubes durante 22 semanas. Se calculó la densidad de incidencia, dividiendo número de lesiones por número de horas de exposición, normalizando por 1000 horas. Para la descripción de las características de las lesiones se determinó frecuencia absoluta y relativa según inicio, mecanismo, tejido, zona anatómica y severidad. Ocurrieron 108 lesiones, con una incidencia de 36,21 lesiones/1000 horas de exposición. La mayor frecuencia fue de inicio agudo repentino (n=77; 71,3%), mecanismo de no contacto (n=46; 42,6%), en músculo/tendón (n=61; 45,5%), ligamento/capsular articular (n=19; 14,2%) y huesos (n=14; 10,4%); y tobillo (n=55; 27,1%), pierna (n=40; 19,7%) y rodilla (n=34; 16,7%). Las lesiones leves fueron más frecuentes (n=68;63%). Se encontró una alta incidencia de lesiones en las basquetbolistas sub-18 participantes de la Liga FEMISUR, siendo las lesiones más frecuentes las de inicio agudo repentino, mecanismo de no contacto, en músculo/tendón, tobillo y severidad leve. Esta información beneficiará a los equipos multidisciplinarios que trabajan con basquetbolistas sub-18, con el fin de implementar un plan de prevención o realizar análisis comparativos.

Palabras clave: Baloncesto; Traumatismos en atletas; Adolescente.

RESUMO

O objetivo deste estudo é determinar a densidade de incidência de lesões e suas características, segundo a proposta do STROBE-SIIS, nas jogadoras de basquete sub-18 participantes da Liga Sul de Basquete Feminino (FEMISUR) na temporada 2023. Utilizou-se estudo do tipo positivista, observacional, descritivo, longitudinal, prospectivo, com amostra não probabilística e de seleção intencional. Formulários elaborados de acordo com o STROBE-SIIS foram enviados por e-mail para 59 jogadores de 12 clubes durante 22 semanas. A densidade de incidência foi calculada dividindo o número de lesões pelo número de horas de exposição, normalizando por 1000 horas. Para descrever as características das lesões, foram determinadas frequências absoluta e relativa de acordo com início, mecanismo, tecido, área anatômica e gravidade. Ocorreram 108 lesões, com incidência de 36,21 lesões/1000 horas de exposição. A maior frequência foi início agudo súbito (n=77; 71,3%), mecanismo sem contato (n=46; 42,6%), músculo/tendão (n=61; 45,5%), ligamento articular/capsular (n=19; 14,2%) e ossos (n=14; 10,4%); e tornozelo (n=55; 27,1%), perna (n=40; 19,7%) e joelho (n=34; 16,7%). Lesões leves foram mais frequentes (n=68;63%). Foi encontrada alta incidência de lesões nos basquetebolistas sub-18 participantes da Liga FEMISUR. As lesões mais frequentes são as de início agudo súbito, mecanismo sem contato, em músculo/tendão, tornozelo e gravidade leve. Esta informação beneficiará equipas multidisciplinares que trabalham com jogadores de basquetebol sub-18, para implementar um plano de prevenção ou realizar análises comparativas.

Palavras chave: Basquete; Trauma em atletas; Adolescente.

INTRODUCTION

Basketball is one of the most widely practiced sports worldwide and nationally. In Chile, the practice of this activity takes place at different levels of organization, which range from the school-training level to the professional level. For the transition between these levels, there are different leagues, the Southern Women's Basketball League (FEMISUR) being one of them. This League aims to promote both the training and development of the discipline, in initiation and competitive settings. To do so, it considers players from four series (U11-U13-U15-U18) from the five regions of southern Chile. Practicing this sport discipline provides multiple physical, psychological, cognitive and social benefits, especially to adolescents who practice it (Bretón & Castro, 2017; Andrades-Suárez et al., 2022; Rosa-Guillamón, 2019). However, its practice also brings with it an inherent risk of injury, due to the characteristics and actions of the game, which are carried out both in training and in competition, which include jumping, dribbling, defending, changes of direction, attacking (Gottlieb et al., 2021).

