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Leg length inequality and its relationship with injuries incidence of young basketball players: an observational study.

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ABSTRACT

Introduction: The leg length inequality (LLI) creates postural changes collaborating with the emergence of functional limitations and musculoskeletal disorders. In a sport like basketball inequality of the lower limbs may be added to the demands of the sport and generate an increase in the incidence of injuries. **Objective:** The aim of this study was to identify young basketball players from with structural or functional LLI and its influence in injury incidence in a period of 6 months. **Methods:** 18 players were followed with an average age of 14.50 ± 1.86 of a basketball team from the city of Sorocaba for a period of 6 months. At the beginning and end of that period were applied tests from the Morbidity Survey Report modified for basketball to obtain data such as physical characteristics, training time, incidence of injuries, quantitative and qualitative measurement of the length of the lower limbs. **Results:** 72.2% of players had LLI and 50% had some kind of injury during this period, among the most common, sprains and muscle strains. **Conclusions:** There was a high rate of players with LLI and a positive relationship between this inequality with the incidence of injury.

Key words: Basketball; Athletic Injuries; Leg Length Inequalities.

INTRODUCTION

One of the most common biomechanical abnormalities in the population is lower limbs inequality (LLI), popularly known as short leg. There are two types of LLI, structural and functional. The structural is related to inequality of bone structures, and functional is related to stiffness or muscle weakness and/or mobility of joints of the pelvis and lower limb, for example, sacroiliac dysfunction (SID), which corresponds to a reversible decrease in joint mobility, without any type of bone displacement. [(1)]

Our body creates compensatory mechanisms, because the LLI changes the position of the center of gravity and the center of pressure. [(2)] These compensatory mechanisms are: pronation of the foot, hip extension and knee on the long leg; supination of the foot, hip flexion and knee at the short leg [(3,4)]; pelvic obliquity in the frontal plane [(4-9)]; and functional scoliosis of the spine. [(5,7,8)] These changes make the joints less able to absorb impacts and the muscles more fatigued due to the necessity to balance the body.

All these factors contribute to functional limitations and musculoskeletal disorders to occur. Among the functional limitations are changes in the gait pattern, running and balance [(1,10-13)]; and the musculoskeletal disorders are the low back pain [(1,5,8,9,14-16)], osteoarthritis of the knee and/or hip [(1,13,17,18)], and stress fracture. [(1,17)]

Brunet et al. [(19)] found that LLI is a contributing factor to the development of injuries in activities that involves running, because of the overload generated in the lower limbs. So in a sport like basketball, which involves running with large impacts, intense and short efforts with sudden changes of direction, frequent jumps, landings and pivoting, LLI could be added to the demands of the sport and generate an increase in the incidence of injuries. [(3,20,21)]

Specifically, the inequality of the lower limbs can lead to overuse injuries in basketball players, as it was discovered by Leppänen, Pasanen, and Kujala [(22)], and the most affected locations were in the lower limbs (knee and pelvis) and the lumbar spine. This type of injury usually affects the practice of sport and the player's ability to compete for a long time.

Thus, the aim of this study was to identify the incidence of inequality of the lower limbs in basketball players and discuss its relation to the injuries presented by them for a period of 6 months.

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METHODS

This is an observational and cross-sectional study of basketball players aged 10 to 18 years.

Ethical aspects

The study was approved by the Research Ethics Committee of the University of Sorocaba (UNISO) by the protocol 1.020.268. The study included minors subjects, where the legal guardians had to sign the Informed Consent Form to allow the participation of the minor in the study.

Participants

To determine the sample, the eligibility criteria was divided into inclusion and exclusion criteria. The inclusion criteria were: being a player belonging to the team Sorocaba Basketball League and aged between 10 and 18 years. On the other hand, the exclusion criteria were: being away from training in the early period of the study and have musculoskeletal pathology that could influence the outcome of the physical test.

Evaluation Tools

The tools used to evaluate basketball players were a two meters tape measure, a digital scale, a fixed height gauge and a stretcher.

Data Collection

Data collection was carried out individually by a Morbidity Survey Report (MSR) from Vanderlei et al. [23] and Pastre et al. [24] (Appendix 1). The first phase was the collection of information such as gender, age, body mass, height, body mass index (BMI), months of training, training hours per week, training sessions per week, and previous injuries. Moreover, in this phase were made two leg length assessments to differentiate structural or functional inequalities. The first evaluation quantifies the LLI and was performed using the Tape Measure Method (TMM) based on Neelly et al. [25] study. The second assessment was carried out through the Downing test that seeks to assess the presence of a dysfunction on the pelvis. [26-29]

The second phase was carried out over the next 6 months and it is related to the incidence and characteristics of injuries presented during this period. The definition of injury in sport chosen for this study was "any problems that occur in the musculoskeletal system that is originated in sports depriving the player of any activity during training or competition".[23,24]

The MSR variables follow the same order as Pastre et al. [24] and Vanderlei et al. [23] presented, where the participants were asked 12 different types of injuries (muscle strain, contracture, tendinopathy, etc.), 4 types of injury mechanism (direct contact, a single traumatic event such as an impact of players, without contact, sport activities like jumping and running, and overuse, repetitive microtraumas in the musculoskeletal system without adequate recovery), 19 anatomical sites of injury or discomfort (trunk, shoulder, wrist, hand, thigh, leg, ankle, foot, etc.), 2 types of return to normal activities (asymptomatic and symptomatic), and 2 moments of injury (training or competition).

