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RESEARCH ARTICLE
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ASSESSMENT OF CARDIORESPIRATORY FITNESS AND PREVALENCE OF WORK-RELATED MUSCULOSKELETAL INJURIES IN STATE-LEVEL BASKETBALL PLAYERS -AN OBSERVATIONAL STUDY

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Abstract

Background: State-level basketball players are exposed to extreme physical demands, leading to changes in their cardiorespiratory fitness and at-risk work-related musculoskeletal injuries. These factors are therefore of prime interest to guide effective training and prevention strategies.

Materials & Methods: This was an observational study for four months on 100 state-level basketball players. Cardiorespiratory fitness assessment was done through the Six-Minute Walk Test, commonly known as 6MWT. Acquisition of musculoskeletal injury data was done by Modified Nordic Musculoskeletal Questionnaire. Other measures included the acquisition of heart rate, blood pressure, and BMI. Descriptive statistics along with inferential statistics were applied to analyze the data.

Results: Average distances covered in the 6MWT were 484.84 meters, showing good overall cardiorespiratory fitness, though with variability among players. Musculoskeletal issues by frequency the most frequent musculoskeletal problems originated from the ankle and feet (39%) and knees (22%). A quarter of participants had suffered from physician-diagnosed ankle and foot problems in the past 12 months. Wrist/hand problems also contributed to significant functional restrictions for 12% of the players.

Conclusion: State-level basketball players generally show good cardiorespiratory fitness, but there is a high prevalence of lower extremity injuries, particularly at the ankle and feet, for which prevention and efficient rehabilitation programs should be implemented. Specific and customized training and injury management strategies would further serve to improve performance and increase their ability to play with minimal risk of injury.

Keywords: Cardiorespiratory fitness, Musculoskeletal injury, Basketball players, Six-Minute Walk Test, Injury prevention.

Introduction

Musculoskeletal diseases, commonly known as MSDs, is among the very common significant problems in many parts of the world. This has the tendency to strike people of all demographic groups and work histories[1]. This category of disorders includes the full range of illnesses or conditions which

affect muscles, bones, and joints, tendons, ligaments along with other structures. The result would often be pain or itching -and always a reduction in ability to perform normal activities[2]. Given financial pressures today owing to its prevalence, productivity disturbance offshoots other than the direct cost of treatment also prove to be a heavy burden that society has to bear Over recent decades with advances such as those in scientific medicine and ergonomic technology at the workplace, musculoskeletal diseases are still a major cause of physical injury and impairment worldwide. It is a sport of high pace, dynamic movements, and continuous physical contact, which places great demands on the athlete's cardiorespiratory system and musculoskeletal structure[3].

The nature of the sport requires immense aerobic as well as anaerobic capacity so as to maintain performance throughout games that often are longer than 40 minutes of intense play. Cardiorespiratory fitness that involves the efficiency of the heart, lungs, and the vascular system in supplying oxygen to working muscles during prolonged physical activity forms a very critical determinant of a basketball player's performance[4]. For instance, excellent cardiorespiratory endurance will allow basketball players to sustain high levels of activity, rapid sprinting, jumping, and other defensive maneuvers, and rapidly recover between bouts of exertion. Besides physical demands associated with basketball, WMSIs can generally be expected in such athletes because basketball training and competition schedules typically involve repetitive high-impact activities[5].

Basketball WMSIs include injuries common to the lower extremities, such as ankle sprains, patellar tendinitis, and ACL tears, as well as upper body injuries involving the shoulder with impingement and wrist strain. Many of these can be acute and traumatic but are, as well, often chronic in nature due to overuse, potentially impacting for a rather significant amount of time before the athlete is allowed back into competition, thus possibly injuring performance but certainly long-term career options[6]. Cardiorespiratory fitness is crucial and highly central to the understanding of basketball players, and musculoskeletal injuries have been reported to be very high among basketball players. The combined assessment of these parameters among state-level basketball players in India forms a significant lacuna in the available literature. Most of the past studies either focused on elite professional athletes or general adolescent populations, thereby leaving a gap in the health and fitness profiles of state-level players, who form the backbone of the sport's competitive landscape of the country[7].