This is why sports professionals who work with this type of athletes must have skills for injury prevention and recovery. This is reflected in the General Meeting of the International Federation of Sports Physiotherapy (2004), which highlights that one of the key competencies of a kinesiologist in the sports field is injury prevention, using the knowledge, skills and attitudes specific to the sport to achieve the best clinical sports practice (Bulley & Donaghy, 2005). In search of compliance with this competence, van Mechelen et al. (1992) published a model that considers the "Sports Injury Prevention Sequence", a document in which four steps are described. The first step is to identify the magnitude, characteristics and severity of the problem, which is an essential step for the rest of the model.

Regarding this first step, incidences of injuries in adolescent basketball players have been found ranging from 2.64 to 14.4 injuries/1000 hours of exposure (Owoeye et al., 2020; Pasanen et al., 2017). The characteristics of these injuries range from acute, such as ankle sprains (Pasanen et al., 2017), cruciate ligament tears (Stojanović et al., 2023) or head contusions (Zynda et al., 2022) to injuries of gradual origin such as knee tendinopathies (Owoeye et al., 2020). These injuries can have different degrees of severity, from mild injuries without loss of sports time, such as skin abrasions, to more serious ones, which can leave the athlete with a prolonged recovery period and, therefore, without training or competitions (Allen et al., 2019). The latter can leave physical repercussions, limitation and impossibility of continuing with the sports practice, which can affect their mental health and social relationships (Smith, 1996). Despite the large amount of information for the fulfillment of the identification of the magnitude, characteristics and severity of the problem, it has been described that the efficiency of the sports injury prevention model depends on its adaptation to the context in which it is executed, which is why researchers are encouraged to carry out studies applied to their reality (Bolling et al., 2018). For the performance of applied epidemiological studies, the International Olympic Committee (IOC) presented the consensus called "Strengthening the Reporting of Observational Studies in Epidemiology: Extension for Sports Injury and Illness Surveillance" (STROBE-SIIS) for the epidemiological registration and reporting of sports injuries, with the aim of improving the consistency of the reports and their replicability (Bahr et al., 2020). This consensus encourages continuous surveillance studies, in and out of competition, to describe injury tendencies, identify their causes and implications, in order to promote the health of athletes. In parallel, the implementation of the methods described in this international

consensus will promote coherence in data collection and research reports, as well as strategic alliances for the purpose of sharing epidemiological information.

In this regard, in Chile there is little epidemiological information on injuries in basketball players and, therefore, a research gap in this area. Only a few records of injuries have been found in this population (Cares et al., 2018; Danes et al., 2020). Based on the above, the main objective of this research is to determine the incidence density of injuries and their characteristics, according to the STROBE-SIIS proposal, in the U18 female basketball players participating in the FEMISUR League in its 2023 season.

METHODS

This research is a study with a positivist approach, with a prospective longitudinal observational-descriptive design and a non-probabilistic sample of intentional or occasional selection. The information was recorded based on the consensus for the epidemiological registration and reporting of sports injuries (STROBE-SIIS) (Bahr et al., 2020). This research was carried out under strict ethical and scientific criteria, guaranteeing that the data obtained will be confidential and will only be used for this study. In addition, signatures of consent and assent were obtained. With this, the ethical criteria were respected, in accordance with the Declaration of Helsinki for the study with human beings (Manzini, 2000). This research was reviewed and approved for implementation by the Scientific Ethics Committee of the Service of the city of Valdivia (No. 512/12.12.2022) in December 2022.

Participants

The 252 players from the 19 clubs participating in the FEMISUR League were invited to participate voluntarily. The inclusion criteria included U18 basketball players from teams participating in the FEMISUR League for the 2023 season and authorization from their guardian if they were minors. The exclusion criteria included players who were injured at the start of the season (prior to participating in this study) or who did not respond to the injury registration form.

Procedures

In March 2023, contact was made with the FEMISUR League and its respective leaders to obtain approval of the project with the clubs that make up this League. After obtaining approval from the directors, the recruitment period for the participants took place between March and April 2023. The follow-up period extended from April 18 to September 17, 2023. The information was collected through two Google Forms sent via email. The first form was a one-time submission at the beginning of the study, which collected the sociodemographic and control variables. The following forms were sent every 14 days, requesting information from the participants regarding the occurrence of injuries, both in training and in competition. In the event that the player recorded an injury, she was asked to report its characteristics.

