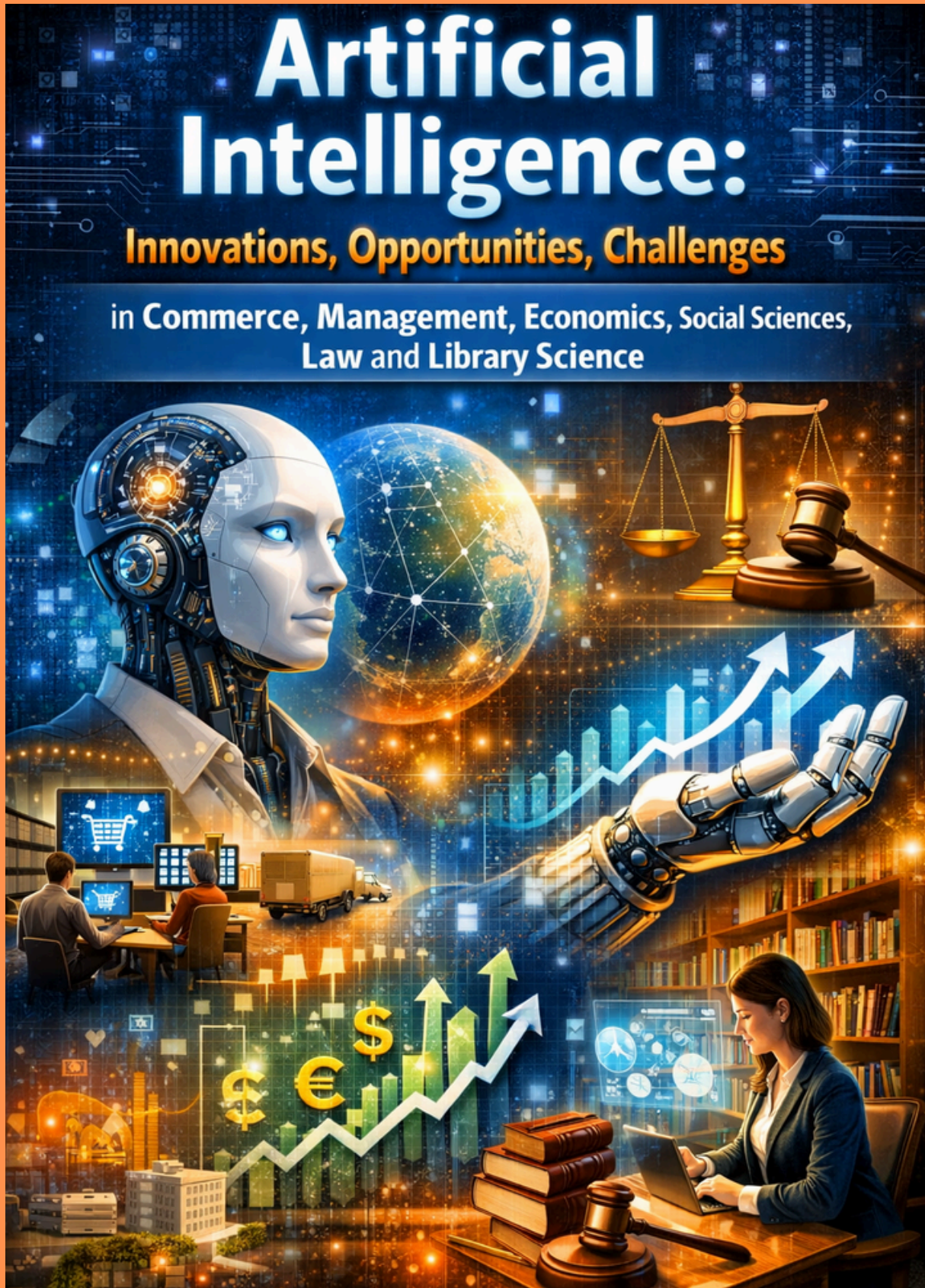


Journal of Research and Development

A Multidisciplinary International Level

Referred and Double Blind Peer Reviewed, Open Access Journal

ISSN:2230-9578 January- 2026 Volume-18 Issue-1 (VII)



Mob: +91-9552416001 Website: <https://jrdrv.org> Chief Editor: Prof. Ramesh V. Bhole