Need of the Study

State basketball players are essentially the spine of the sport within a country and at international venues. However, despite playing a crucial role in the sport, there is little research on the health and fitness profiles of players in terms of cardiorespiratory fitness and musculoskeletal injuries attributed to work. Understanding these aspects is critical because cardiorespiratory fitness has a direct influence on the ability to persist in high-intensity activities, while musculoskeletal injuries can seriously impair performance, reduce playing time, and end careers prematurely. This makes it important to evaluate the nature of cardiorespiratory capacity and injury profiles for these athletes so that risk areas could be determined. From there, this could be used to develop particular training and injury prevention programs that could improve performance while minimizing the propensity for injuries. Without such information, coaches, trainers, and health care professionals may lack sufficient evidence by which to make decisions regarding training regimens and rehabilitation protocols. Consequently, this study is necessary to fulfill the present knowledge gap and provide an overall understanding of the physical fitness and injury patterns of state-level basketball players.

Statement of the Question

What is the level of cardiorespiratory fitness and the prevalence of work-related musculoskeletal injuries among state-level basketball players, and how do these factors influence their overall performance and health?

Aims and Objectives of the Study

Aim:

To evaluate the cardiorespiratory fitness and determine the prevalence and characteristics of work-related musculoskeletal injuries in state-level basketball players, and to analyze the relationship between fitness levels and injury susceptibility.

Objectives:

1. **To assess the cardiorespiratory fitness levels** of state-level basketball players using standardized fitness tests such as 6 min – Walking Test and VO2 max estimation.
2. **To determine the prevalence and types of work-related musculoskeletal injuries** among state-level basketball players, including the location, severity, and duration of these injuries.

Hypothesis

Null Hypothesis (H0):

There is no significant relationship between cardiorespiratory fitness levels and the prevalence of work-related musculoskeletal injuries among state-level basketball players.

Alternate Hypothesis (H1):

There is a significant relationship between cardiorespiratory fitness levels and the prevalence of work-related musculoskeletal injuries among state-level basketball players, indicating that variations in fitness levels are associated with differences in injury incidence and severity.

Methodology

Study design: - An observational study.
Sample size: 100 subjects.
Method of sampling: Random sampling.
Study duration: Four months.
Study Place: Arunachal Pradesh Basketball Association.
Condition/ Population: Adults
Keywords: Cardiorespiratory fitness, Musculoskeletal injury, basketball players
Databases Searched: PubMed, ScienceDirect, Google Scholar, Research-gate
Year Searched: 2016-2023
Language: English

Inclusion criteria:

- Age between 15-30 years.
- Currently playing individuals.
- State level basketball professional players.
- Both male and female.

Exclusion criteria:

- Age more than 30 years.
- This study does not include professional players who have stopped playing.
- Any major surgery in last 1 year.
- Anti-depressant drugs.
- Injuries that occurred while training in gym, training sessions or while playing any other sport.
- Cardiopulmonary disease.
- Locomotor disorders.
- Electrocardiographic abnormalities.

Outcome measures

1. Six-Minute Walk Test (6MWT)
2. Heart Rate Monitor
3. Sphygmomanometer (Blood Pressure Monitor)
4. Body Mass Index (BMI) Calculation
5. Modified Nordic Musculoskeletal Questionnaire
6. Demographic Questionnaire

PROCEDURE

This observational study was conducted at the Arunachal Pradesh Basketball Association within a period of four months. The state-level sample size for this study is 100 players with the help of random sampling. Major outcomes such as cardio-respiratory fitness and prevalence of work-related musculoskeletal injuries among the athletes have been studied in this present study. Adult basketball players actively competing at the state level are targeted for this study.

The inclusion criteria of the study were set for an age between 15 to 30 years, male, and female players who are actively playing at a state level. These parameters ensured that only active players participated who would provide the appropriate data for the study objectives; the exclusion criteria also had those individuals who were over 30, players who have retired from professional play, and people who had undergone major surgery in the last year. Other exclusion criteria were the patients on antidepressive drugs, those with external injuries unrelated to basketball, such as physical exercises in the gymnasium or other sports injuries, patients with cardiopulmonary diseases, locomotor disorders, or electrocardiographic abnormalities to warrant homogenity of the sample.

The primary outcome measures that were used in the context of this study included the Six-Minute Walk Test to determine cardiorespiratory fitness; heart rate recording; and record of blood pressure through a sphygmomanometer. Body Mass Index was calculated to quantify body composition, while Modified Nordic Musculoskeletal Questionnaire was also administered to capture the prevalence and severity of musculoskeletal injuries. A demographic questionnaire was however employed to get basic demographics from the participants such as age, gender, and playing position.