Statistical analyses

To interpret the results the Microsoft Excel (2013) was utilized. In addition, it was used an exploratory and descriptive analysis based on the mean and standard deviation (SD) for continuous variables and frequencies and percentages for categorical variables.

RESULTS

The initial sample counted with the participation of 70 players which after undergoing the eligibility criteria were selected and reduced to 54. Among these volunteers and players initially selected, 36 were excluded from the sample for reasons such as change of team or sport leave (Figure 1). Thus, the final sample consisted of 18 players whose which the general characteristics are described in Table 1.

Regarding the analysis of the incidence of LLI, considering only the equal or greater differences than 0.5 cm, were found in 72.2% of the players, of these, 46.1% had a shorter right leg while 53.9% presented the same condition in their left leg.

Another result was observed for the presence or absence of dysfunction of the pelvis (SID) associated with LLI. Among the LLI cases, 50% of them were related to SID, showing a structural change accompanied by a functional one, while in 22.2% of cases the LLI happened isolated (structural change), and 11.1% of cases were observed only SID (functional limitation) (Figure 2).

With regard to the incidence of injuries, 50% of the players reported at least one injury, of these, 66.6% with LLI associated with SID; 22.2% with only LLI; and 11.1% with only SID. Players who did not have LLI or SID did not report any injury. The most common types of injuries were sprains (55.5%) and muscle strain (44.4%), and the mechanisms of injury were during running or landing without contact with another player (55.5%), direct contact with another player (22.2%) and (22.2%) overload training. As for the most affected regions: ankle (33.3%), knee (22.2%), anterior thigh (22.2%), hip (11.1%) and hand (11.1%).

DISCUSSION

The results of this study showed a high incidence of LLI in the evaluated players, as well as the high rate of injuries in this group, showing a direct relationship between LLI and the injury rate. This fact can be seen when observed that 88.8% of the athletes who had injury during the study period had this difference (66.6% LLI and SID associated; only 22.2% LLI). Another important aspect observed was that only 22.2% of injuries were reported by the athletes as due to direct contact with another player demonstrating that the injuries can have

