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Traditional Indian Physical Culture and Modern Sports Science: A Confluence of Heritage and Innovation

Vinayak Ravi Shanker*

Assistant Professor, Faculty of Sports Science and Management, Poornima University, Jaipur.

*Corresponding Author: vinayak.shanker@poornima.edu.in

Abstract

The ancient methodologies of Indian physical culture are filled with methods to develop strength, endurance, balance, and mental stamina. Based on a philosophy of holistic health, many practices have continued through generations, becoming essential to the community's way of life these philosophies have produced, some of which are yoga, mallakhamb, kushti, and danda-baithak programs. This chapter discusses how these traditional systems may be interpreted, recovered, or adopted into contemporary sports science methodologies. The chapter will support integrated systems by providing evidence that benefits found in physiology, biomechanics, and psychological domains that are rooted in traditional methods of training not only develop future generations of athletes through the use of Integrated Knowledge Systems, but will also provide solutions to current issues such as overtraining, injuries, and mental burnout faced by athletes participating in high-performance sports. Furthermore, this integrated method will demonstrate that Indian Physical Culture Systems preserve our cultural heritage and have a significant impact on traditional methods used in high-performance sports.

Keywords: Indian Knowledge Systems, Physical Culture, Mallakhamb, Yoga, Traditional Fitness, Modern Sports Science, NEP 2020.

Introduction

Traditionally physical culture in India encompasses more than just the narrow definition of fitness through the physical. The philosophy of physical culture in India is based on holistic principles including discipline and ethics, spiritual growth, and community. For example, physical exercises like Yogasana (yoga postures), pranayama (breath control), kushti (wrestling), and mallakhamb (pole gymnastics) were not just ways to keep fit, but rather provided an avenue or vehicle to gain mental clarity, emotional stability, and moral character. The Vedas, Upanishads, and Ayurvedic Samhitas (ancient Indian texts) highlight the close relationship between body, mind,

and spirit. This idea is consistent with the emerging global paradigm of integrative wellness based on the biopsychosocial model of health that is rapidly gaining popularity in sports science in this century.

Throughout their lives, Indians were expected to live a physically active life and to engage in physical discipline on a daily basis as part of their community. This belief has been present in every phase of Indian history from the Vedic times until the end of the Middle Ages. Physical proficiency was not only sought after for purposes of warfare or competition; but it was also recognized as being an important part of attaining dharma (conducting oneself in accordance with one's dharma), artha (seeking material things) and kama (seeking the enjoyment of things), and finally obtaining moksha (enlightenment or liberation). Wrestlers (pehelwans) learned and developed their wrestling ability in an akhara, or community training facility, through the guidance of their guru. To assist the pehelwans in achieving strength and skill in wrestling, they were required to follow strict dietary rules (satvik), primarily vegetarian and consisting of only fresh food, and to live their lives in a disciplined manner so as to emphasize humility, to serve others (seva), and to develop their inner strength. As such, these physical skill-training programs were not only inclusive of all levels of society, but they were also intended to be programs that would provide long-term benefits for participants (i.e., long-term human development), rather than short-term benefits for athletic ability or entertainment.

In recent years there has been a growing shift to different perspectives regarding training philosophy. The development of "Western" based philosophies regarding training has directed training towards metrics that are quantifiable, such as VO_2 max, 1RM (one-repetition max) testing, or lactate threshold testing, plus also reflecting an emphasis on individualized competition and compartmentalization of scientific study through specialized areas. As a result of this shift, systems of training which were uniquely Indian in origin and nature were often neglected, and labelled as unscientific or "folk" based. After gaining independence in 1947, the gap created by separating Westernized and Indian training systems continued and increased. Globalized systems of education and professional sport tended to favour Eurocentric style training systems, which were implemented and instilled through the act of colonization, and have continued to be reinforced through the commercialization of fitness industries (i.e., fitness centres). Traditionally based practices are frequently found as ancillary to athletic training and are often viewed primarily as traditional cultural displays and/or fitness retreats.