Study variables

Injury: It was defined as "Any complaint or discomfort that affects the physical condition of the athlete and prevents the performance of the sports activity both in training and competition" (Blake et al., 2014).

Characteristics and severity of the injury: These were defined according to the IOC STROBE-SIIS consensus in Table 1 (Bahr et al., 2020).

Table 1

Lesion characteristics according to STROBE-SIIS.

Injury onset: characterization of the beginning of the injury.	• Acute of sudden origin (injury that occurs spontaneously or unexpectedly). • Repetitive sudden onset (injury that occurs unexpectedly as a result of repetitive actions). • Repetitive, gradual in onset (injury that develops over time due to repetitive action).
Mechanism of injury: mechanism of origin of the injury.	• Non-contact (injury where there is no interruption or disturbance of the athlete's movement pattern). • Indirect contact through another athlete (injury that occurs through interaction with another athlete or opponent in which an action is generated that cannot be controlled by the affected athlete). • Indirect contact through an object (injury caused by interaction with an object as a result of an improper action or error on the part of the athlete). • Direct contact with another athlete (injury caused by the action of one athlete towards another). • Direct contact with an object (injury caused by an object towards an athlete).
Injured tissue: cellular group that originates a system which is affected.	• Muscle/tendon, nerves, bones, cartilage/synovial/bursa, ligament/joint capsule, superficial tissue/skin, arteries/arterioles/capillaries/venules/veins, internal organs and unspecified.
Injured anatomical zone: segment of the human body where an injury occurs.	• Head, neck, shoulder, upper arm (between elbow and shoulder), elbow, forearm, wrist/hand, chest, thoracic spine, lumbar spine, pelvis/buttocks, hip/groin, thigh, knee, lower leg (between knee and ankle), ankle, and foot.
Severity of injury: according to sports disability	• Mild (1 to 7 days). • Moderate (8 to 20 days). • Severe (greater than 28 days).

Sociodemographic/control variables: age, height, weight, body mass index (BMI), weekly training hours and playing position.

Statistical analysis: For the analysis of the data collected during the research, the computer program JASP version 0.17.2.1 was used. For the descriptive analysis of the participants according to sociodemographic/control characteristics, the distributional behavior of the quantitative variables was evaluated using the Kolmogorov test, ruling out the hypothesis of adjustment to normality with p values less than 0.05. The description was made through the distribution of absolute and relative frequencies, and measures of central tendency and dispersion. The use of means and their standard deviation or median and interquartile range will obey the distributional behavior of the different variables. In an exploratory analysis, differences were determined between the group of uninjured and injured players using the T-test or Mann-Whitney tests according to the behavior of the variable. For the variables of interest in this study, they were described through absolute frequency and relative frequency, based on the STROBE-SIIS recommendations, according to the playing position. The

incidence density was calculated through the injuries reported by the players during the course of the investigation, divided by the hours of exposure they presented throughout the follow-up, which was multiplied by 1000, obtaining the total incidence per thousand hours.

RESULTS

Twelve of the nineteen clubs in the 2023 FEMISUR League agreed to participate in this study. Of these, 59 players were analyzed. 45 players (76.27%) had an injury during the follow-up period. There were no significant differences between injured and non-injured players regarding their demographic characteristics or sport (Table 2).

Table 2

Characteristics of FEMISUR League basketball players according to the occurrence of injury.