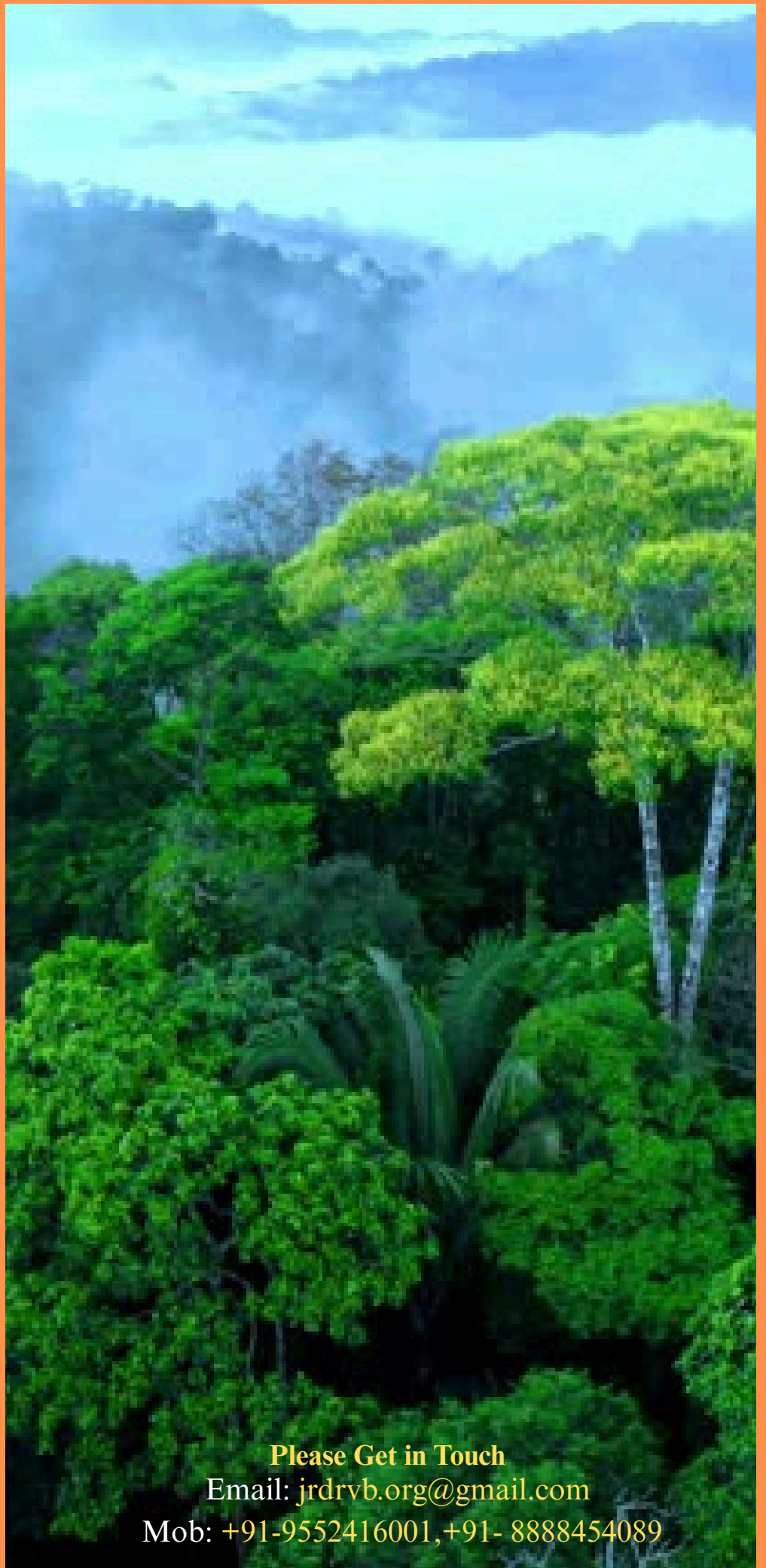
MULTIDISCIPLINARY INTERNATIONAL JOURNAL

Website: <https://jrdrv.org>



ISSN: 2230-9578
January- 2026
Volume-18 Issue-1 (VII)

Please Get in Touch
Email: jrdrv.org@gmail.com
Mob: +91-9552416001, +91- 8888454089





Journal of Research and Development

Peer Reviewed International, Open Access Journal.

ISSN : [2230-9578](https://doi.org/10.2230-9578) | Website: <https://jrdrv.org> Volume-18, Issue-1(VII) | January - 2026

Journal of Research and Development

*A Multidisciplinary International Double Blind Peer Reviewed Refereed
International Research Journal*

Volume No-18, Issue-1(VII), January - 2026

Publication Language - English, Hindi, Marathi and other Indian Languages

Periodicity of Publication- Monthly

Email: jrdrv.org@gmail.com

Journal Website: <https://jrdrv.org>

CHIEF EDITOR

Dr. Ramesh V. Bhole

Professor

Sardar Vallabhbhai Patel Arts and Science College Ainpur,

Tal Raver, Dist Jalgaon

Email: jrdrv.org@gmail.com

Disclaimer

The Editors shall not be held responsible for the originality or the views and opinions expressed in the papers. The author(s) alone shall bear full responsibility for the originality of their work and the ideas expressed therein.

© All rights reserved with the Editors.



Journal of Research and Development

Peer Reviewed International, Open Access Journal.

ISSN : [2230-9578](https://doi.org/10.2230-9578) | Website: <https://jrdrv.org>

JOURNAL PARTICULARS

Name of Journal	JOURNAL OF RESEARCH AND DEVELOPMENT
Frequency	Monthly : Jan to Dec (12 issues per year)
ISSN	2230-9578
Publisher	Dr. Ramesh V. Bhole
Chief Editor	Dr. Ramesh V. Bhole
Copy right	Journal of Research and Development
Starting Year	January 2010
Subject	Multi-Disciplinary
Review Process	Double Blind Peer
Language	English, Hindi, Marathi, and other Indian Constitutional Languages.
Publication Format	Print
Access	
License	 Creative Commons (CC BY-NC-SA 4.0)
Phone No.	+91 93256 65856, +91-8888454089
Email	jrdrv.org@gmail.com
Journal Website	https://jrdrv.org
Registered office Address	‘Ravichandram’ Survey No-101/1, Plot, No-23, Mundada Nagar, Jalgaon, Maharashtra, India
Admin. Office Address	‘Ravichandram’ Survey No-101/1, Plot, No-23, Mundada Nagar, Jalgaon , Maharashtra, India
Printing	Amitsons Digital Copiers 106 and 110, Paras Chambers 1st Floor, Near Laxmi Narayan Theatre, Above Bank Of India, Swargate-411042

