PERCEPTION OF ARTIFICIAL INTELLIGENT (AI) IN PREDICTING AND PREVENTING SPORT INJURIES THROUGH MOVEMENT ANALYSIS

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Abstract
The study examined how artificial intelligence (AI) and movement analysis can be used to predict and prevent the occurrence of sports injuries among Nigeria university athletes. The research questions to be examined were, in particular, to establish the rates of sports injuries, to find out whether wearable devices and data analysis tools can significantly predict the injury prevention outcomes. The type of research design was descriptive. The sample population comprised of university athletes selected in selected tertiary institutions in Oyo, Osun and Lagos State in Nigeria. Multistage sampling process was applied to choose the participants. A sample of 423 athletes was used in 9 universities with the balance of 47 athletes per university. The structured questionnaire to be used to collect data was developed based on a five-point Likert scale, whereby, it measured the experience of athletes in terms of injury, preventive behaviours, and their perception of AI-based monitoring systems. The process of data

collection was based on direct administration of questionnaires to the athletes in training sessions and sporting activities. Descriptive statistics, chi-square, one-sample t-test and regression analyses were used to analyse the data. The findings revealed that male athletes were the largest respondents with 61 percent whereas females were 39 percent. Majority of the athletes fell within the age range of 21-23 year old (46.3) and 42.1% sporting experience (3-4 years). The biggest participation rate was in football (25.5%). The results also indicated that conventional injury prevention measures had very important impacts on the occurrence of injuries. The authors came to the conclusion that, although the classic methods of prevention of injuries remain significant, the combination of artificial intelligence, wearables and movement analysis systems presents a more proactive and data-driven method of preventing sports injuries.

Introduction

There is a tremendous growth in sport participation in learning institutions all over the world including tertiary institutions in Nigeria, where organised sporting activities have become a critical part of physical growth, competition, and talent discovery. Nevertheless, the rise in training demands and competitions has brought other issues in the form of increased cases of sports-related injuries in student-athletes. These injuries can have adverse effects on athletic performance and musculoskeletal health in the long term as well as participation and impact athletes on a psychological level. This has contributed to injury prevention being a key concern in sports sciences and sports medicine studies. The conventional methods of injury prevention in sports have been based mostly on the observational evaluation, retrospective reporting of injuries, and generalised conditioning systems. Despite the fact that such methods reveal useful information, they can sometimes fail to identify inefficiency and fatigue-induced alterations in movement patterns that predisposes athletes to injury. The new opportunities brought by Artificial Intelligence (AI) and predictive analytics are now available to analyse complex biomechanical data and detect the risk of injuries before they emerge (Mishra *et al.*, 2024; Wang & Pei, 2024).The

systems based on AI can process a great amount of information provided by wearable sensors, motion capture systems, and athlete monitoring technologies. These systems are capable of identifying abnormal movement mechanics, muscular imbalance and training-load abnormalities that have an association with the risk of injury through the use of machine learning algorithms (Maghsoomi *et al*., 2025; Musat *et al.*, 2024). Such possibilities enable coaches and sports scientists to implement preventive actions in the early stages of training, adjusting training loads, correcting movement patterns, and providing individualised measures to prevent injuries.

The fast pace of the evolution of wearable technologies has also enhanced the use of AI in sports science. Inertial measurement units, GPS trackers, and smart sensors are devices that can be used to monitor the performance and physiological reactions of athletes continuously (Zega *et al*., 2025). These technologies record the data about the movement mechanics, acceleration, joint angles, and muscle activity, which can be processed by AI algorithms to detect the indicators of injuries (Camomilla *et al*., 2018). Those systems facilitate the evidence-based decision-making of coaches and sports scientists and help to enhance the safety of athletes and optimise their performance. In spite of such developments, the usage of AI-based injury prediction systems is not consistent in the sporting setting. In several institutions, especially the developing ones, the monitors still utilise manual methods of monitoring because of the lack of technological infrastructure and experience in sports analytics (Guelmami *et al.*, 2023; Guo, 2024). In Nigeria, the university sports activity is usually driven by competition and performance and relatively less by a systematic monitoring of injuries and predictive analytics (Iduh *et al*., 2024; Nwabuwe, 2025).

Recent literature highlights that movement analysis via AI can be used to mitigate them by developing proactive preventive measures of injuries that combine biomechanics, wearable computing, and predictive analytics (Souaifi *et al*., 2025; Bartlett et al., 2021). Nevertheless, the successful execution should involve the joint work

of technological systems and sports professionals who have contextual knowledge of the training settings (Owen *et al*., 2024; Jain, 2025). Despite the promising results that AI technologies have shown on the elite sports setting, there are few empirical studies that study their implementation in a tertiary institution sports setting. Thus, the paper examines the potential of AI-based movement analysis to forecast and prevent sports injuries among the athletes at Nigerian tertiary institutions. By combining qualitative evidence of sports practitioners with biomechanical data of wearable devices, the study fits into the emerging area of AI-based sports injury prevention.