In the last several years, there has been a change from one way of thinking to another about traditional Indian knowledge systems. This has increased interest in traditional Indian systems of knowledge academic and physical field venues (i.e. through globalization of yoga), increased interest in functional training, and recognition of the limitations associated with using only reductionist "Western" models (i.e. high

injury rates associated with excessive use of gym-based (repetitive) physical training). Scientific data has begun to support physiological and psychological benefits associated with Indian physical culture through the use of tools such as electromyography (EMG; muscle activation patterns), VO₂ max testing (aerobic capacity), and flexibility measures. Although integrating Indian physical culture into modern sports science has recently become recognized as an innovative approach capable of providing sustainable solutions to the long-standing global challenges of fitness, wellness, and sport in the 21st century, it is also viewed as solution to the long-standing challenges associated with developing sustainable athletic careers with lower risk of burnout and improving recovery times through performance enhancement compared to other models.

Historical Overview of Indian Physical Culture

The physical development of India has been shaped over thousands of years by a continuum of traditions drawing upon spiritual doctrines, health-centric lifestyles, and a deep sense of community. Physical exercise was never considered an independent activity but was part of a larger system of philosophy and ethics. The foundational texts of India - the Vedas (especially the Rig Veda and Atharva Veda), Upanishads, and Sanskrit classical Ayurvedic texts (Charaka Samhita, Sushrut Samhita) - express the interdependence of body (Sharira), mind (Manas), and spirit (Atma) as connected through the practice of vyayam (i.e., general exercise), yoga asana (postures), and pranayama (control of the breath), with the objectives of enhancing physical strength, developing mental calmness, preventing disease, and achieving spiritual enlightenment.

The Akhara is a well-known place of discipline and training for various forms of Indian physical expression (including kushti). It likely developed around the 11th-12th centuries, with support from local kings, and was maintained by the community. Akharas existed beyond class and caste; they were places for people of all backgrounds to come and train together. Individuals known as pehelwans participated in structured training regimens at these facilities. This included training using mud to help them develop grip, stability, and resilience when slipping; maintaining a satvik or clean diet including milk, ghee, almonds, and seasonal fruits; conducting spiritual activities such as prayers or meditation; and participating in physical training based on traditional Indian knowledge.

Kushti extends past just competition within these institutions, as it is part of a disciplined, spiritual lifestyle which follows the guru-shishya parampara (teacher/student tradition). The development of physical skills is directly related to moral discipline, humility (vinaya) to one's teacher and respect for one's teacher. Traditional methods and tools of strength training (dand (dynamic Hindu push-ups using all ranges of motion through the whole kinetic chain with a wave-like movement), baithak (deep Hindu squats with all ranges of motion using the calves), gada (large

heavy wooden clubs swung in circles from the shoulders and core for power) & nal (round stone weights used to measure grip/rotation strength) created the basis for training. They not only developed muscle endurance/stability but also helped develop tendon resilience/joint flexibility which are now widely accepted in modern biomechanics as necessary to avoid injuries.

The akhara was additionally a culturally innovative social organisation facilitating inclusion and collective collaboration for all classes of people in the community and for performing collaborative community activities to demonstrate that physically strong individuals should be used to create a harmonious society through physical strength usage.

Mallakhamb is a unique discipline to the field of Wrestling, as it combines acrobatics, yoga postures, and dynamic movement training, similar to the sport of wrestling. The name Mallakhamb (sanskrit) is derived from the two roots 'malla' (wrestler) and 'khamb' (pole), where works on performing complex movements on a vertical pole or on a hanging rope. Mallakhamb was developed originally as an additional training aid for wrestlers to enhance their balance, hand grip, and core strength, later becoming a separate competitive sport, with formal national and international championships. The training demands and objectives of this discipline include testing and developing neuromuscular coordination, grip strength, flexibility, scapular stability, and kinesthetic awareness. Besides its physical demands, Mallakhamb has common characteristics to Yoga, which includes principles of focus, inner balance and breath control. In addition the recent literature suggests, those who practice Mallakhamb are likely to have better results in developing upper body strength, core stability and increased flexibility than regular gymnastic training amongst similarly-aged individuals.

There are countless ways of practicing the art of physical movement. And there are many types of physical expression throughout the world. Physical movement is one of the many ways that people express themselves in all aspects of life – be it through dance or martial arts or exercise, or any other form of physical expression. What if you could connect your physical body to your mental and spiritual body through a series of physical and mental movements? What if you could experience a full-body workout while engaging in meditation, breath work, and mindfulness? You would experience a transformation in your physical, mental, emotional, and spiritual well-being. When you participate in asanas (postures), dhyana (meditation), and pranayama (breath work) on a regular basis, you create harmony between your physical body and your mental body. You develop a relaxed state of clarity that allows you to achieve harmony between your physical body, mental body, and spiritual body. All three bodies are connected through your thoughts and emotions. Through yoga, you can also build relationships within your community and beyond through the principles of yogic philosophy. This connection can

lead to greater self-awareness and understanding, which will allow you to become a leader within your community and within your own life.