24.	AI-Based Doping Detection: Technical Approaches, Advantages and Challenges Savita Rajaram Majagaonkar	96-99
25.	AI as a Pedagogical Tool in Degree College: A Reflective Study on English Language and Literature Sunita T. Metakari, Dr Ravindra A. Kulkarni	100-104
26.	Applications of Artificial Intelligence in Business Management: A Study of Emerging Trends Dr. Khot Pratap N., Dr. Walvekar Sagar B.	105-109
27.	English Language Learning in the Age of Artificial Intelligence: Future Challenges and Possibilities Muskan Faruk Mujawar	110-113
28.	English Learning, Translation, and Cross-Cultural Communication: An Integrative Perspective Shila Santosh Chougule, Prashant B. Bhandare	114-117
29.	The English Language and Future Challenges: Global Dynamics, Technology, and Pedagogical Shifts Shinde Vaishali Vasantrao	118-120
30.	New Era of English Language Learning & Teaching with Reference to Artificial Intelligence Shahin Nizamuddin Mulla	121-124
31.	Globalisation and Changing Trade Patterns in India Vinayak J. Mahadik, Geeta S. Shete	125-129
32.	Gender-wise Analysis of Income Tax Awareness among School Teachers Dr. Sangram sing V. Nalawade	130-133
33.	An Application of Various Methods and Techniques Used in ELT At the Secondary Level Swati Sanatkumar Patil, Dr. Prakash A. Patil	134-136
34.	Inclusive Role of Artificial Intelligence for Person with Disabilities Education: Innovations, Challenges & Future in India Dr. Sanjay Shamrao Kamble	137-142
35.	Emergency Stabilization in 1991: Analyzing the short-term measures that saved the Indian Economy Shatrughna Shivaji Patil	143-146
36.	Continuous Accounting and Real-Time Reporting Dr. Archana Digvijay Suryavanshi	147-149
37.	Technological Advancements in Volleyball Training Dr. Sandip Shamrao Patil	150-152
38.	A Study on Digital Economy Initiatives and Women's Empowerment in India Geeta S. Shete, Dr. Bharat Vitthal Patil	153-156
39.	The Role of Local History in Overall Development of the society and National Integrity in India Dr. Vaishali Abhijit Sarang	157-161
40.	Economics Of Higher Education: Lessons from Past and Way Forward Dr. Suvarna Shamrao Suryawanshi, Shilpa Mhaishale	162-165
41.	Rural Business Development through Digital Economy Shubhada V. Desai	166-167
42.	Influence Of Sports Participation on Students' Academic Achievement Dr. Mahendra Anandrao Kadam-Patil, Dr. Amar Anil Tupe	168-174
43.	History of Indian Trade Practices: An Evolutionary Study Kiran Prakash Menkudale	175-176
44.	The Health and Physical Education Dr. Priya Prakash Tele	177-180
45.	Role of physical education in chronic conditions Dr. Priya Prakash Tele	181-183
46.	Study of Tariff War between India and the United States and Its Causes Dr. Shivprasad Madhukar Shete	184-186
47.	Digital Economy and Women's Empowerment Vinayak Yashwant Vanmore	187-189

48	Constitutional Protection Against Gender Discrimination Digambar Rajanna Nagarhawa	190-194
49	AI Adoption and Its Influence on Indian Industries during the Global Tariff War Era Dr. Bharat Vitthal Patil, Sanjay Jagannath Kasabe	195-198
50	The Emotional Intelligence Between Residential and Non-Residential Sportsmen Dr. Shreedevi Ajit Pawar (Hirugade)	199-201
51	Doping In India: Challenges And Strategies to Combat Doping Dr. Ganesh Maruti Lawangare	202-204
52	Say Yes to Sports and No to Drugs: Encouraging Healthy Lifestyles Among Youth Dr. K. Kanchana	205-207
53	Artificial Intelligence in Business Decision Making-A Conceptual Framework Dr. Avinash Mahadev, Dr. Bharat Vitthal Patil	208-210
54	Navigating the Global Shift: Challenges, Technological Integration, and Strategic Evolution of the English Language in the 21st Century Dhananjay S. Bharsakle, Shila Santosh Chougule	211-214
55	Use of Artificial Intelligence in Business Organisations Dr. Chougule Harsha Atul	215-217
56	AI in Historical Research and Methodology Appasaheb Namdev Kengar	218-220
57	Gender Impact on India's Economic Resilience Dr. S.S. Suryawanshi, Shilpa Mhaishale	221-223
58	From Industrial Revolution to Artificial Intelligence: Historical Evolution and its Economic Implications for India Dr. U. N. Kshirsagar, Dr. R. G. Deshpande	224-227
59	The Listening Gap-Examining Cognitive and Pedagogical Challenges in the Age of Artificial Intelligence Amit Kumar Chavan	228-232
60	A Study of Education and Women's Economic Empowerment Geeta S. Shete, Shraddha Aba Kadam	233-235
61	The Role of Artificial Intelligence in Agriculture Rani Mahadev Kamble	236-238
62	An Analytical Study of Digital Transformation of Business S. C. Jagtap	239-246
63	The Impact of Chatbots and Conversational AI on Human Communication Dr. Shinde Amol Dnyandeo	247-250
64	Consumer Protection Law in India: Enforcement, Pendency & Comparative Insights for Reform Rutuja Mahavir Shirdhone	251-255
65	Physical and Mental Effects of Narcotics Use among Kabaddi Players in Maharashtra Dr Mayur Mohanrao Shinde	256-259
66	Constitutional Law and Social Justice in India Gouri Balasaheb Gavade	260-263
67	A Socio -Legal Study of Women Empowerment: Indian Perspective Kranti Gautam Dhale	264-266
68	Conversational AI: Concept and Technology Pooja Ashok Kamble	267-271
69	Mental Toughness Sandeep Sahadev Patil	272-273
70	Tariff Wars: Economic, Political, and Strategic Dimensions: A Comparative Analysis of United States-China and United States-India Trade Conflicts Monika Samar Kagwade, Dr. B. R. Patil	274-277
71	Cross cultural literary works engage with different cultural perspectives in English literature Deepali Machhindra Mane	278-280
72	English language and Future challenges Chandanshive Shubhangi	281-284
73	Chatbots, Conversational, AI and future of communication Chandanshive Shubhangi	285-288