Objectives of the Study

- Examine prevalence of sports injuries among university athletes.
- Assess relationship between injury prevention practices and injuries.
- Evaluate athletes' perception of AL-based monitoring systems.
- Determine influence of wearable technologies on injury prevention

Literature Review

The field of artificial intelligence has gradually gained significance in the research of sports science, especially in sports injury prediction and prevention. With the help of AI systems, researchers can analyse large and complex data obtained through athlete monitoring technologies and determine patterns related to fatigue, biomechanical inefficiency, and injury occurrence (Mishra *et al*., 2024; Wang & Pei, 2024). In contrast to the conventional methods of analysis, AI-based models have the ability to perform an analysis of numerous performance variables at the same time, which enhances the accuracy of injury risks prediction.

Training load, physiological stress and biomechanical performance indicators have all been analysed using machine learning techniques. The research indicates that such predictive models are capable of

identifying weak correlations between training intensity, recovery patterns, and injury outcomes (Maghsoomi *et al*., 2025). The ability to make these predictions transforms sports medicine into a more reactive treatment to injury, rather than a proactive prevention of injuries. Another important field in AI use in sports science is training load monitoring. Overworking and lack of rest have been known causes of injuries in sports. Training information can be processed with AI-based monitoring systems to determine the best possible workload levels and are used to avoid overtraining (Gabbett, 2016; Shukla *et al*., 2024). The systems also feed coaches and sports scientists with real-time feedback so that they can make changes to the training intensity and recovery strategies.

Biomechanics is a key factor in the explanation of the sports injury mechanism. It studies the mechanical forces influencing the human body during movement, such as joint movement, muscle activity pattern and ground reaction force. Ineffective mobility mechanisms can cause strain on the musculoskeletal system and raise the risk of injury (Bartlett *et al.,* 2021). Biomechanical analysis has become much more efficient with the help of AI technologies. The classical biomechanical measures are frequently based on motion capture systems, which can be found in laboratories, and manual analysis of the movement data. Nonetheless, nowadays, machine learning algorithms may be used to automatically analyse biomechanical data and identify movement anomalies related to risk of injury (Souaifi *et al.*, 2025). The studies have shown that AI-based movement screening can identify the early signs of injury risk (including asymmetrical movement of the limb, abnormal landing mechanics, and excessive loading of the joints during sports performance) (Musat *et al*., 2024). Early detection of such indicators would allow coaches to administer corrective interventions to ensure that the movement processes become more efficient and the risk of injuries is minimised.

Wearable computing has been implemented as the essential part of the contemporary athlete monitoring systems. The equipment (e.g.,

accelerators, gyroscopes, GPS devices) permits the sustained gathering of biomechanical and physiological information in the course of training and competition (Zega *et al*., 2025). Such devices can provide AI systems with the ability to analyse such variables as acceleration, velocity, joint angles, and muscle activity. Wearable sensor data obtained can establish intricate correlations between workload intensity, injury risk, and biomechanics when combined with machine learning algorithms (Camomilla *et al.*, 2018). Researchers have demonstrated that wearable tracking devices are effective in preventing injuries because they identify alterations in movement mechanisms that are caused by fatigue (Shull *et al.*, 2014). Still, there are a number of issues in the introduction of wearable technologies. The accuracy and reliability of data are important issues especially when sensors are applied in dynamic sporting contexts. Also, other ethical considerations, including the consent of athletes, the ownership, and the privacy of their data have been called critical in the field of AI-driven sports analytics (Akameze *et al*., 2025).

The use of AI technologies in professional sports is quite widespread, but there is a relatively small application in university sports programmes. Additional state-of-the-art monitoring systems of an athlete cannot be afforded by many tertiary institutions due to the lack of technologies and funds (Iduh *et al*., 2024; Nwabuwe, 2025). Nevertheless, current studies indicate that the introduction of wearable devices and analytics based on AI to the sports setting of universities might contribute to a significant enhancement of the health monitoring and injury prevention practises of athletes (Onifade *et al*., 2025; Adebisi *et al.*, 2025). Such technologies allow controlling performance indicators systematically and give coaches and sports scientists valuable information.

The human factor is also critical in effective realisation of AI technologies. To be able to utilise AI-generated insights in the practise of training, coaches and athletes have to learn to trust them and understand them. Consequently, the use of AI-based analytics

will not be sufficient to develop effective injury prevention strategies without expert human judgement (Owen *et al.*, 2024; Jain, 2025). Although the literature on the use of AI-based injury prediction has grown, there are multiple gaps in the research. It is also possible that most current research is based on professional sports settings, and there is little information on the implementation of AI-based injury prevention systems in tertiary institutions. In addition, not many research studies combine biomechanical data with the qualitative information of coaches and athletes. To fill these gaps, the current paper will focus on a mixed-method method to research the potential of AI-driven movement analysis in benefiting injury prevention among athletes in Nigerian higher institutions of learning.