Data Collection Procedure

Data collection for this observational study was carried out in a sequential manner, over a span of four months, at the Arunachal Pradesh Basketball Association. The entire process began with participant recruitment who met the inclusion criteria. Potential participants identified and approached for informed consent to participate in the study on a voluntary basis. After obtaining consent, a demographic questionnaire was administered to secure basic information related to age, gender, height, weight, playing position, and years of playing experience. This initial step helped establish a baseline understanding of the characteristics of the sample.

Once the demographic data had been gathered, the process of assessing cardiorespiratory fitness proceeds through the administration of Six-Minute Walk Test (6MWT). Participants were asked to walk the distance they could cover within six minutes on a level, measured course. Heart rate and blood pressure were recorded using heart rate monitor and sphygmomanometer, respectively. For purposes of reference, the baseline measurements of heart rate and blood pressure were recorded at the start of the test. The post-exercise heart rate and blood pressure were registered after the end of the test to determine the cardiovascular response of the subjects at the time of physical exertion. The total distance covered in the 6MWT was documented; Body Mass Index (BMI) was calculated from the measurements obtained for height and weight on each subject.

The Modified Nordic Musculoskeletal Questionnaire was applied to assess the frequency, nature, and severity of musculoskeletal injury occurring in the respondents. It used pain or ache in the respective body regions, symptom duration, frequency of symptoms, and disturbance caused to training and competition. The study informed the respondents to outline their musculoskeletal health over the past 12 months.

Maintaining the lines of confidentiality and privacy was kept extremely strict during the period of data collection. All the data collected was computerized in a secure database and only available to the research team. The gathered data was further arranged in order to be ready for statistical analysis in order to point out patterns, associations, and findings that may appear to be of significance with respect to cardiorespiratory fitness and musculoskeletal injuries among basketball players at the state level. The structured methodology ensured that the data collected was both accurate and reliable and formed a foundation for these conclusions and recommendations made by the study.

Fig no 1 – Data collection using a Sphygmomanometer (Blood Pressure Monitor)

Fig no 2 – Subjects performing Six-Minute Walk Test (6MWT)

Fig no 3 - Modified Nordic Musculoskeletal Questionnaire

Data Analysis

Systematic entry of data collected during the study into Microsoft Excel provided a basis for further statistical analysis. Descriptive statistics-calculation of mean, standard deviation, and frequency distribution-was conducted with a view of presenting demographics characteristics, cardiorespiratory levels of fitness, and prevalence of musculoskeletal injuries. An analysis of the results for the Six-Minute Walk Test has been done to determine mean distances covered by participants as well as to establish variability differences in walking distances among different age groups, genders, and playing positions.

This p-level was set at 0.05 so that the study would have statistical significance, and the results that came out were communicated in tables and graphs for clear and concise expression of data so that the readers could easily interpret and discuss the said study. Comprehensive analysis in the study would help identify risk factors and correlation, and resultant evidence-based recommendations would provide strategies for training and injury prevention among state-level basketball players.

Result

TABLE NO 1 – SHOWS THE DEMOGRAPHIC DATA OF THE SUBJECTS

	N	Mean	Std. Deviation	Std. Error Mean
Age	100	22.47	2.959	.296
Height(cm)	100	167.08	9.225	.923
Weight(kg)	100	61.17	9.879	.988
BMI	100	21.836	2.4168	.2417

Table 1 presents the demographic data of the 100 state-level basketball players who participated in the study. The average age of the participants was 22.47 years, with a standard deviation of 2.959,

indicating a relatively young cohort with most participants falling within a narrow age range. The standard error of the mean (0.296) suggests a high level of precision in the age data collected.
The mean height of the participants was 167.08 cm, with a standard deviation of 9.225 cm, reflecting some variability in height among the players. The standard error of the mean for height was 0.923 cm, indicating a relatively consistent measurement of height across the sample.
Regarding weight, the average was found to be 61.17 kg, with a standard deviation of 9.879 kg. This suggests that there was moderate variability in the body weight of the participants. The standard error of the mean for weight was 0.988 kg, reflecting the reliability of the weight data collected.
The Body Mass Index (BMI) of the participants had a mean value of 21.836, with a standard deviation of 2.4168, indicating that most players had a BMI within the normal range for their age and height. The standard error of the mean for BMI was 0.2417, demonstrating a high level of accuracy in the BMI calculations for the sample.