Original Article

AI-Based Doping Detection: Technical Approaches, Advantages and Challenges

Savita Rajaram Majagaonkar

Assi. Prof., Rajarshi Chhatrapati Shahu College, Kolhapur Maharashtra State

Email: savitamajagaonkar@gmail.com

Manuscript ID: **Abstract**

JRD -2026-180124

ISSN: 2230-9578

Volume 18

Issue 1(VII)

Pp. 96-99

January 2026

Submitted: 12 Dec. 2025

Revised: 22 Dec. 2025

Accepted: 12 Jan.2026

Published: 31 Jan. 2026

Doping in competitive sports threatens fairness, athlete health, and integrity. Traditional doping detection methods such as laboratory analyses and Athlete Biological Passports (ABP) face limitations in scalability, adaptability, and timeliness. Artificial Intelligence (AI) offers promising solutions by analyzing complex datasets, detecting subtle patterns, and enabling real-time monitoring. This paper reviews AI-based technical approaches, evaluates the advantages over conventional methods, and discusses the key challenges of implementation, including data quality, ethical concerns, and regulatory integration. In recent years, Artificial Intelligence (AI) has emerged as a powerful tool in anti-doping efforts due to its ability to process large and complex datasets, identify subtle patterns, and support real-time monitoring. This paper examines AI-based technical approaches to doping detection, such as machine learning, deep learning, anomaly detection, and natural language processing. It highlights the advantages of AI-enabled systems, including enhanced sensitivity, scalability, adaptability, and cost efficiency. At the same time, the study discusses key challenges such as data quality and availability, model transparency, ethical and legal concerns, privacy issues, and integration with regulatory frameworks. The paper concludes that while AI has significant potential to strengthen anti-doping mechanisms, its effective implementation requires careful governance, ethical oversight, and collaboration between technologists, sports scientists, and regulatory bodies.

Keywords: Artificial Intelligence, Doping Detection, Anti-Doping, Technology.

Introduction:

Athletic performance enhancement can be gained using various diets, training routines and hard work. However, it can and has been achieved since ancient competitions by using a wide variety of physiological, mechanical and pharmacological doping techniques (Baron, Martin, and Abol, 2007). Doping is one of the most serious and controversial issue in sports all over the world especially in India. Doping is the use of prohibited substances or methods to enhance athletic performance. In sports, doping is considered unethical and can lead to serious health risks. Anti-doping agencies and sports organizations work to combat doping through testing, education and stricter penalties. Traditional detection methods such as gas chromatography–mass spectrometry (GC-MS) and immunoassays are precise but limited in scalability and adaptability to new substances. The Athlete Biological Passport (ABP) approach tracks biomarkers over time to identify anomalies beyond individual baselines (Sottas et al., 2010). However, physiological variability can complicate interpretation. In recent years, AI has gained traction in anti-doping through its capacity to analyze multimodal data, enabling enhanced detection and predictive capabilities (Agostini et al., 2022). This study throw a light on traditional doping detection, AI based technical approaches of doping detection, advantages and challenges before AI based technical approaches.

Traditional Doping Detection Techniques:

1. Laboratory Analysis:

For abused drugs, doping detection is traditionally performed by analyzing biofluids such as blood and urine, although using other types of samples such as hair may be easier or less invasive.



Quick Response Code:



Website:

<https://jrdrv.org/>



Creative Commons (CC BY-NC-SA 4.0)

This is an open access journal, and articles are distributed under the terms of the [Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International](https://creativecommons.org/licenses/by-nc-sa/4.0/) Public License, which allows others to remix, tweak, and build upon the work noncommercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

Address for correspondence:

Savita Rajaram Majagaonkar, Assi. Prof., Rajarshi Chhatrapati Shahu College, Kolhapur Maharashtra State

How to cite this article:

Savita Rajaram Majagaonkar (2026). AI-Based Doping Detection: Technical Approaches, Advantages and Challenges. *Journal of Research & Development*, 18(1), 96-99.