Theoretical Framework

Theory of Predictive Analytics.

This paper was based on the theory of Predictive Analytics which was the theory that explains how the data-driven models could predict future outcomes by examining the trends both in the historical and real time data (Shmueli & Koppius, 2011). The theory focuses on computational methods like machine learning and statistical modelling that were used to determine retrospective associations among variables that predict future occurrences. Predictive Analytics Theory operates around four major constructs, which include data acquisition, pattern recognition, predictive model and decision support. Data acquisition refers to gathering pertinent data of the technologies of monitoring the athletes like wearable sensors and motion capture devices. Pattern recognition was a set of analytical procedures in which algorithms extract significant correlations in data sets.

Predictive modelling is a process that entails the creation of machine learning models that can predict future events on the basis of observed patterns. The process of reducing predictive knowledge into real practise interventions to enhance performance and avert injuries is known as decision support. In the field of sports science, the constructs are intertwined with movement analysis and

biomechanics. Wearable technologies produce massive amounts of biomechanical data in the form of descriptions of how athletes move in training and competition. This data is processed by AI algorithms to detect unusual movement patterns, overloading of the joints, and biomechanical changes related to fatigue, which is associated with the risk of injury. The predictive models help coaches and sports scientists to introduce specific interventions to enhance movement efficiency and reduce the occurrence of injuries by identifying these trends at the earliest possible stage. Moreover, the combination of qualitative data provided by the sports practitioners will contribute to the better implementation of the predictive analytics in the context of real-life sports settings. Predictive Analytics Theory offers an excellent conceptualization of the idea of how the notion of AI-guided movement analysis can enhance the process of injury prevention in sports. The theory makes it possible to explain how AI technologies will be used to create safer and more efficient athletes in the sport programmes of tertiary institutions by connecting the biomechanical data collection and predictive modelling and decision-making procedures.

Methodology

A mixed-methods research design was used in this study as it combined a quantitative descriptive method with a qualitative phenomenological method to examine the contribution of Artificial Intelligence (AI) in sport injuries prediction and prevention using movement analysis in university students in Nigeria. The research population involved student athletes who were under enrolled in organised sports schemes in tertiary institutions in Nigeria especially the universities found in South-Western Nigeria. Such athletes are busy in different competitive sports like athletics, football, basketball, volleyball and other inter-university sporting activities held within the system of the Nigerian universities. The population of university athletes is also a relevant group of athletes to research the topic of sports injury prevention since they have a high probability of being exposed to structured training programmes, competitive sport activities, and performance monitoring systems. Organised

university sports frequently imposes rigorous training programmes in the middle of which athletes can be exposed to musculoskeletal load and injury rates. Studies have indicated that athletes who engage in competitive sports activities on a regular basis will most likely suffer injuries as a result of repetitive pattern of movement, heavy training loads, and biomechanical inefficiencies (Maghsoomi *et al.*, 2025; Souaifi *et al*., 2025). The participants to this particular study were specifically the athletes in the federal, state and private universities. These are the three types of institutions, which constitute the significant structural segments of the Nigerian higher education system.

The inclusion of athletes with the three institutional categories was important to make sure that the study obtained the widest range of experiences associated with monitoring sports performance and injury prevention strategies. It has been noted in previous research that institutional factors may have an effect on the access of sports science technologies like wearable monitoring devices and biomechanical analysis equipment (Adebisi *et al.,* 2025; Onifade *et al*., 2025). The discussion of athletes in federal, state and private universities thus offered a wider perspective of how performance monitoring systems based on AI can be deployed in different institutional settings. In addition, Nigerian university athletes form a significant subject group in sports injury prevention studies due to the fact that universities are key platforms where athletes can be well developed and talent discovered. Research into the deployment of AI-based injury prediction systems in these settings can lead to positive impacts on enhancing the health of athletes, the performance of athletes, and enhancing sports science in Nigerian higher education establishments. Multi-stage sampling procedure was utilised in picking out the participants in this study. This strategy was employed to have sufficient sample of the athletes in the various institutional classes and geographical regions in South-Western Nigeria.

Popular vote on Geo-Political Zone.