TABLE NO 2 – SHOWS THE GENDER RATIO OF THE SUBJECTS

Gender					
		Frequency	**Per cent**	**Valid Percent**	**Cumulative Percent**
Valid	**Male**	72	72.0	72.0	72.0
	Female	28	28.0	28.0	100.0
	Total	100	100.0	100.0	

Table 2 displays the gender distribution of the participants in the study. Out of the total 100 subjects, 72 were male, representing 72% of the sample. The remaining 28 participants were female, accounting for 28% of the sample. The gender ratio indicates a higher representation of male basketball players compared to female players in this study population.
The valid percent for each gender group mirrors the frequency percentage, confirming that there were no missing data or exclusions in this category. The cumulative percentage shows that, collectively, the male participants constitute 72% of the sample, and with the addition of female participants, the cumulative percentage reaches 100%.
This gender distribution provides a clear overview of the sample composition, highlighting the predominance of male players, which is typical in many competitive basketball settings. The relatively smaller proportion of female participants underscores the need for future studies to focus on this subgroup to gain deeper insights into their specific fitness and injury profiles.

TABLE NO 3 – SHOWS THE GENDER RATIO OF THE SUBJECTS

	N	**Mean**	**Std. Deviation**	**Std. Error Mean**
Pre HR	100	79.74	9.909	.991
Post HR	100	89.73	13.132	1.313
Pre-Systolic	100	118.29	13.841	1.384
Post Systolic	100	128.42	15.476	1.548
Pre-Diastolic	100	76.21	8.603	.860
Post Diastolic	100	83.00	10.868	1.087
Number of laps	100	17.748	16.5667	1.6567
Total distance covered (meters)	100	484.84	72.980	7.298

Table 3 provides an overview of various physiological and performance parameters measured before and after the Six-Minute Walk Test (6MWT) for the 100 participants. The mean resting heart rate (Pre HR) of the participants was 79.74 beats per minute (bpm) with a standard deviation of 9.909 bpm, indicating a moderate variation in baseline cardiovascular condition. After the exercise, the mean

heart rate (Post HR) increased to 89.73 bpm, with a higher standard deviation of 13.132 bpm, reflecting the physiological response to physical exertion and varying levels of fitness among the players.

The mean pre-exercise systolic blood pressure (Pre-Systolic) was 118.29 mmHg with a standard deviation of 13.841 mmHg, while the post-exercise systolic blood pressure (Post Systolic) rose to an average of 128.42 mmHg, with a standard deviation of 15.476 mmHg. This increase in systolic blood pressure post-exercise is a normal physiological response, indicating the participants' cardiovascular adaptation to the physical activity.

Similarly, the mean pre-exercise diastolic blood pressure (Pre-Diastolic) was 76.21 mmHg, with a standard deviation of 8.603 mmHg, while the post-exercise diastolic pressure (Post Diastolic) increased to 83.00 mmHg, with a standard deviation of 10.868 mmHg. These changes highlight the cardiovascular demand placed on the participants during the exercise test.

In terms of performance, the participants completed an average of 17.748 laps, with a high standard deviation of 16.5667 laps, indicating a wide range of performance capabilities within the group. The total distance covered during the 6MWT had a mean value of 484.84 meters, with a standard deviation of 72.980 meters. This variation suggests differences in cardiorespiratory endurance among the players, which could be influenced by factors such as fitness levels, training intensity, and playing experience.

TABLE NO 4 – HAVE YOU AT ANY TIME DURING THE LAST 12 MONTHS HAD TROUBLE

		Count	Column N %
Neck	No	93	93.0%
	Yes	7	7.0%
Shoulders	No	83	83.0%
	Yes	17	17.0%
Elbows	No	95	95.0%
	Yes	5	5.0%
Wrists / Hands	No	77	77.0%
	Yes	23	23.0%
Upper back	No	93	93.0%
	Yes	7	7.0%
Lower back	No	86	86.0%
	Yes	14	14.0%
Hips/Thighs	No	89	89.0%
	Yes	11	11.0%
Knees	No	78	78.0%
	Yes	22	22.0%
Ankle /Feet	No	61	61.0%
	Yes	39	39.0%

Table 4 presents the prevalence of musculoskeletal issues reported by the participants in various body regions over the past 12 months. The findings reveal that most players did not experience significant trouble in many areas, but some regions exhibited a higher incidence of problems, indicating areas of concern for basketball players.