However, because hair and other samples may be limited in size, cLC-MS can be appropriate for analysis. Conventional laboratory methods relies heavily on analyzing biological samples (urine, blood) using chromatography techniques like Gas Chromatography-Mass Spectrometry (GC-MS) and Liquid Chromatography-Mass Spectrometry (LC-MS/MS) to identify prohibited substances or their metabolites, alongside specialized methods like Flow Cytometry for blood doping using These approaches require highly controlled environments, expert operators, and significantly time-intensive processes. Despite of these requirements these approaches are accurate and reactive rather than predictive (World Anti-Doping Agency [WADA], 2021).

2. Biological Passport System:

The Athlete Biological Passport (ABP) monitors select biomarkers such as hematological and steroidal variables over time. It is an individual electronic record used by anti-doping agencies (like WADA) to track an athlete's biological markers (like blood and hormones) over time, creating a personalized baseline to indirectly detect the effects of performance-enhancing drugs and doping, rather than just finding the substances themselves, making it a key tool for modern anti-doping efforts. It can indicate doping without direct detection of substances, but may generate false positives due to natural biological variation or environmental factors (Sottas et al., 2011). AI can augment ABP interpretability by learning individualized patterns and reducing false alarms.

AI-Based Technical Approaches:

AI methodologies help analyze complex datasets that extend beyond what traditional approaches can manage. AI is revolutionizing doping detection in sports by enhancing accuracy, efficiency, and predictive capabilities. The World Anti-Doping Agency (WADA) is funding research to develop AI-powered techniques that analyze large datasets on athlete performance, using algorithms to detect anomalies linked to doping.

1. Machine Learning (ML) on Biomarkers:

Supervised machine learning models such as support vector machines, random forests, and neural networks can be trained to differentiate between profiles of clean and doped athletes based on biomarkers such as blood parameters or hormone levels. These models detect patterns that may be imperceptible through manual analysis (Agostini et al., 2022).

2. Deep Learning for Time-Series and Biometric Data:

Deep learning architectures like recurrent neural networks (RNNs) and long short-term memory (LSTM) networks are suited for temporal data such as performance logs and biometric readings from wearable. These models can capture nonlinear relationships and temporal dependencies, enabling detection of subtle anomalies in training or performance data (Goodfellow et al., 2016; Ghasemzadeh & Jafari, 2011).

3. Anomaly Detection:

Unsupervised and semi-supervised models such as auto-encoders and one-class support vector machines identify unusual patterns without requiring labeled examples of every possible doping scenario. This is crucial in situations with limited labeled data or emerging substances (Bishop, 2006).

4. Natural Language Processing (NLP)

NLP techniques can be applied to unstructured textual, such as scientific literature, social media, or online forums data (Simpson et al., 2018), to identify trends around new substances or illicit communities discussing performance-enhancing drugs. Monitoring such signals can inform anti-doping strategies and early detection efforts (Sukumaran et al., 2024).

Advantages of AI-Enabled Detection

AI-based systems offer several benefits over traditional methods:

1. Enhanced Sensitivity and Specificity

AI models can detect subtle deviations in complex data patterns that simple threshold-based systems may overlook, potentially reducing both false negatives and false positives (Rabadan et al., 2020).

2. Scalability and Real-Time Monitoring

AI enables real-time analysis of continuous data streams from wearables and performance logs, facilitating rapid feedback loops and near real-time anomaly detection (Ghasemzadeh & Jafari, 2011).

3. Adaptability to New Substances:

Machine learning models can be updated with new data to learn patterns associated with emerging substances or techniques, making them more adaptable than static rule-based systems.

4. Cost Efficiency:

Automated data analysis reduces dependence on manual laboratory procedures, offering potential reductions in operational costs over time and allowing broader coverage of athletes.

Challenges in AI-Based Doping Detection:

Despite advantages, significant challenges remain.

1. Data Availability and Quality”

AI systems require high-quality, well-labeled datasets. Privacy regulations, limited access to athlete health data, and ethical constraints restrict availability. Noisy or biased data can compromise model reliability.

2. Model Transparency and Interpretability”

Complex models such as deep neural networks often function as “black boxes.” For anti-doping enforcement, transparent and interpretable explanations are essential to support decision-making and avoid unjust sanctions (Woolf et al., 2019).

3. Ethical and Legal Concerns”

Collecting and processing biometric and performance data raises privacy issues. Athletes must consent to data collection, and AI predictions should not lead to discrimination or unjust profiling (Woolf et al., 2019).

4. Integration with Regulatory Bodies

AI adoption requires alignment with anti-doping agencies’ operational protocols and validation standards. Agencies like WADA must establish guidelines for AI integration, accreditation, and compliance.

5. Adversarial Manipulation

There is potential for adversarial behavior where actors intentionally manipulate data to evade detection, analogous to adversarial attacks in machine learning.

Case Studies and Applications

• Bioinformatics and Metabolomics Models

Research in metabolomics has shown that machine learning can differentiate between doped and clean samples with high accuracy in experimental settings, suggesting feasibility for real-world implementation (Agostini et al., 2022).

• Wearable Sensors in Endurance Sports

Studies using wearable sensor data such as heart rate and power output in cycling or running have demonstrated that AI models can detect atypical physiological responses, potentially signaling doping or misuse of performance-enhancing interventions. (Grivas, and Safari, 2025; Sunny, et al. 2025; Chidambaram et al., 2022)

Conclusion:

AI-based doping detection has the potential to significantly augment traditional methods by improving sensitivity, scalability, and adaptability. However, realizing this potential requires overcoming challenges in data quality, model interpretability, privacy, and integration with existing regulatory frameworks. Continued interdisciplinary research is essential for establishing robust and ethical AI-enabled anti-doping infrastructures.