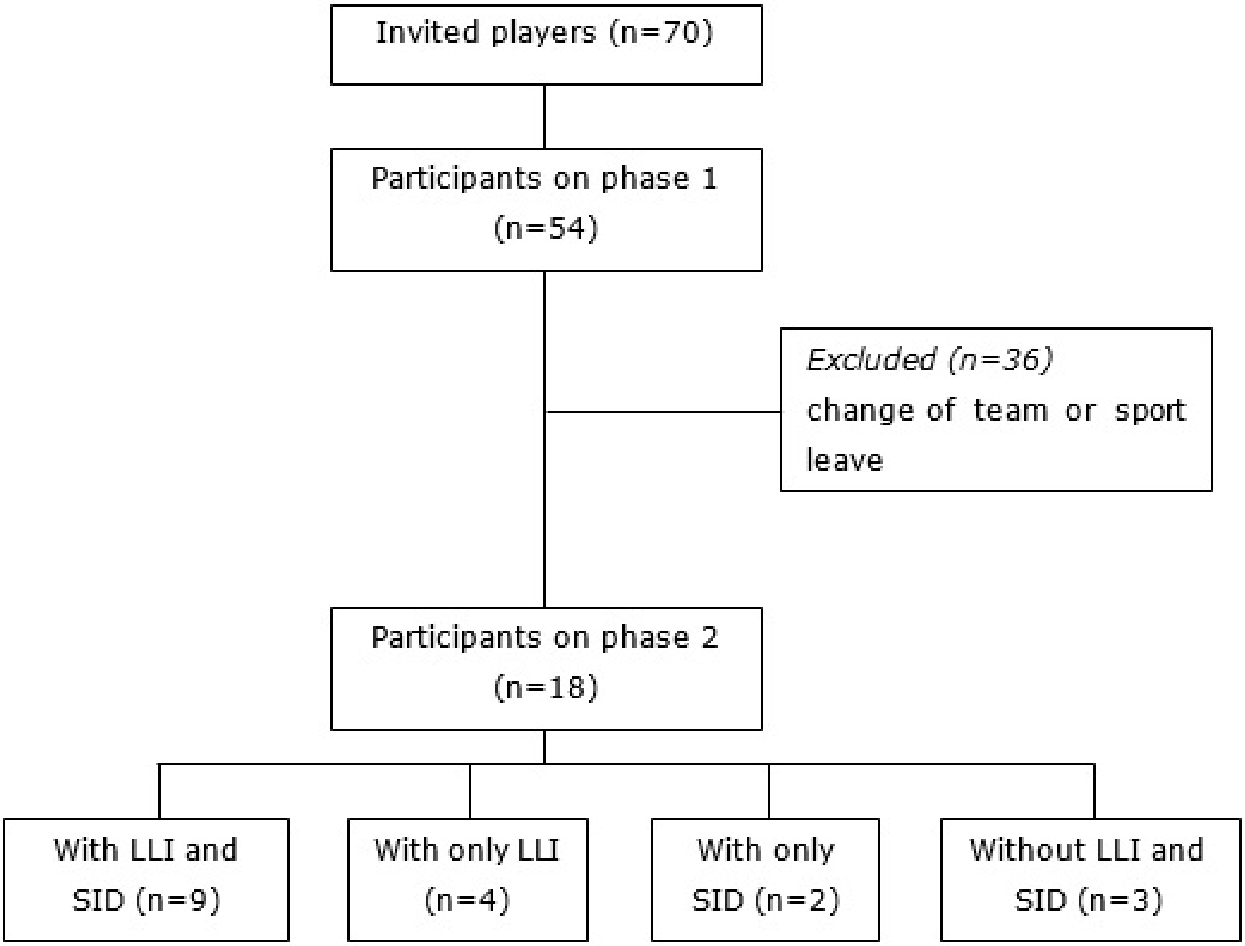

Figure 1 - Flowchart composition of participants

Table 1 – General characteristics of the basketball players

	Players (n=18)
Age (years)	14.50 ± 1.86
Body mass (kg)	64.07 ± 13.24
Height (m)	1.73 ± 0.12
BMI (kg/m²)	21.19 ± 2.72
Months of training	17.17 ± 15.70
Training hours per week	4.17 ± 2.03
Training sessions per week	2.78 ± 1.36

n – number of subjects, kg – kilogram, m – meter, BMI – Body Mass Index, kg/m² = kilogram per meter squared.

an important functional relationship, and yet the vast majority of them (88.8%) located in the lower limbs, even in sport that is highly related to the upper limbs.

Other studies showed the relationship of LLI and injuries, such as Brunet et al. [19] reporting that the biomechanical imbalance generated by LLI in recreational runners can increase from two to four times the body weight, making the body more vulnerable to injury. Liu et al. [30] suggests that individuals with LLI had an increase in the degree of supination of the subtalar joint, producing a stiffer foot thus less capable of absorbing impact, which is more prone to injury. These reports corroborate with the findings of this study, where most players with LLI and SID were injured, mostly in the lower limbs without being by direct contact with other players, indicating that a functional change influence on the incidence and type of injury.

The correction of LLI is defended by authors such as Brunet et al. [19] to prevent the installation of overuse injuries because it generates postural imbalances that contribute to the occurrence of injuries in running activities. In a functional LLI, that occurs when LLI and SID are associated, the treatment may include temporary postural insoles, joint mobilizations, stretching and strengthening the muscles that generated the DSI. In contrast, the treatment of structural LLI would be performed with the use of permanent postural insoles and postural reeducation.