In terms of neck issues, only 7% of the participants reported having trouble, while the overwhelming majority, 93%, did not experience any neck-related discomfort. This suggests that neck problems are relatively uncommon among the players in this study. Similarly, the incidence of upper back issues

was low, with just 7% of participants reporting trouble, highlighting that the upper back is generally less affected in this population.

The prevalence of shoulder problems was notably higher, with 17% of participants indicating they had experienced issues in this area. This is a significant concern given the demands placed on the shoulders during basketball activities, such as shooting, passing, and rebounding. The elbow, however, appeared to be less problematic, with only 5% of participants reporting issues, suggesting that elbow injuries are relatively rare among the players.

Trouble with the wrists and hands was reported by 23% of the participants, reflecting the critical role these areas play in ball handling and shooting, which are fundamental to the game of basketball. This relatively high prevalence indicates the need for targeted preventive measures and conditioning for the wrists and hands to reduce the risk of injury.

Lower back issues were reported by 14% of the participants, a concerning figure given the importance of a strong and stable core for athletic performance and injury prevention. Similarly, the hips and thighs were problematic for 11% of the participants, indicating that these areas, which are heavily involved in movements like jumping and sprinting, are also at risk for injury.

The knee, a common site of injury in basketball due to frequent jumping and directional changes, showed a significant prevalence, with 22% of participants reporting trouble. This highlights the need for effective knee injury prevention and management strategies among basketball players.

Finally, the ankle and feet were the most affected regions, with 39% of participants experiencing issues. This high prevalence underscores the vulnerability of the lower extremities in basketball, where quick movements and high-impact landings are frequent. Ankle sprains and foot injuries are well-documented in the sport, and this data reaffirms the importance of focusing on these areas in both training and injury prevention programs.

TABLE NO 5 – HAVE YOU AT ANY TIME DURING THE LAST 12 MONTHS BEEN PREVENTED FROM DOING YOUR NORMAL WORK BECAUSE OF TROUBLE?

		Count	Column N %
Neck	No	98	98.0%
	Yes	2	2.0%
Shoulders	No	95	95.0%
	Yes	5	5.0%
Elbows	No	96	96.0%
	Yes	4	4.0%
Wrists / Hands	No	87	87.0%
	Yes	13	13.0%
Upper back	No	98	98.0%
	Yes	2	2.0%
Lower back	No	91	91.0%
	Yes	9	9.0%
Hips/Thighs	No	96	96.0%
	Yes	4	4.0%
Knees	No	85	85.0%
	Yes	15	15.0%
Ankle /Feet	No	72	72.0%
	Yes	28	28.0%

Table 5 illustrates the impact of musculoskeletal issues on the participants' ability to perform their normal work or activities over the past 12 months. The data shows the extent to which specific body

regions have hindered the players from engaging in their usual activities, highlighting the functional impact of these musculoskeletal problems.

The majority of participants, 98%, reported no disruption in their normal activities due to neck trouble, with only 2% indicating that neck issues had prevented them from performing their usual work. This suggests that while neck problems are present in a small portion of players, they rarely lead to significant functional limitations.

For shoulder issues, 5% of participants stated that shoulder problems had prevented them from engaging in their normal activities, while 95% did not experience such hindrance. This indicates that shoulder problems, although relatively common, do not frequently result in significant functional disability among the players.

Elbow issues affected 4% of the participants to the extent that they were unable to perform their normal activities, with 96% reporting no such impact. This aligns with the low overall prevalence of elbow problems reported earlier, suggesting that elbow issues are not a major concern in terms of functional limitation for these players.

Wrists and hands had a more substantial impact, with 13% of participants being prevented from doing their normal work due to trouble in these areas. Given the critical role of the hands and wrists in basketball, this level of functional impairment highlights the need for focused preventive measures and rehabilitation to address these issues.

The upper back, like the neck, showed a minimal impact, with only 2% of participants being prevented from performing their usual activities. This suggests that while upper back issues are present, they do not typically lead to significant functional limitations.

Lower back problems were more impactful, with 9% of participants reporting that lower back pain had prevented them from doing their normal work. This finding underscores the importance of core stability and back health in maintaining functional performance in basketball players.

Hips and thighs caused functional limitations in 4% of the participants, with 96% reporting no such impact. This indicates that while some players do experience significant trouble in these areas, it is not a widespread issue affecting the majority.

Knee problems were reported by 15% of the participants as preventing them from engaging in their normal activities. This relatively high percentage reflects the significant role that knee health plays in the overall functionality and performance of basketball players, necessitating targeted interventions to prevent and manage knee injuries.