Sociodemographic variables	Total n=59	Not injured n=14 (23,73%)	Injured n=45 (76,27%)	p*
Age[a]	16,41 (0,82)	16,59 (0,92)	16,35 (0,79)	0,36
BMI[b]	24,02 [21,69-25,95]	23,79 [15,80-17,22]	24,10 [15,83-16,85]	0,94
Weight[b]	62,83 [58,00-67,50]	60,78 [57,65-63,75]	63,46 [58,00- 68,00]	0,60
Height[a]	1,61 (0,06)	1,59 (0,06)	1,62 (0,06)	0,22
Weekly training hours [a]	8,67 (3,59)	9,31 (3,79)	8,48 (3,54)	0,45
Position[c]				0,26
Point Guard	19 (32,20)	5 (35,71)	14 (31,11)	
Shooting Guard	9 (15.25)	4 (28,57)	5 (11,11)	
Small Forward	15 (25,42)	4 (28,57)	11 (24,44)	
Power Forward	7 (11,86)	0 (0,00)	7 (15,55)	
Center	9 (15,25)	1 (7,14)	8 (17,77)	

[a] Data shown as mean (standard deviation); *: T-test.

[b] Data shown as median [interquartile ranges]; *: Mann Whitney test.

[c] Data shown as absolute frequency (%); *: Chi square.

BMI: Body mass index.

n= Absolute frequency, (%) Relative frequency.

The most frequent injuries were those of sudden origin with a total of 77 records (71.30%), followed by repetitive injuries of sudden origin (n=22; 20.40%) and repetitive injuries of gradual origin (n=9; 8.30%). The most predominant injury mechanism was non-contact with 42.60%. The injured tissue with the greatest number of injuries was muscle/tendon with 45.50%, followed by ligament/joint capsule with 14.20%. With 27.10%, the most frequently injured anatomical area exposed by the players was the ankle, followed by the lower leg (19.70%). Figure 1 shows the most frequently injured anatomical areas by playing position. Finally, mild injuries were the most frequent with 63%.

Figure 1

Injury frequency by anatomical zone, in FEMISUR U18 League players, according to playing position.
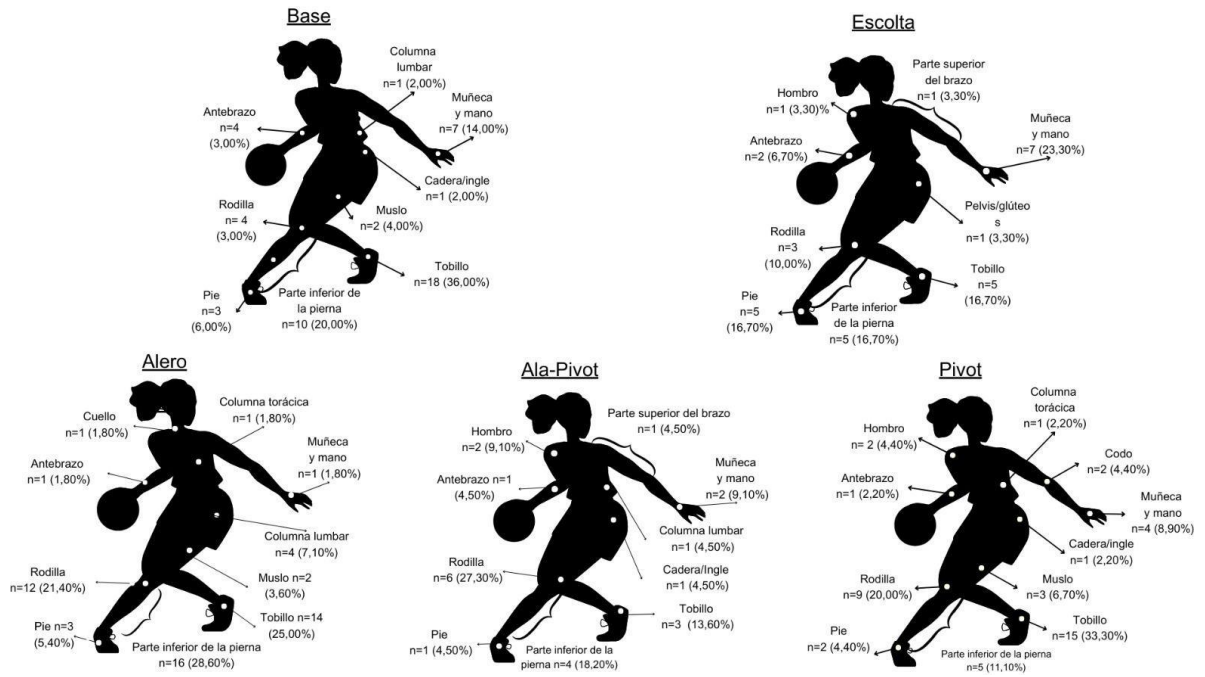
The total incidence of injuries in U-18 basketball players in the 2023 FEMISUR League was 36.21 injuries/1000 hours of exposure, which fluctuated between 15,625 and 45,454 injuries/1000 hours of exposure during the follow-up period (Figure 2).