The sample used in the first stage was the purposive selection of one

geo-political zone out of six geo-political zones in Nigeria. The area was selected because of the large number of universities and active university sports programmes in the area. The purposive selection was to ensure that the study was centred in an area where there is a substantial involvement in organised sports activities and this made more athletes available to the study. The second stage involved picking three states randomly with the help of the balloting technique. The chosen states were Oyo (Ibadan), Osun and Lagos States. The selection was random, and every state had identically equal chances to be included in the study, which minimised selection bias and increased sample representativeness. In the third phase, purposely selecting one federal, one state, and one private university were chosen in each of the three states. This gave a total of nine universities that were to be included in the study. These purposive selection were used to make sure that all major types of the universities in Nigeria were not left out. This was relevant since the institutional difference can affect the access to sports science facilities, wearable technologies and athlete monitoring systems. The Cochran (1977) formula of calculating the sample size given a population that is unknown was applied in the determination of the suitable sample size since the number of athletes in the chosen universities may not be established precisely.

Cochran formula is presented in the form:

$$n_0 = \frac{Z^2 pq}{e^2}$$

Where:

n_0 = required sample size
Z = Z-value for 95% confidence level (1.96)
p = estimated population proportion (0.5)
q = 1 − p (0.5)
e = margin of error (0.05)

Substituting the values:

$$n_0 = \frac{(1.96)^2 (0.5) (0.5)}{(0.05)^2}$$

$$n_0 = \frac{3.8416 \times 0.25}{0.0025}$$

$$n_0 = 384.16$$

Therefore, the required minimum sample size was around 384 people. Equal proportionate sampling was done to balance the representation among institutions. As a result, each of the nine universities was chosen to come up with 47 athletes; hence, making the total number of 423 athletes. In this study, there were two primary research tools, which were used to collect data.

A questionnaire based on a structured questionnaire was created to find some quantitative data among athletes. The survey was divided into a number of sections that contained questions intended to measure the variables that pertained to: demographic attributes of athlete, injury prevalence and injury prevention interventions, training intensity and Risk of Injury, views on AI-driven systems of performance monitoring, wearable technology and movement analysis. The questionnaire was based on a five-point Likert scale (Strongly Agree 5 Strongly Disagree 1). The questionnaire was designed based on the available information on sports injury prevention and the AI use in performance monitoring. Past literature has demonstrated that the mechanisms of monitoring athletes based on their movement patterns, training load, and biomechanical parameters can give useful information regarding the risk of injury (Mishra *et al.,* 2024; Maghsoomi *et al*., 2025). The validation of the scale was made using a sample of 30 athletes in Olabisi Onabanjo University. Cronbach Alpha of 0.90 was obtained and KMO obtained was 0.70 and the Bartletts test obtained was $x2\ (29) = 13.01$, $p < 0.001$. This means that the research instruments can be used to carry out the main study, as they are valid and reliable.

The semi-structured interview guide was designed to gather qualitative data of the chosen athletes, coaches, and sports practitioners. The interview questions were aimed at the experience of the participants with sports injury, their attitude to AI-based monitoring technologies, and their attitudes toward the success of movement analysis in prevention of injury. The semi-structured format provided the freedom to the participants to share their opinions even as long as discussions stayed on track in the paper. The practical use of AI technologies in the sport setting has been suggested to be examined using qualitative methods due to the ability of these methods to offer greater understanding of how the coaches and athletes interpret performance analytics (Owen *et al.,* 2024; Jain, 2025).Before the data was collected, it was approved by the Research Ethics Committee of the University of Ilesa. The consent granted made the study to adhere to institutional and international ethical principles in research with human subjects. The participants were given information on the objective of the study and elaborate explanations given on their role in the research. Best informed consent was signed by all the participants prior to the research instruments being administered. The study was participatory and the participants were guaranteed that they could pull out of the study any time without repercussions. The study was conducted in compliance with the traditional research ethical guidelines, such as justice, beneficence, and non-maleficence. Justice was applied in ensuring that the subjects were treated equally and were selected without discrimination. Beneficence meant that the research needed to have potential benefits to the participants and the general sports fraternity and non-maleficence meant that no harm would be caused by the participation in the study. The research process was also done in a confidential and anonymity manner, and all data obtained was not utilised in any other manner other than academically.

Two categories of data were gathered, that is, quantitative and qualitative data. Quantitative data involved gathering of numerical data and qualitative data was involved in gathering audio files that were translated into text. This data has been gathered by means of

one-on-one interviews and survey. The data was collected by direct interaction with the respondents in their respective universities. The questionnaires were in structured form and were conducted using paper-and-pencil method which not only ensured accessibility by the participants but also ensured that completed questionnaires could be easily retrieved. Also, qualitative interviews were also carried out on some of the selected individuals in quiet places within the universities to ensure that their answers were accurately recorded. This method of conducting questionnaires and interviews combined allowed the study to collect both quantitative and qualitative data that were required to analyse the efficiency of AI-based systems of analysing movements in the prediction and prevention of sports injuries in Nigerian university athletes.

Results

Socio-Demographic Respondent Characteristics.

This section gives the socio-demographic features of the involved athletes based on federal, state and private universities in South-Western Nigeria. The number of student-athletes that were involved in the study was 423.