Finally, the ankle and feet showed the highest impact on normal activities, with 28% of participants indicating that trouble in these areas had prevented them from performing their usual work. This substantial percentage highlights the critical need for ankle and foot injury prevention and management strategies, as these areas are heavily involved in the rapid movements and impacts associated with basketball.

TABLE NO 6 – HAVE YOU HAD TROUBLE AT ANY TIME DURING THE LAST 7 DAYS?

		Count	Column N %
Neck	No	98	98.0%
	Yes	2	2.0%
Shoulders	No	99	99.0%
	Yes	1	1.0%
Elbows	No	99	99.0%
	Yes	1	1.0%
Wrists / Hands	No	99	99.0%
	Yes	1	1.0%
Upper back	No	100	100.0%
	Yes	0	0.0%
Lower back	No	99	99.0%
	Yes	1	1.0%
Hips/Thighs	No	99	99.0%
	Yes	1	1.0%
Knees	No	100	100.0%
	Yes	0	0.0%
Ankle /Feet	No	96	96.0%
	Yes	4	4.0%

Table 6 presents the prevalence of musculoskeletal trouble experienced by participants during the last seven days prior to the data collection. The data highlights the recent incidence of pain or discomfort in various body regions, providing insight into the short-term musculoskeletal health of the players.

The majority of participants (98%) reported no trouble with their neck in the past week, while only 2% indicated experiencing neck-related issues. This suggests that acute neck problems are relatively uncommon among the players.

Shoulder trouble was reported by only 1% of the participants, with 99% experiencing no issues in this area during the last seven days. This low prevalence indicates that shoulder pain or discomfort was not a significant short-term concern for most players at the time of the study.

Similarly, elbow and wrist/hand issues were reported by just 1% of the participants, with 99% indicating no trouble in these areas. These findings suggest that, in the short term, elbow and wrist/hand problems are infrequent among the players, possibly due to effective management and preventive strategies.

The upper back showed no reported trouble at all, as 100% of the participants indicated no issues in this region during the last week. This reflects the minimal impact of upper back problems on the players' recent musculoskeletal health.

Lower back trouble was reported by 1% of the participants, while 99% experienced no discomfort in this area. Despite its lower prevalence in the short term, the presence of any lower back issues is still noteworthy, given the role of the lower back in maintaining core stability and overall functional performance.

Hips and thighs also had a very low incidence of trouble, with only 1% of participants reporting issues, and 99% indicating no problems. This suggests that, like the lower back, these areas were generally well-managed in the short term among the players.

Knees showed no reported trouble in the last seven days, with 100% of participants indicating no issues. This is a positive finding, considering that knee problems are often a major concern in basketball players. The absence of knee issues in the short term suggests effective preventive measures or a period of reduced stress on the knees.

Ankle and feet trouble, however, was reported by 4% of the participants, with 96% indicating no issues in this area. Although the prevalence is relatively low, ankle and feet problems remain the most frequently reported issues among the body regions assessed. This highlights the ongoing vulnerability of these areas, likely due to the high-impact movements and frequent directional changes involved in basketball.

TABLE NO 7 – HAVE YOU EVER HURT YOUR BODY PART IN AN ACCIDENT?

		Count	Column N %
Neck	No	100	100.0%
	Yes	0	0.0%
Shoulders	No	98	98.0%
	Yes	2	2.0%
Elbows	No	100	100.0%
	Yes	0	0.0%
Wrists / Hands	No	97	97.0%
	Yes	3	3.0%
Upper back	No	100	100.0%
	Yes	0	0.0%
Lower back	No	100	100.0%
	Yes	0	0.0%
Hips/Thighs	No	100	100.0%
	Yes	0	0.0%
Knees	No	98	98.0%
	Yes	2	2.0%
Ankle /Feet	No	98	98.0%
	Yes	2	2.0%

Table 7 shows the incidence of participants having injured specific body parts in accidents at any point in their lives. The data reveals a generally low prevalence of accidental injuries across most body regions among the study population, indicating that such incidents are not a common cause of musculoskeletal issues for these basketball players.

For the neck, all 100 participants (100%) reported no history of accidental injury, suggesting that neck injuries from accidents are rare in this cohort. Similarly, no participants reported having sustained accidental injuries to the elbows, upper back, lower back, or hips/thighs, reflecting that these areas have been well-protected from accidental trauma.