References:

1. Agostini, D., Ferri-Marini, C., Calabrese, C., & Tosti, S. (2022). Machine learning for sports performance and anti-doping monitoring. *Frontiers in Sports and Active Living*, 4, Article 847615. <https://doi.org/10.3389/fspor.2022.847615>
2. Baron, D. A., Martin, D. M., Abol, Magd S. (2007). Doping in sports and its spread to at-risk populations: an international review. *World Psychiatry*. 2007 Jun;6(2):118-23. PMID: 18235871; PMCID: PMC2219897.
3. Bishop, C. M. (2006). *Pattern recognition and machine learning*. Springer.
4. Chidambaram, S., Maheswaran, Y., Patel, K., Sounderajah, V., Hashimoto, D. A., Seastedt, K. P., McGregor, A. H., Markar, S. R., Darzi, A. (2022) Using Artificial Intelligence-Enhanced Sensing and Wearable Technology in Sports Medicine and Performance Optimisation. *Sensors (Basel)*. 2022 Sep 13;22(18):6920. doi: 10.3390/s22186920. PMID: 36146263; PMCID: PMC9502817.
5. Ghasemzadeh, H., & Jafari, R. (2011). Physical activity monitoring using wearable sensors: A review. *IEEE Sensors Journal*, 11(12), 3139–3163. <https://doi.org/10.1109/JSEN.2011.2166369>
6. Goodfellow, I., Bengio, Y., & Courville, A. (2016). *Deep learning*. MIT Press.
7. Grivas, G. V., & Safari, K. (2025). Artificial Intelligence in Endurance Sports: Metabolic, Recovery, and Nutritional Perspectives. *Nutrients*, 17(20), 3209.
8. Rabadan, M., Díaz, V., & García-García, J. M. (2020). Predictive analytics in sport: Machine learning for performance and anti-doping. *Applied Sciences*, 10(19), 6820. <https://doi.org/10.3390/app10196820>
9. Simpson, S. S., Adams, N., Brugman, C. M., & Conners, T. J. (2018). Detecting Novel and Emerging Drug Terms Using Natural Language Processing: A Social Media Corpus Study. *JMIR Public Health and Surveillance*.
10. Sottas, P.-E., Robinson, N., Fischetto, G., Dolle, G., Alonso, J. M., & Saugy, M. (2011). Prevalence estimation of blood doping in elite sport using a Bayesian network. *Haematologica*, 96(12), 1804–1809. <https://doi.org/10.3324/haematol.2011.050039>
11. Sottas, P.-E., Saugy, M., & Saudan, C. (2010). Endogenous steroid profiling in the athlete biological passport. *British Journal of Sports Medicine*, 44(Suppl 1), i16–i20. <https://doi.org/10.1136/bjism.2009.068122>



Journal of Research and Development

A Multidisciplinary International Level Referred and Double Blind Peer Reviewed, Open Access

ISSN : 2230-9578 | Website: <https://jrdrv.org> Volume-18, Issue-1(VII)| January- 2026

12. Sukumaran, C., Karafil, A. Y., Marimuthu, K., & Chokkalingam, S. (2024). Exploring the Evolving Perception of Sports Doping through Text Analytics: Figuring out Public Sentiments. Burdur Mehmet Akif Ersoy University Journal of Sports Sciences.
13. Sunny, J. S., et al. (2025). *Anomaly Detection Framework for Wearables Data: A Perspective Review on Data Concepts, Data Analysis Algorithms and Prospects. Sensors.*
14. Woolf, K., Mazzeo, S., & Taylor, J. (2019). Ethical implications of artificial intelligence in sport. *Journal of the Philosophy of Sport*, 46(2), 205–223. <https://doi.org/10.1080/00948705.2019.1608311>
15. World Anti-Doping Agency. (2021). World Anti-Doping Code. WADA. <https://www.wada-ama.org>
16. World Anti-Doping Agency. (2023). Athlete Biological Passport operating guidelines. WADA. <https://www.wada-ama.org>

Original Article

Doping In India: Challenges And Strategies to Combat Doping

Dr. Ganesh Maruti Lawangare

Asso. Prof., Department of Physical Education, Rajarshi Chhatrapati Shahu College, Kolhapur, Maharashtra

Email: gmlawangare99@gmail.com

Manuscript ID: **Abstract**

JRD -2026-180151

ISSN: 2230-9578

Volume 18

Issue 1(VII)

Pp. 202-204

January 2026

Submitted: 15 Dec. 2025

Revised: 25 Dec. 2025

Accepted: 15 Jan. 2026

Published: 31 Jan. 2026

Doping remains a major integrity and public health challenge in Indian sport. This paper analyses the prevalence of doping in India, highlights current statistics of doping cases in India. The present study focuses on challenges before India's anti-doping ecosystem and explores successful anti-doping models of countries which have very less doping cases. The study suggests that, with concerted efforts, combining strategic policy, international best practices, and a cultural shift towards clean sport, India can significantly reduce positive cases and improve its standing in global sport.