Table 1: Socio-Demographic Characteristics of Respondents (N = 423)

Variable	Category	Frequency	Percentage (%)
Gender	Male	258	61.0
	Female	165	39.0
Age		132	31.2
	21–23 years	196	46.3
	24–26 years	71	16.8
	27 years and above	24	5.7
Type of University	Federal	141	33.3
	State	141	33.3
	Private	141	33.3

Variable	Category	Frequency	Percentage (%)
Sport Type	Football	108	25.5
	Athletics	86	20.3
	Basketball	74	17.5
	Volleyball	63	14.9
	Other sports	92	21.8
Years of Athletic Participation	1–2 years	101	23.9
	3–4 years	178	42.1
	5 years and above	144	34.0

The findings indicate that most of the respondents were males (61percent) and females were 39. The majority of the athletes were of the age group 21-23 (46.3%), which means that the participants were mainly young adults who were actively involved in competitive university sports. There was even distribution of participation between federal, state, and private universities which portrays balanced institutional representation. The maximum number of participants in sports participating in football was 25.5% then athletics and finally basketball. Furthermore, 42.1 percent of the athletes indicated 3-4 years of experience in sporting activities indicating moderate to high exposure to structured training programmes.

Sports Injuries Prevalence and Pattern among University Athletes.

The first one looked at the occurrence and trend of sports injuries in university athletes.

Table 2: Prevalence of Sports Injuries among Respondents

Injury Experience	Frequency	Percentage (%)
Experienced injury in the past year	249	58.89
No injury experience	174	41.11
Total	**423**	**100**

According to the results, 63 percent of the athletes said that they had experienced at least one sports-related injury in the previous year, and 37 percent said that they had not experienced any injury in the last year. This indicates that sport injuries are not rare among sports in universities.

Table 3: Common Injury Prevention Practices

Prevention Practice	Frequency	Percentage (%)
Warm-up exercises before training	329	77.8
Stretching routines	301	71.2
Strength and conditioning programs	214	50.6
Physiotherapy or rehabilitation sessions	118	27.9
Use of protective gear	173	40.9

The results are that warm-up exercises (77.8) and stretching routines (71.2) are the most widely used methods of preventive measures of injuries among athletes. Nevertheless, the percentage of athletes who participated in physiotherapy sessions was lower (27.9%), which indicates that the necessary services of specialised support with injury prevention were not easily accessible.

The Relationship between the Injury Prevention Practises and Injury Occurrence

To determine the relationship between practises of preventing injuries and the occurrence of the injury, a Chi-square test was carried out.

Table 3: Chi-Square Analysis of Injury Prevention Practices and Injury Occurrence

Injury Prevention Practice	χ^2	df	p-value	Decision
Warm-up Exercises	14.23	1	0.000	Significant
Stretching Routine	9.78	1	0.002	Significant
Strength Conditioning	7.64	1	0.006	Significant
Use of Protective Equipment	4.91	1	0.027	Significant

The findings have shown that warm-up exercises (2 = 14.23, p = 0.001) and stretching regimens (2 = 9.78, p = 0.002) had a significant association with reduced injuries in athletes. There was also a large association between strength conditioning programmes and injury reduction (2 = 7.64, p = 0.006). Such results indicate that athletes who participated in regular and organised injury prevention measures had much lower rates of injuries in comparison to those that did not.

Training Intensity Effect on Injury Risk.

A logistic regression analysis was done to ascertain the predictive ability of training intensity on the likelihood of injury in athletes.

Table 4: Logistic Regression Analysis Showing the Influence of Training Intensity on Injury Risk

Predictor Variable	B	SE	Wald	p-value	Odds Ratio
Training Frequency	0.41	0.12	11.68	0.001	1.51
Training Duration	0.36	0.14	6.61	0.010	1.43

The results of the regression analysis indicated that training frequency was an important predictor of injury occurrence (B = 0.41, p = 0.001). The odds ratio (OR = 1.51) shows that more athletes who had higher training frequency were about 1.5 times more prone to injuries than athletes with lower frequency of training. Equally, training period was a strong predictor of injury risk (B = 0.36, p = 0.010), which implies that the longer the training period the more the chances of the occurrence of injury among athletes. The descriptive analysis of the intensity of the training is provided in Table 4.1:

Table 4.1: Average Duration of Training Sessions

Training Duration	Frequency	Percentage (%)
Less than 1 hour	58	13.7
1–2 hours	201	47.5
2–3 hours	124	29.3
More than 3 hours	40	9.5

The findings indicate that almost fifty percent of the athletes (47.50) trained one or two hours at a time, and twenty-nine point three (29.30) trained two or three hours. This means that majority of the university athletes are involved in moderate-duration training.

The Perceptions of AI-Driven Performance Monitoring Systems by Athletes.

A one-sample t-test was used to compare the perceptions of athletes towards AI-powered monitoring technologies with a test value of 3.0 (midpoint of Likert scale).