In contrast, 2% of the participants indicated having experienced accidental injuries to their shoulders, while 98% reported no such incidents. Although the percentage is low, shoulder injuries could still be significant for the affected players due to the shoulder's essential role in basketball activities.

Wrists and hands showed a slightly higher prevalence, with 3% of participants having reported past injuries in these areas. This is noteworthy, as the wrists and hands are particularly vulnerable in a sport that involves frequent ball handling, shooting, and contact with opponents.

Knees and ankles/feet also had 2% of participants reporting accidental injuries. Given the critical role of these body parts in movements such as jumping, running, and rapid direction changes, even a small incidence of past injuries could have lasting effects on the players' performance and susceptibility to future injuries.

TABLE NO 8 – HAVE YOU BEEN SEEN BY A DOCTOR BECAUSE OF TROUBLE DURING THE LAST 12 MONTHS?

		Count	Column N %
Neck	No	99	99.0%
	Yes	1	1.0%
Shoulders	No	98	98.0%
	Yes	2	2.0%
Elbows	No	98	98.0%
	Yes	2	2.0%
Wrists / Hands	No	88	88.0%
	Yes	12	12.0%
Upper back	No	100	100.0%
	Yes	0	0.0%
Lower back	No	94	94.0%
	Yes	6	6.0%
Hips/Thighs	No	99	99.0%
	Yes	1	1.0%
Knees	No	88	88.0%
	Yes	12	12.0%
Ankle /Feet	No	75	75.0%
	Yes	25	25.0%

Table 8 presents the data on participants who have sought medical consultation due to musculoskeletal trouble in various body regions over the past 12 months. The results highlight the frequency with which state-level basketball players experienced issues severe enough to require professional medical attention, offering insight into the burden of these conditions on the athletes.

The neck had the lowest incidence, with only 1% of participants seeking medical advice for neck problems, while 99% did not experience neck issues that warranted a doctor's visit. This indicates that neck problems, while present, were generally not severe enough to require professional medical intervention. Shoulder and elbow issues were each reported by 2% of participants, suggesting that these problems were more significant for a small number of players. Although the majority of participants did not seek medical attention for shoulder or elbow issues, the small percentage who did may have experienced conditions serious enough to impact their performance and require professional care. The wrists and hands had a noticeably higher incidence, with 12% of participants consulting a doctor due to trouble in these areas. This relatively high figure reflects the critical role of the wrists and hands in basketball activities, such as dribbling, passing, and shooting, which could lead to more frequent and severe injuries requiring medical evaluation and management participants reported seeing a doctor for upper back problems, indicating that this region did not present significant medical concerns for the players. Similarly, the hips and thighs also had a low incidence, with only 1% seeking medical attention, suggesting that these areas were generally well-managed among the athletes.

Lower back issues were more common, with 6% of participants consulting a doctor due to lower back trouble. This higher incidence highlights the importance of core stability and proper back health in basketball players, as lower back problems can significantly impact mobility and performance. Knee problems were another area of concern, with 12% of participants seeking medical help for knee issues over the past year. Given the high demands placed on the knees in basketball, this finding underscores the need for effective preventive strategies and rehabilitation protocols to manage and reduce knee injuries among players.The highest incidence of medical consultations was reported for ankle and feet problems, with 25% of participants having seen a doctor for issues in these areas. This substantial percentage reflects the vulnerability of the lower extremities in basketball, where quick movements,

jumping, and frequent directional changes put considerable stress on the ankles and feet. It emphasizes the need for focused interventions to protect these areas and minimize the risk of injury.

Discussion

The main purpose of the present study is the analysis of cardiorespiratory fitness and prevalence of work-related musculoskeletal injuries among state-level basketball players. Several key observations can be seen in the health and fitness profile of the participants, such as areas of strength and concern. Cardiorespiratory Fitness and Performance: Outcomes of the Six-Minute Walk Test revealed an average distance covered of 484.84 meters. This measure was thus able to establish a generally good level of cardiorespiratory fitness among the players, as basketball games are indeed characterized by high levels of aerobic and anaerobic capacity demands[29]. Increased heart rate and blood pressure after the exercise are very normal physiological responses to the exercise itself, indicating that the participants' cardiovascular systems dealt with the load efficiently. The high standard deviation here is rather interesting because the wide variability in the number of laps finished and total distances covered signify that players were different in fitness levels. This difference may be attributed to a difference in training intensity, varying degrees of fitness, and perhaps a difference in the health status of the individual. Thus, there is the necessity to avail distinct training systems that help each individual player achieve his maximum cardio-respiratory fitness[30].