Figure 2

Incidence of injuries in FEMISUR 18 League players, by self-report, within the follow-up period.
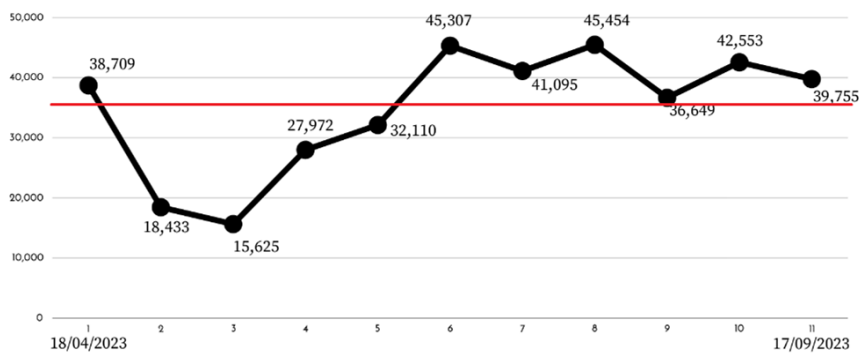
DISCUSSION

The main objective of the study was to determine the incidence density of injuries and their characteristics in FEMISUR League U-18 basketball players in their 2023 season.

The incidence found in our study population was higher compared to other studies in female basketball players of similar age (Borowski et al., 2008; López et al., 2017; Owoeye et al., 2020; Pasanen et al., 2017). These differences may be due to two factors. First, the diagnostic method used in this study is a self-report, where the participants, under the definition of injury provided, determined whether they were injured or not. Other studies have defined the care by a sports health professional (e.g.: doctors, kinesiologists, coaches) to determine the injury (Borowski et al., 2008; López et al., 2017; Owoeye et al., 2020). This, on the one hand, could lead to an overestimation of the injury rate by the athletes participating in this research. However, this could be nuanced since they were given a clear definition of injury. On the other hand, the lower incidence of injuries shown in the literature could be due to the possibilities of each athlete to access a sports health professional, which could be low. Secondly, the definition of injury used in this study defines any complaint or discomfort that affects the physical condition of the athlete and prevents the performance of the sports activity both in training and competition (Blake et al., 2014), therefore, the impediment of only one training/competition could be recorded. Other studies have described that an injury should result in losses of more than one day/training (Kluitenberg et al., 2016), or result from participation in an organized training or competition, so the incidence of these would be lower (Borowski et al., 2008; Owoeye et al., 2020). This point should be considered by researchers and professionals in charge of athletes' health, since differences in definitions could generate disparate epidemiological results (Timpka et al., 2014). This is why it is proposed to generate a consensus on the definition of injury, among athletes and their professional environment, which will help to have better records.

The incidence of injuries had a tendency to be higher at the beginning of the season, then to obtain fewer reports of injury and, subsequently, a new increase in the final part of it. This trend can be explained by various reasons. On the one hand, the high initial incidence may be due to the rapid introduction to competition (FEMISUR), a short pre-season or the lack of a structured training programme during the athletes' holidays between seasons (Shanley et al., 2011). On the other hand, the rise in the second part of the season may be associated with the physical and psychological load accumulated during the season and the demands of competition in search of a better position in the championship classification (Koutedakis & Sharp, 1998). However, sports injuries have a multifactorial character (Wiese-Bjornstal, 2010), so these hypotheses should be analysed in prospective longitudinal studies with multivariate analysis.