The uniqueness of indigenous systems lies in their inherent inclusivity, preventive orientation and ethical integration into physical training. In contrast to the many modern day fitness paradigms that focus on metrics, competition, or commodification, Indian physical traditions emphasised internal awareness (svadhyaya), self-regulation and spiritual progress. Through rituals, moral codes (yamas and niyamas), and a collective sense of purpose, these systems are deeply rooted in culture and sustainable, resulting in adherence to them throughout life rather than for short periods of time.

As modern sports science progresses with areas including biomechanics, performance psychology and physiological analysis, it is clear that these fields increasingly align with the ancient Indian traditions. The rich legacy of physical culture in India provides a complete and integrated model of education that goes beyond fitness to include the development of emotional competence and ethical character. Inserting this time-honored tradition back into today's sport training settings and educational institutions enables us to combine the wisdom of our ancestors with the newest technology (e.g., wearable devices to track movement and monitor heart rate variability while practicing pranayama) to create a comprehensive and contextually appropriate framework for performance and wellness for all types of people, from children in school to adults participating in elite-level competitive sports.

Scientific Foundations in Traditional Practices

India's physical culture refers to an old and complete understanding of human physiology and psychology. This culture is in correlation with many modern sports science concepts. Recently, scientific examination of traditional disciplines such as yoga, mallakhamb, and danda-baithak has begun to support their effectiveness in developing athletes as well as for overall mental wellness through studies utilizing EMGs (electromyographic studies) for determining how and when muscles are recruited; VO₂ Max-type testing to measure aerobic capacity; and force plate technology to measure balance.

The practice of yoga has grown into a universally acknowledged approach for improving overall health and physical performance. The research that is available proves the efficacy of yoga for increasing flexibility (primarily by lengthening myofascial chains), improving spinal alignment, improving joint function, and improving cardiovascular function. These benefits create the foundation for athletic conditioning by reducing the risk of injury, and enhancing the efficiency of movement. Additionally, yogic practices enhance cognitive clarity, emotional stability, and regulation of stress through the modulation of the autonomic nervous system, specifically through stimulation of the parasympathetic branch of the autonomic nervous system. Techniques such as pranayama (breathing techniques) and dhyana (meditation) are

highly effective in reducing cortisol levels, increasing heart rate variability (HRV), and assisting in recovery after activity. Studies indicate that those who regularly practice yoga have significantly higher VO_2 max values, and perform better on endurance tests than those who do not practice yoga; thus, regularly practicing yoga improves aerobic and muscular endurance.

Many benefits have been found with the applications of Mallakhamb in enhancing many of the neuromuscular and proprioceptive systems symbiotically. Performing dynamic movements such as holds, spins and balancing, on an unstable pole or rope requires an exceptionally high level of coordination, core strength, and dynamic balance – all of which are crucial for developing elite performance levels in not only gymnastics, acrobatics, and wrestling, but also in contact sports like MMA. Participants using Mallakhamb exhibit significantly higher increases (compared to control groups using traditional fitness protocols) in their hand grip strength, lower body power, flexibility, and cardiovascular endurance. The practice of Mallakhamb trains the entire kinetic chain to create scapular stability, explosive power, and reactively control the body in unstable environments. These are functionally very similar to other forms of functional training such as Olympic rings or slackline, but provide the added benefit of cultural and mental focus.

The traditional Danda-Baithak movements, which belong to the Indian traditional sport of wrestling, use indigenous workout Methods based on functional movement principles. Dand and baithak have been used for centuries in an akhara setting and are described as two distinct functional movements performed together. The dand is a Hindu push-up performed with a unique cat-cow wave motion, while the baithak is a deep squat, usually performed in high repetitions, while elevated on the heels or using the arms for balance. Both exercises interact with multiple joints and muscle groups at the same time to create compound full-body movements. Danda-baithak develops muscular endurance, tendon strength (especially around the knee and shoulder), acute aerobic conditioning through high repetitions and explosive strength. Current interpretations see these exercises as the earliest forms of progressive overload and calisthenics and as great tools for improving structural integrity and injury prevention. In addition, Danda-Baithak aids in upper body muscular endurance (push-up test) and cardiovascular endurance, highlighting its use as a low-cost, equipment-free method of physical training.