Musculoskeletal Health Over the Last 12 Months: As reflected in Tables 4 and 5, the prevalence of problems with musculoskeletal components during the past year is such that although a majority of players did not report serious problems, some body regions were affected significantly. The ankles and feet were most affected, as reported by 39% of players; 28% of them also said that ankle and foot problems prevented them from performing their usual activities. This high prevalence is consistent with the high-impact nature of basketball, putting considerable stress on the lower extremities due to frequent jumping, rapid direction changes, and contact with other players. Additionally, knee was among the specific areas that raised complaints in 22% of participants. This is quite well known and documented in respect to injuries in basketball, particularly ACL tears and patellar tendinitis. In this regard, these findings call for targeted preventive measures, such as strength training, proprioceptive exercises, and appropriate footwear, that may minimize chances of lower limb injuries[31].

Short-term Musculoskeletal Complaints: While an overwhelming number of regions reported low levels of musculoskeletal issues over the last seven days, issues with ankles and feet remain notable, with 4% of athletes reporting that they caused some trouble. This means that while acute complaints were less common, chronic problems with ankles and feet persist. The absence of major knee complaints last week is a positive finding, suggesting adequate management and possibly lessened training volume or competition intensity in the recent period. The findings indicate that, even though the players are unlikely to have repeat acute flare-ups, there is a chronic risk of problems, especially in the lower limbs, that could imperil their long-term performance and health.

History of Accidental Injuries: Data from Table 7 show that most participants had never sustained accidental injury to any of their major body parts-of particular note, 97% had never suffered injury to the shoulders, wrists/hands, knees, or ankles/feet. The very low prevalence is a marker of not significant musculoskeletal problems among these athletes. These could have a long-lasting effect on the injured, thus requiring particular measures for rehabilitation and prevention in order not to allow a high recurrence rate.

Musculoskeletal Issues-Related Medical Consultation Table 8 shows some data pointing out a high percentage of players who received medical attention for their inability to perform in some body areas, like the wrists/hands (12%), lower back (6%), knees (12%), and ankles/feet (25%). High rates of consultation for medical purposes in respect of ankle and foot conditions further emphasize the severity of these injuries in the capacity to play and the need for medical intervention. In general, despite their good health in most players, musculoskeletal conditions, particularly those affecting the lower limbs and hands, are sufficiently common to warrant professional attention. This suggests the

need for injury management programs that integrate preventive training with access to medical treatment and rehabilitation[32].

Practical Implications to Training and Injury Prevention Results from this study have several practical implications for coaches, trainers, and healthcare workers working with basketball players who compete at the state level. Variation in cardiorespiratory fitness and an extremely high prevalence of lower extremity injuries are good reasons to develop an individualized training program for each player. Such programs will correct the weaknesses in strength and conditioning while improving overall fitness and targeting the stability and strength of the lower limbs to prevent injuries. All in all, it is also vital to have periodic checks and monitoring of the state of the musculoskeletal health so that problems will be detected early, so it can be intervened before it gets worse.

Conclusion

It concluded that the state-level basketball players generally had a fair level of cardiorespiratory fitness, but enormous variation existed at the individual level, and hence they needed training programs to reach their optimum fitness potential. Most common musculoskeletal injuries were found in the lower extremity, ankles, feet, and knees and thus represent the most significant cause of problems of concern to a player's health, and their lifetime health in this sport. This type of injuries accounted for a high percentage of athletes presenting to the team physician for care with most of whom, presumably, unlikely to put at risk performance. Though such factors are important, the sheer volume of such injuries implies that targeted rather than blanket preventive measures are needed, such as strength and proprioceptive training, proper footwear, and integrated injury management programs that include early medical attention and appropriate rehabilitation. Thirdly, in controlling injury risk factors, there should be a collaboration between coaches and trainers together with healthcare professionals to administer evidence-based interventions that can result in improved health and performance by the athletes. Future research will further investigate the effectiveness of interventions so that interventions like biomechanics and training load can help better understand the prevention and enhancement of performance in basketball players.

Author Contributions

Nidhi Oza and Kanchan Dixit designed the concept and performed the procedures, Rabeena supervised the Research work, wrote the initial draft and Final Draft. All authors approved the final manuscript.

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