Regarding the characteristics of the injuries recorded, the most frequent were those of sudden, acute onset and non-contact origin. This result is consistent and agrees with what is shown in the literature (Borowski et al., 2008; López et al., 2017; Owoeye et al., 2020). Basketball requires actions with constant changes of direction, accelerations, jumps and landings, which expose players to this injury mechanism (López et al., 2017; Panagiotakis et al., 2017; Peña et al., 2023; Saito et al., 2023; Stojanović et al., 2018). Regarding this result, it should be considered that this study was based on determining the incidence of injuries, so all "new" injuries in the population of players that arose during the study period were recorded, so players who suffered from recurrent injuries (for example, patellar tendinopathy)

might not have recorded this condition. It is recommended that, for this type of injuries, measures such as prevalence be used for their epidemiological recording (Bahr et al., 2020).

The tissue with the highest frequency of injury found was in muscle/tendon, followed by ligament/capsular. This result is different from what is shown in much of the scientific literature, where ligament injury is the most frequent (Borowski et al., 2008; López et al., 2017; Owoeye et al., 2020; Pasanen et al., 2017). We believe that this difference was due to the difficulties in defining the injured tissue by the researchers so that it was understandable for the study population. Unlike the other characteristics (origin, mechanism, anatomical area and severity), which had a clearer definition or contained more familiar answers, the definition of injured tissue was "cellular set that originates a system that is affected", which, due to the little experience in anatomy on the part of the participating players, could be a source of confusion. The latter should be a point to consider in future studies where self-reporting is used as a tool for recording injuries.

The anatomical areas with the highest frequency of injuries were the ankle and the leg. This is consistent with most epidemiological studies in this population (Andreoli et al., 2018; Stojanović et al., 2023). Sudden inversions, internal rotations, and low plantar flexion of the ankle or contact with an opponent's foot during landing actions seem to be the mechanisms that explain its high frequency (Panagiotakis et al., 2017). In this regard, a systematic review has recently been published describing that the number of games, history of hip, hamstring or quadriceps injuries were risk factors for ankle sprains in National Basketball Association (NBA) players (Tummala et al., 2023).

The players with the highest incidence of injuries were the power forwards and pivots. These players are usually the tallest and heaviest on the team and are in constant contact with opposing players. These characteristics could be an important factor in their higher injury rate (Bove et al., 2019). This is why the health team that works in basketball teams must pay special attention to athletes who play in these positions.

Finally, mild injuries (1 to 7 days of sports disability) were the most frequent in our study. This finding is consistent with other studies in populations with similar characteristics (Borowski et al., 2008; López et al., 2017; Owoeye et al., 2020). It should be considered that both the incidence and severity of injuries tend to increase as the competition season progresses, so this value may be higher in leagues with longer competition time (Bullock et al., 2021).

CONCLUSION

A high incidence of injuries was found in female basketball players of the FEMISUR League during the 2023 season. The most frequent injuries were sudden acute onset injuries, non-contact injuries, muscle/tendon injuries, ankle injuries, and mild injuries.

This research has not been without some limitations. The sample size that was finally analyzed was low compared to the accessible population (n=59;23.41%). This limitation is one of the most typical in this type of study, so the results should be taken with caution and only as an approximation to the study problem (Salazar et al., 2019). Despite this, the sample was distributed among 12 of the 19 teams that participate in the FEMISUR League, so it has a certain heterogeneity and representativeness of the

entire population. We suggest that future research develop awareness periods regarding the benefits of having an updated epidemiological record with managers, coaches and players, in order to have greater adherence to this type of study. Another limitation is that the injury diagnosis was made through a self-report, without confirmation of a diagnosis by the health team; this could generate problems with the accuracy of the injury diagnosis. However, it has been found that self-reports of injuries, with clear definitions of this, have a high reliability when compared to medical diagnoses. However, this reliability is reduced when athletes must make a more precise diagnosis of their injury, for example, anatomical area or injured tissue (Schuh-Renner et al., 2019). For this reason, we recommend defining or illustrating each variable, to improve the accuracy of the records.

Despite these limitations, the results of this study are useful, as it is essential information to develop injury reduction programs. Finally, this information should be considered and used in the optimization of sports policy and in training and competition processes, especially through multidisciplinary teams that work with youth basketball players, and in this way, educate and reduce the incidence of injuries.

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