Keywords: Doping, Anti-Doping, positive doping cases

Introduction

Doping is a complex issue with serious consequences for athletes, sports, and society. In India, the issue has attracted increasing attention due to rising violation rates and international scrutiny. Doping refers to the use of prohibited substances and methods by athletes to enhance performance, endurance, strength, or recovery beyond natural physiological limits. The practice undermines the integrity of sport, poses significant health risks to athletes, and erodes public confidence in fair competition. Globally, World Anti-Doping Agency (WADA) which is an independent organization, promotes clean sports and enforced through testing, education, and compliance mechanisms administered by national and international agencies.

Despite global frameworks aimed at harmonizing anti-doping practices, doping remains a persistent challenge in many countries, including India. In recent years, India has witnessed increasing numbers of athletes testing positive for banned substances, drawing attention to the prevalence of doping and the effectiveness of current control mechanisms. This paper focuses on the prevalence of doping in India, challenges of doping, case studies of successful anti-doping models and what strategies should India adopt to combat doping.

Prevalence of Doping in India

Several factors contribute to the prevalence of doping in India. The key factors are limited awareness of prohibited substances, inadequate medical supervision, supplement contamination, easy access of banned substances, recognition - rewards and systemic gaps in anti-doping education are often cited as underlying issues. Additionally, pressures to perform at national and international levels may incentivize some athletes to seek performance enhancement through banned methods.

According to a report summarizing WADA's 2024 Testing Figures, India conducted 7,113 tests in the previous year and reported 260 adverse analytical findings, translating to the highest positivity rate (3.6 %) among major countries that conducted more than 5,000 tests (Outlook India, 2025). The trend of high positivity rates is not unique to 2024 alone. In 2023, India's positivity rate was reported at 3.8 %, considerably above the rates in countries such as the United States (1.1 %) and China (0.2 %). These statistics indicate that, relative to testing volume, Indian athletes continue to show a higher prevalence of adverse analytical findings compared to several developed sporting nations, highlighting a persistent concern for sports governance and athlete education.

Creative Commons (CC BY-NC-SA 4.0)

This is an open access journal, and articles are distributed under the terms of the [Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International](https://creativecommons.org/licenses/by-nc-sa/4.0/) Public License, which allows others to remix, tweak, and build upon the work noncommercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

Address for correspondence:

Ganesh Maruti Lawangare, Asso. Prof., Department of Physical Education, Rajarshi Chhatrapati Shahu College, Kolhapur, Maharashtra

How to cite this article:

Ganesh Maruti Lawangare (2026) Doping in India: Challenges and Strategies to Combat Doping. *Journal of Research & Development*, 18(1), 202-204.



Quick Response Code:



Website:
<https://jrdrv.org/>



Efforts to combat doping:

Efforts to combat doping in India involve both enforcement and preventive measures. The National Anti-Doping Agency (NADA) conducts routine testing, awareness programs, and collaborates with international bodies to align with global standards. Despite these efforts, the continued high positivity rates suggest that further reforms in policy, education, and technological integration may be necessary to curb doping practices more effectively.

Challenges in India's Anti-Doping Ecosystem

Despite efforts, India continues to record high rates of anti-doping rule violations relative to many peer countries. The challenges in India's Anti-doping ecosystem are;

Awareness and Education Gaps:

One of the most pressing challenges in India's anti-doping regime is the lack of awareness and education among athletes, especially at the grassroots and developmental levels. Many athletes, particularly from rural or semi-urban backgrounds, do not fully understand the World Anti-Doping Agency (WADA) Prohibited List, the principles of strict liability, or how easily supplements can lead to positive tests. Surveys suggest that only a minority of athletes have attended formal anti-doping education sessions, making them vulnerable to unintentional violations when they consume prohibited substances or contaminated supplements without knowing the risks. Additionally, coaches and support personnel in local training environments often lack structured training on anti-doping protocols, which perpetuates misinformation and poor practices among young or inexperienced athletes.

Supplement Contamination and Market Issues:

Testing of athlete supplements in India shows **significant failure rates**, indicating that products athletes might use can contain prohibited substances or fail international standards. *18% of tested nutritional supplements failed compliance parameters* in a study by the Centre of Excellence in Nutritional Supplements Testing for Sportspersons at the National Forensic Sciences University. Additionally, NADA partners with FSSAI to highlight contamination risks and educate athletes on supplement safety.

Weak Grassroots Anti-Doping Culture:

Media coverage of India's high positive doping rates indirectly highlights suboptimal anti-doping uptake among many athletes, particularly outside elite circles, India recorded **260 positive tests** in 2024 — topping the global list for countries with over 5,000 tests. While this statistic alone doesn't measure grassroots awareness, the prevalence speaks to systemic gaps in education and compliance outside elite or national-level environments where structured outreach tends to be stronger.

Resource Constraints and Technical Capacity:

Significant gaps have been documented in how NADA administers where about tracking and monitoring key tools for out-of-competition testing and effective detection. The World Anti-Doping Agency's *Operation Carousel* investigation identified numerous where about failures and cited deficiencies in monitoring and testing coverage. While this primarily reflects procedural compliance, the underlying issue is partly capacity and resource limitations, insufficient monitoring systems and personnel to enforce where about requirements effectively.