From an energy systems review, these time-tested regimens provide a comprehensive training stimulus across all three energy pathways. Yoga, as well as pranayama, primarily train the aerobic energy system and help improve fat metabolism, efficiency of the mitochondria, and active recovery. Mallakhamb, as well as high-rep Danda-Baithak, can stimulate both anaerobic (exercise up to the lactate threshold during explosive type movements) and aerobic systems depending on how long each session lasts and how intense the training is. This is similar to the modern concept of

periodized training models that give endurance sport athletes (e.g., marathon) the same benefits as power sport athletes (e.g., wrestlers/gymnasts).

An exclusive advantage of these programs is they provide a whole-system approach to wellness, thereby decreasing habitual over-exertion (chronic), and providing support for mindfulness, active recovery, and longevity. Traditional regimens include rest days according to natural cycles, nutrition awareness, and mental practice processes, which are all very similar to current training practices (i.e. training periodization, deloading phases, and/or physiological skills training). Most current athletes/coaches utilize yogic stretches for flexibility and recovery, Mallakhamb-style drills for neuromotor control/grip strength, and high repetition calisthenics from Danda-Baithak as foundational conditioning and injury prevention.

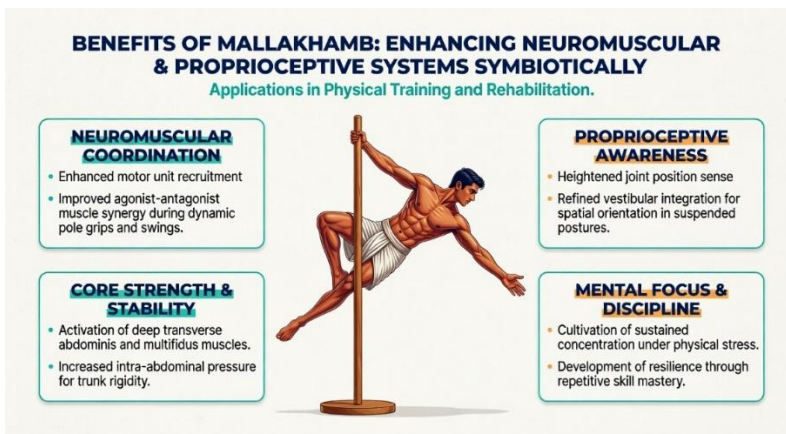


Figure 1: Benefits of Mallakhamb

Consequently, physical activities based on Indian tradition are far more than mere history or culture, but rather are scientifically based, biomechanically correct, and performance-centred systems which have been developed over many centuries of observation and refinement. As sports science continues to strive for new innovations in their pursuit of science-based solutions to the challenge of excessive specialization and mental health problems, there is increasing rationale for Indian cultural methods to be re-examined and re-integrated into modern-day sports training methods. Merging Indian and modern techniques increases the performance of the athlete's performance resources, but also provides a means to pay tribute to and enhance the value of India's rich cultural and scientific heritage as it pertains to physical education and performance training.

Innovation through Integration

An ever-changing sports science environment is currently moving toward a holistic method of developing athletes and creating sustainable athletic performance instead of a method that focuses on achieving short-term gains. As a result, Indigenous

Indian physical culture, which includes various movement patterns, techniques related to breathing, and nourishment from Ayurveda, is being adopted in many high-performance sports around the world as an additional context. The exchange of information between cultures enhances an athlete's physical conditioning, increases an athlete's psychological resilience, decreases their chances of being injured and allows an athlete to use a more individualized approach to their recovery.

- **Yoga: A Contemporary Recovery and Mobility Tool**

Integration of the old and the new, in terms of tradition and innovation, is a very successful example of how yoga can successfully enhance athletes' performance. Athletes of many sports professional (N.B.A., E.P.L., N.F.L.), cricket, Olympic sports incorporate daily use of asanas (postures) and learn to use pranayama techniques (control of breath) to enhance their overall conditioning through improved elasticity of the muscular system by stimulating the fascial lines and improving the mobility of the joints through controlled movement. In addition to this, yoga helps prevent injury from overuse by providing better proprioceptive feedback to the body as well as better alignment of the musculoskeletal system. The meditative aspects of yoga develop focus, emotional stability and mindfulness which are essential when competing under pressure.