Table 5: One-Sample t-test Showing Athletes' Perceptions of AI-Driven Monitoring Systems

Variable	Mean	T	df	p-value	Decision
AI detects abnormal movement patterns	3.87	14.26	422	0.000	Significant
AI predicts injury risk	3.79	12.98	422	0.000	Significant
AI improves performance monitoring	3.91	15.34	422	0.000	Significant
AI enhances coaching decisions	3.74	11.87	422	0.000	Significant

The findings suggest that the average rating of the entire AI-related statements was much higher than the value of neutrality (3.0). This indicates that there are really positive attitudes of athletes to AI-based monitoring tools in sports training and injury prevention.

Influence of Wearable Technology and Movement Analysis Tools on Injury Prevention

A multiple regression study was done to assess whether the application of wearable devices and movement analysis tools predicts the outcome of injury prevention.

Table 6: Multiple Regression Analysis Showing the Influence of Wearable Technology on Injury Prevention

Predictor	B	SE	Beta	t	p-value	R	R^2	F	p-value
Wearable Technology Usage	0.39	0.08	0.34	4.86	0.00	0.48	0.23	63.18	0.00
Movement Analysis Tools	0.42	0.09	0.31	4.47	0.00				

Regression outcomes show that the use of wearable technology was a significant predictor of the outcomes of injury prevention (0.34 = 0.001). Equally, the analysis of use of movement analysis tools was a significant predictor of injury prevention (2 = 0.31, p < 0.001). The model described around 23% of the variation in the outcome of injury prevention (R 2 = 0.23), which implies that AI-based monitoring technologies play an important role in the risk of injury reduction in athletes.

Wearable technology and movement analysis tools are utilised as well.

The last outcome evaluated the scope of using wearable technology and motion analysis tools among the athletes during training.

Table 7: Use of Wearable Technology among Athletes

Wearable Technology Usage	Frequency	Percentage (%)
Regularly use wearable devices	118	27.9
Occasionally use wearable devices	149	35.2
Rarely use wearable devices	84	19.9
Never used wearable devices	72	17.0
Total	423	100.0

The findings show that 27.9 percent of athletes are frequent users of wearable technology with the rest 35.2 percent saying that they occasionally wore the wearable technology. Nevertheless, 17% reported that they had not used wearable devices at all, which implies that the comparison of technology adoption among university athletes differs.

Table 8: Types of Wearable Technologies Used

Device Type	Frequency	Percentage (%)
Fitness trackers	138	32.6
Smartwatches	119	28.1
GPS performance trackers	92	21.7
Motion capture systems	41	9.7
Biomechanical analysis sensors	33	7.8

The most popular wearable technologies became fitness trackers and smartwatches, whereas more complex technologies (motion capture and biomechanical sensors) were in lesser demand, probably because of the cost and accessibility factors.

Discussion of Findings

The results of the given study could be considered valuable in the understanding of the popularity of sports-related injuries in the context of university athletes and the new potential of artificial intelligence-based technologies in terms of predicting and preventing such injuries. The findings showed that a significant percentage of athletes had sustained at least one sports related injury in the last one year, and this means that the incidence of injuries is still a widespread issue in sports in universities. This observation adds to previous claims that greater involvement in organised sports especially competitive environments in tertiary institutions predisposes athletes to increased risk of musculoskeletal trauma as a result of repetitive movements, high training workloads and performance demands (Bahr *et al*. and Krosshaug, 2005 2007). Most athletes in the university tend to work on an intensive training regime that blends both the academic and athletic demands that causes the development of fatigue and biomechanical stress that predisposes injuries.

The demographic composition of the participants is also a helpful context of the vulnerability to injuries. Most of the athletes were in the 21-23 year of age, which means that respondents were in their prime time of athletic growth and development, which is physically active and competitive. Athletes of this age normally participate in more intense training and competitive sports and, therefore, have more exposure to physical stress and risk of injuries. The great number of male athletes as opposed to women can also be an indicator of the larger representation in the overall university athletic programmes whereby men tend to be more active especially in activities like football and athletics. This trend is consistent with the findings made in the past that there are sports with the highest rates of physical contact and dynamic movement patterns that are correlated

with a high risk of injury (Maghsoomi *et al.*, 2025; Souaifi et al., 2025). According to the highest rate of participation among the respondents, football has been largely known to be one of the most injured sports because of quick directional changes, tackling, and loading of lower limbs.