Implementation and Compliance Issues:

Independent reviews have reported lapses in anti-doping implementation and missed/failed tests:

- WADA's *Operation Carousel* revealed that NADA had not registered many whereabouts failures in ADAMS, even while identifying dozens of filings and missed test failures in audits.
- A deeper investigation found that over a quarter of athletes in NADA's testing pool failed to file whereabouts, and many were not tested during the year.

These findings illustrate administrative gaps, delayed compliance, and execution problems in India's anti-doping processes.

Strategies to Reduce Positive Doping Cases:

Education and Awareness Programs:

Mandatory anti-doping education for athletes, coaches, and support staff at all levels is crucial. Awareness initiatives should emphasize on interpretation and updates of the *WADA Prohibited List*, risks of supplements and contamination, rights and responsibilities under anti-doping codes. Educational outreach should begin at junior development stages to foster a culture of clean sport.

Strengthening Testing Protocols:

Improved testing strategies include randomized out-of-competition testing, Biological Passports for long-term monitoring of athletes' biomarkers, coordination between NADA and WADA-accredited laboratories. Advanced testing decreases the likelihood of doping going undetected and acts as a strong deterrent.

Certified Supplement & Nutrition Programs:

Collaboration with regulatory bodies — such as the *Food Safety and Standards Authority of India (FSSAI)* — to create certified supplement lists and testing protocols reduces inadvertent doping through contaminated products.

Independent Governance & Integrity Structures:

Ensuring the independence of anti-doping bodies from sporting federations helps avoid conflicts of interest and enhances enforcement credibility.

Successful Anti-Doping Models:

United States — USADA:

The U.S. Anti-Doping Agency (USADA) is often cited as a benchmark due to its organizational independence, comprehensive integration of testing, education, and scientific research, public education and behavioral campaigns. These elements enhance trust and compliance.

Australia — Sport Integrity Australia:

Australia's model takes a holistic sport integrity approach, linking anti-doping with broader ethical sport behavior, intelligence, and education. Australian systems emphasize strict athlete "whereabouts" reporting to support surprise testing.

United Kingdom — UK Anti-Doping (UKAD)

UKAD blends strong behavioral science with education to prevent doping. Its emphasis on early education, community outreach, and supplemental guidance resources has helped cultivate a culture of self-regulated clean sport.

Netherlands & European Cooperation:

The Dutch anti-doping authority emphasizes international collaboration, sharing data and implementation strategies with partner nations to strengthen global deterrence and enforcement.

Policy Recommendations:

Based on global best practices and Indian context, the key recommendations include:

- Expand and strengthen education and awareness efforts across all sports levels
- Increase transparency and independence in anti-doping governance
- Enhance testing protocols through biological passports and wider randomness
- Support athletes legally and ethically
- Establish certified supplement frameworks with regulatory partners

Conclusion

India's high incidence of doping positives highlights systemic challenges in education, regulation, and enforcement. However, with concerted efforts, combining strategic policy, international best practices, and a cultural shift towards clean sport, India can significantly reduce positive cases and improve its standing in global sport.

The adaptation of international anti-doping models, tailored to India's unique sports landscape, will be key to building a sustainable and fair competitive environment.

References

1. "18% of nutritional supplements tested failed quality parameters, posing contamination risks for athletes." *Times of India — CoE-NSTS report* (2025).
2. "India recorded 260 positive doping cases in 2024, ranking highest in the world among countries with over 5,000 tests." *Punjab Kesari (Hindi news)* (2025).
3. "India tops global doping cases with 260 positives; athletics, weightlifting, and wrestling most affected." *ABP Live (Hindi)* (2025).
4. "India's positive doping rate was among the highest reported in 2024, a cause for concern." *IBC24 news* (2025).
5. "WADA identified whereabouts failures and positive tests in India under Operation Carousel, reflecting gaps in monitoring and compliance." *New Indian Express (based on WADA report)* (2023).
6. "WADA's Operation Carousel audit revealed inadequate oversight of athlete whereabouts and gaps in testing." *Indian Express report on WADA investigation* (2022/23).
7. European anti-doping collaboration and data sharing studies.
8. <https://blog.iplayers.in/doping-in-sports-an-indian-perspective/>
9. <https://vajiramandravi.com/current-affairs/doping-in-india/>
10. <https://visionias.in/current-affairs/monthly-magazine/2024-05-21/social-issues/doping-in-sports>
11. National Anti-Doping Agency, India implements the Anti-Doping Program and works towards promoting clean sport and awareness." *NADA India official website — NADA India* (2025).
12. National anti-doping compliance and implementation data.
13. Outlook India. (2025, December 18). *India throws up highest doping positivity rate among major countries in WADA's 2024 testing report*. Outlook India.
14. Reports on supplement contamination related to positive doping cases in India.
15. Sport Integrity Australia anti-doping framework.
16. UK Anti-Doping (UKAD) education and prevention documents.
17. USADA organizational model — official mission and strategy documents.
18. World Anti-Doping Agency (2024). World Anti-Doping Testing Figures Report.
19. National Anti-Doping Agency (India). (2025). Anti-Doping Awareness Programs.
20. Economic Times (2025). National Anti-Doping Amendment Bill Explained.
21. IJIRT (2023). Artificial Intelligence in Doping Detection.
22. ScienceDirect (2025). Ethical Implications of AI in Sports Anti-Doping.
23. World Anti-Doping Agency (WADA) Annual Testing Figures — positing India's high number of positive cases.