- **Mallakhamb: Functional Skill-Building for Modern Athletes**

Mallakhamb has quickly become an innovative method of training on an unstable surface and utilizing physical skills in a functional manner. Performing complex movements on either a vertical pole or rope requires very high levels of core activation, spatial orientation, neuromuscular efficiency, and reflexive stability. All of these physical attributes can be developed through the performance of Mallakhamb skills and can be used in gymnastics, parkour, mixed martial arts (MMA), and other sports that rely on precise motor function (e.g., tennis, badminton). Performing dynamic, multi-planar movements that depend solely on your own body weight instead of weight (or resistance) provides a smooth transition when progressing from basic holdings to advanced inversions and/or spins; therefore, Mallakhamb is suitable for all athletes, regardless of their fitness level. Additionally, coaches are beginning to utilize drills inspired by Mallakhamb's game to increase motor learning opportunities and decrease the risk of injury when developing skills using traditional gymnastics and/or strength training programs.

- **Ayurveda and Personalized Sports Nutrition**

The ayurvedic philosophy is an individualized approach to understanding physiology through the tridoshas (3) framework (Vata=dynamics/movement, Pitta=dynamics/ metabolism & transformation, Kapha=dynamics/structure/stability). Therefore, the study of contemporary sports nutrition has developed an interest in both the links that exist in comparison between ayurveda 'tridosha' profile and modern concepts such as nutrigenomics and metabolic type. The ayurvedic perspective on

seasonal regimens (ritucharya) advises that changes in diet, etc. be made according to the rhythms of nature (ritus) in these six Indian seasons, to maintain the doshas in balance develop agni (digestive fire) and support recovery. For example, in the winter (hemanta/shishira) we are advised to consume warmer, and light foods; and to exercise moderately to counteract the aggravation of Vata; in the summer (grishma) we are encouraged to eat cooler, more hydrating foods (to pacify) and strategies to control Pitta. Studies have demonstrated that following ritucharya will help to improve performance, decrease the risk of injuries that occur with the seasonal change, improve immune function, and allow the athlete's performance to be aligned with circadian and circannual rhythms. Adaptogenic herbs, such as ashwagandha (*Withania somnifera*), have demonstrated potential in increasing endurance, reducing cortisol levels, and accelerating recovery when used as part of an athlete's nutrition plan.

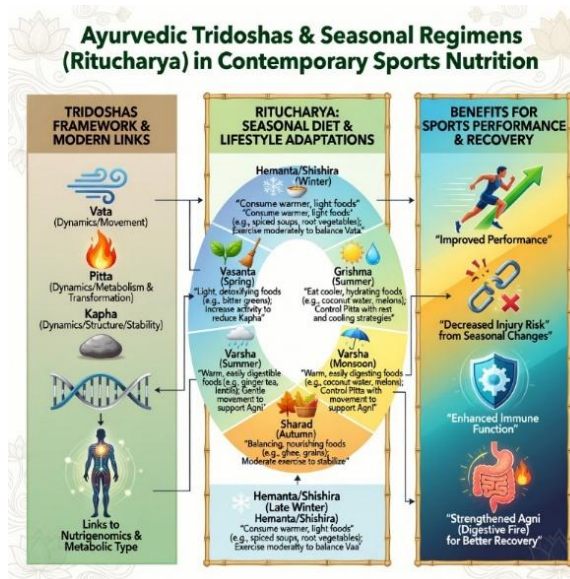


Figure 2: Ayurvedic Tridosha and Seasonal Food Habits

- **Toward a Hybrid Performance Paradigm**

When you combine traditional Indian training methods with contemporary sports science, you create hybrid training approaches that integrate, rather than simply add, the two methods, providing a seamless flow throughout the whole process. These hybrids allow for improved athlete performance measurements while continuing to emphasize the long-term health of the athlete by developing the whole athlete, including his or her mind, body, emotions and even values. These paradigms can be very valuable within the context of the diversity of India's sporting culture due to the many different levels of resources available to participants in this infrastructure, from elite level national programs to grassroots level academies.

Relevance in Education and Coaching

Integrating Indian Knowledge Systems (IKS) within the formal education and coaching of sports provides a culturally based and looking ahead to the future way of trying to do things. Sports such as Yoga and Mallakhamb emphasize functional movement, community involvement, and dependence on a very low amount of resources to make a case for being included as part of the curriculum in schools, colleges, and universities. They provide an advantage to both urban elite institutions and rural systems; therefore, they are recommended to be included in both programs because they have scientific merit while also representing cultural authenticity.