The other significant research implication is associated with the effect of traditional injury preventive measures, including warm-up exercises, stretching programmes, and strength conditioning programmes. The findings established that athletes who regularly participated in such practises had a lot fewer injuries. This fact highlights the topicality of the already developed methods of injury prevention in sport science. Warm-up exercises and stretching increase muscle tone, increase joint motion, and prepare the neuromuscular system with physical activities, and as a result, muscle strains, and ligament injuries are minimised. On the same note, structured strength conditioning programmes are known to assist in establishing muscular stability and balance that is essential in ensuring that athletes possess appropriate biomechanics when performing high-intensity movements. These results reinforce previous injury prevention models that state that adequate conditioning and preparation prior to training or competition are still major elements of injury-prevention strategies (Bahr & Krosshaug, 2005; Meeuwissen *et al.*, 2007). Nevertheless, these conventional methods have merits, but they are not always able to identify nuanced biomechanical inefficient processes, or fatigue-related shifts in movement patterns that significantly add to injury vulnerability over time. To this extent, the analysis of the perceptions of athletes about the artificial intelligence-based monitoring technologies developed by the researchers is one of the most important contributions of this research. The results show that sports people tend to have a positive vision of the application of AI-based systems in sports training and injury prevention. The mean ratings on the statements that were associated with AI were also much higher than the neutral point, which indicates that athletes are aware of the possible advantages of technological interventions in the context of performance monitoring

and injury prevention. This reputation can be described by an increasing interest in the current athlete monitoring technologies based on wearable sensors, motion tracking devices, and machine learning algorithms to process biomechanical data in real-time. These technologies enable a coach and sports scientists to identify some deviation in movement patterns that can indicate fatigue, imbalance, or inappropriate technique. It is a common truth that the introduction of artificial intelligence in sports analytics became a groundbreaking phenomenon that has the potential to improve injury monitoring and prediction of potential threats (Mishra *et al.*, 2024; Wang & Pei, 2024).

The regression analysis also underlines this argument by showing that the use of wearable technology and movement analysis tools were significant to predict injury prevention outcomes in athletes. Predictive value of wearable devices suggests that continuous physiological and biomechanical variable monitoring is significant in determining the earliest risk factors of injury. Wearable technologies can record data on the variables like the velocity of movement, the position of the joint, the intensity of the work, and patterns of recovery. These data, when subjected to the machine learning algorithms, can show the abnormal patterns that might not be seen under the traditional observation methods. As a result, the implementation of AI-based analytics allows sports practitioners to make evidence-based choices about training changes, workload changes, and recovery treatment interventions. This is in line with the new research which indicates that predictive analytics may have a significant positive impact on sports injury prevention due to their ability to prevent sports injuries through proactive instead of reactive intervention approaches (Mishra *et al*., 2024; Wang & Pei, 2024).

Although the use of AI technologies can be most advantageous, the results also showed a difference in the number of athletes who adopt new technologies. Although some percent of the respondents said that they frequently wear the wearable devices, others said that they rarely wore them or had no exposure whatsoever. The difference in

this implies that the provision of sports technology in different institutions can vary in accordance with the resources, infrastructures and technological capacities available. It is possible that universities that have established sports science programmes can better deploy the more sophisticated monitoring systems than those with fewer funds who might have to use more time-tested methods of coaching. Institutional investment in sports technology is important in this case because it brings out these disparities so that no athlete in various universities can be left behind in enjoying modern advances in injury prevention.

Moreover, the qualitative aspect of the research gives more information on the perception of AI-based monitoring systems by athletes and sports practitioners. The qualitative methods have been suggested to study the case of technological integration into the sport setting since they will record the real-life experiences and the perceptions of the athletes and coaches that engage with those systems in the actual training setting (Owen *et al.*, 2024; Jain, 2025). Combining qualitative views allows demonstrating the perceived effectiveness of such technologies and also the difficulties in implementing the technologies, such as the problems in cost, technical knowledge, and the acceptance of the technologies. The results of the given research support the developing opinion that the effective injury prevention in sports is possible only in terms of the multidimensional approach that facilitates the integration of the classical training techniques and the hi-tech solutions. Although traditional methods, including warm-up exercises, stretching, and strength conditioning, cannot be ignored, the combination of artificial intelligence and wearable monitoring technologies allows taking the preventive measures and identifying the risk of injuries much earlier. This integration of biomechanical analysis, predictive analytics, and monitoring systems of athletes is an enormous innovation in the field of sports science with the potential to revolutionise injury prevention methods in university athletics programmes and even more.

Using AI-catalysed insights, combined with time-tested training principles, sports practitioners will be able to build more customised and data-driven injury prevention systems that can preserve the health of athletes and maximise their performance.

Conclusion

The paper has analysed how artificial intelligence and movement analysis can be used to predict and prevent sports injury in athletes. The results showed that sports injuries have been a major bane in the sporting context especially among athletes that are involved in intense training and competitions. The findings also showed that although the conventional methods of injury prevention like proper warm-up sessions, stretching, and strength training are still relevant in mitigating the risk of injury, new technologies present more possibilities of enhancing the methods of injury prevention.