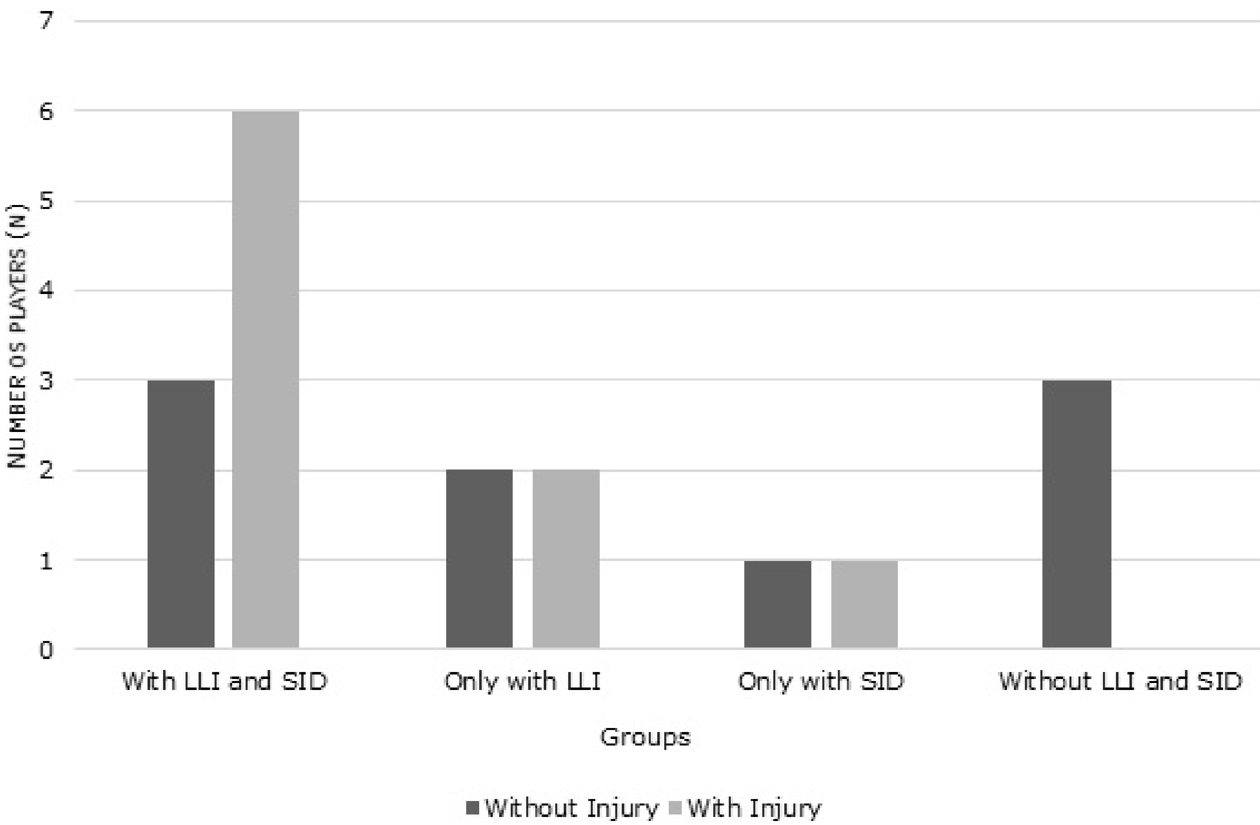

Figure 2 - Injury incidence according to the players dysfunction group

With regards to the amount of LLI, in millimeters, needed to prevent or treat potential problems in the musculoskeletal system resulting from this dysfunction, there is no consensus in the literature with a minimal difference to start a treatment.[5-7] However, considering the functional demand of a high-level sport and the results of this study, it can be justified the need to treat it independently of its size difference.

CONCLUSIONS

There was a high rate of players with LLI and a positive relationship between this inequality with the incidence and characteristics of injuries, indicating the need to intervene in this inequality, preventively.

ABBREVIATIONS

LLI – lower limb inequality, SID – sacroiliac dysfunction, n – number of subjects, kg – kilogram, m – meter, BMI – Body Mass Index, kg/m^2 = kilogram per meter squared.

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AUTHORS' CONTRIBUTIONS

LVS carried out the lower limb inequality and incidence of injuries in basketball studies, participated in the data collection, and drafted the manuscript. MFR carried out the biomechanics of injuries in basketball studies and participated in the data collection. CSO coordinated and helped to draft the manuscript. HPN carried out the lower limb inequality studies, performed the statistical analysis and helped to draft the manuscript.

CONFLITS OF INTEREST:

No.

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Appendix 1: Morbidity Survey Report - Basketball

ID: ______ Age: ______ Height: ______ Body Mass: ______ BMI: ______
Months of training: _____ Training hours/week: ______ Training sessions/week: ______
Previous injuries ____

____

Lower limbs	Size (mm)	Anterior iliac mobility	Posterior iliac mobility
Right			
Left			

Variables	Sport injuries							
ID of sport injury	1ª	2ª	3ª	4ª	5ª	6ª	7ª	8ª
Type of injury								
Mechanicsm of injury								
Anatomical sites								
Return to normal acitivities								
Moments of injury								

Codification of variables

Type of injury	Mechanism of injury	Anatomical sites	
1- Mescle strain	1- Direct contact	1- Shoulder	13- Posterior thigh
2- Muscle contracture	2- Without contact	2- Arm	14- Knee
3- Tendionopathy	3- Overuse	3- Forearm	15- Leg
4- Sprain	4- Other	4- Elbow	16- Calf
5- Muscle pain		5- Wrist	17- Ankle
6- Periostitis		6- Hand	18- Foot
7- Synovitis		7- Thorax	19- Other
8- Fracture		8- Abdomen	
9- Bursitis		9- Lumbar region	
10- Inespecific acute pain		10- Cervical region	
11- Inespecific chronic pain		11- Hip	
12- Other		12- Anterior thigh	

Return to normal activities
1- Asymptomatic
2- Symptomatic

Moment of injury
1- Training
2- Competition