The researchers determined that athletes tend to have a positive attitude to using the monitoring systems based on artificial intelligence and wearable technologies in sport training. These technologies permit constant observation of physiological and biomechanical rhythms of athletes, which makes it possible to identify alterations in abnormal movement patterns that can put them at risk. Moving the analysis systems can give essential information to the coaches, physiotherapists and sports scientists by highlighting the possible risk before it turns to a serious injury to be used to adjust training and take preventive measures. Moreover, the findings revealed that the utilisation of wearable devices and motion analysis tools are an important factor in identifying the risk of injuries and helping to implement the effective strategies of injury prevention. These technologies are able to increase the performance of sport professionals making wise decisions on the workload of the athlete, the period of recovery and performance optimization. That way, the introduction of artificial intelligence to sports training can be viewed as a significant innovation in the contemporary sports science and health management of sportspeople. Nevertheless, the article also

pointed out the differences in the adoption and access to such technologies in athletes, which indicates that institutional support and technological infrastructure are still relevant in the successful application of AI-based injury prevention systems. In the absence of proper resources, training and policy endorsing the advantages of these nascent technologies may not entirely be achieved in the context of university sports. The research concludes that artificial intelligence-based movement analysis combined with traditional training and conditioning methods are a better and more holistic and proactive method of injury prevention in sport. The integration of technological innovation and the proven methods of injury prevention can help sports organisations and educational institutions to provide safer training environments and improve the performance of athletes, as well as, improve the long-term health and well-being of athletes.

Recommendations

Resting on the results of the current research, the recommendations are offered to enhance the injury prediction and prevention among athletes by efficiently using artificial intelligence and movement analysis systems.

The systematic implementation of wearable monitoring tools and AI-driven movement analysis tools in training programmes of conducting athletes should be introduced by university sports authorities. This ought to apply during the initial training season and be practised during the season of competition. This should be done by equipping the athletes with wearable devices that can measure both biomechanical and physiological information both on-training and competition. University sports administrators, sports scientists, and athletic trainers have the responsibility of implementing this. The idea behind this initiative is to provide the opportunity to constantly track the movements and workload of athletes to notice an abnormal pattern of deviations which can cause injuries and correct it before injuries cause severe physical harm.

Regular movement screening and biomechanical assessment should be part of the training regimen of the athletes by coaches and strength-and-conditioner specialists. Such tests have to be done in preseason tests, in between training tests, and post competitions. This is possible by using organised video analysis, motion tracking devices and AI based movement analysis tools. This process should be monitored by coaches, sports performance analysts, and physiotherapists. The purpose is to detect inaccurate movement patterns, muscular imbalances or fatigue determined alterations in technique that can place an athlete at risk of injury. Early detection will enable coaches to adjust the training programmes and introduce corrective activities that will enhance movement efficiency and minimise risk of injury.

Regular trainings on application of modern sports technology should also be carried out to coaches, physiotherapists and sports administrators in universities. Such sessions and training must be done prior to the commencement of every sports season and regularly throughout the year. The training ought to be based on the ways of using wearable monitoring devices and interpreting data on the performance of athletes, as well as using the results of movement analysis as a part of injury prevention. The university management, physical and health education departments and sports science units should take this responsibility. Such recommendation is explained by the fact that the efficient adoption of AI-based injury prevention mechanisms is heavily reliant on the technical skill of the individuals, who are in charge of the athlete performance and health management.

Traditional conditioning and technology-based injury prevention should be the common practise that should be promoted among athletes as a regular routine when it comes to preventing injuries. These must happen in day to day training activities, warm up and after training rest. Athletes are also supposed to do stretching exercises, strength training, balance training, and recovery plans in addition to following the use of wearable monitoring devices where necessary.

This should be monitored by coaches and athletic trainers to make sure that it is well adhered to. It will enhance muscular strength, joint stability and flexibility, which will lower the risk of fatigue, overtraining or poor movement mechanics-related injuries.

The institutional policymakers and the government authorities should designate more funds to develop the sports science infrastructure in the universities. This ought to be included in sports development plans and annual budgets of institutions. The investment must help in purchasing wearable technology, motion sensors, and AI-based performance analysis software. These investments should be coordinated by the ministries of education and sports, the governing councils of universities, and the sports development agencies. Increasing the technological infrastructure will allow the universities to implement the latest systems of injury monitoring to promote the safety of players and their performance.

Lastly, scholars and universities must also encourage interdisciplinary research in the use of artificial intelligence in sports injuries prevention. This research is to be conducted on a regular basis in various fields of sports and competitions. It should promote collaboration between the professionals in the field of sports science, biomechanics, artificial intelligence, physiotherapy, and psychology. The goal is to create better predictive mechanisms and new strategies of injury prevention that can be implemented in all types of sporting conditions. The ongoing research will help to enhance the athlete monitoring systems and promote the knowledge on the technology-based strategies to prevent sport-related injuries.

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