- **Strengthening Cultural Identity in Sports Education**

When students become familiar with indigenous traditions, they can build emotional and intellectual ties to their training. These ties produce a sense of pride, self-assuredness, and connection to the past. As learners see emerging fitness trends throughout the world, they are able to compare them to aspects of their own heritage, providing a new perspective that allows learners to view their cultural legacy creatively and as evolving rather than fixed.

- **Affordable and Accessible Training Models**

The conventional way to use Danda-Baithak or asanas doesn't need much besides an open area, a rope or a stick: this is perfect for governmental institutions, community centers, or poor places to deliver sport equity through building fitness with minimal equipment, usually just by doing high-reps.

- **Toward a Holistic Coaching Paradigm**

Coaching becomes enhanced through using IKS-based approaches that join the physical components of athletic conditioning to the psychological aspects of overall well-being. Techniques such as pranayama and visualization drills can increase an athlete's ability to regulate their emotions, concentrate, and be resilient in high-pressure situations. When these techniques are combined with contemporary sports psychology techniques (e.g., goal setting and biofeedback), they form a multi-dimensional toolbox that assists in developing athletes in a sustainable way while also minimizing athlete burnout.

- **Academic Integration and Evidence-Based Evaluation**

The use of EMG, VO₂ max testing, motion capture, and psychological scaling to analyze traditional sports science or physical education disciplines as distinct sub-disciplines in a B.Sc. Sports Science or Physical Education program can lead to the growth of interdisciplinary research and foster an understanding and appreciation for physical culture in India.

Policy and Government Support

The policy framework of India supports this integration in multiple ways. Specifically, the National Education Policy (NEP) 2020 supports the inclusion of indigenous knowledge systems (IKS) within all subjects and areas in schools and colleges, including physical education, yoga, and sports. NEP 2020 identifies the need for an integrated approach to education by valuing indigenous knowledge as well as modern science. Furthermore, the Khelo India initiative, which is run by the Ministry of Youth Affairs and Sports, has created opportunities for the revival of traditional and regional sports, as well as providing financial assistance for infrastructure development and talent identification that will include akhara-style or Mallakhamb training opportunities.

The University Grants Commission (UGC), as well as the Ministry of Education's IKS Division, provide funding for interdisciplinary projects that collect, validate, and spread knowledge of traditional physical practices. Projects like Bharatiya Khel are also being developed to incorporate indigenous games and movement systems into the school curriculum, thereby linking cultural education with physical literacy.

Future Possibilities and Global Impact

A shift toward mindful, functional, and sustainable concepts is transforming a rapidly growing wellness market on a global scale. As expensive fitness models utilizing a lot of gym equipment come under scrutiny for being inaccessible and environmentally damaging, there are alternatives that have roots in traditional Indian systems and have proven to be biomechanically effective and culturally relevant.

With the global acceptance of Yoga (e.g., G20 Yoga Initiatives, Global Yoga Day) Also increases evidence supporting the use of Yoga for recovery in elite athletes as well as the Global demand for Ayurvedic adaptogens and herbal preparations is also increasing significantly. Structured Yoga-based injury prevention programs, Mallakhamb based functional training, and Danda-Baithak conditioning certifications can be created for fitness professionals worldwide. International partnerships between Indian institutions (such as Poornima University; Sports Authority of India) and international research agencies could utilize advanced technologies such as EMG, 3D motion analysis, and metabolomics to establish robust evidence that supports incorporation into mainstream athletic performance/recovery, rehabilitation, and corporate/military wellness programming.

Ultimately, India can export not just practices but a complete philosophy of balanced, ethical, and sustainable physical culture.

Conclusion

India's combination of traditional forms of movement (such as yoga, mallakhamb and kushti with its danda baithak routines) with modern sports sciences

creates an innovative and effective approach to furthering both the development of sports in this country and developing a global health paradigm. Along with developing physical capacities, these ancient modalities; yoga, mallakhamb, and kushti together with the Ayurvedic system were all holistic approaches to creating overall wellness through mental, spiritual, emotional and physical strength and healthy communities.

These methods offer solutions to modern day living, which includes sedentary lifestyles, increased mental health issues, a rise in the number of injuries in professional sports, and an over-reliance on technology-based training methods. There has been an increasing amount of scientific research conducted which supports the theory that adopting one or more of these types of training methods will help enhance performance, achieve faster recovery times, increase VO₂ max, improve flexibility, and develop higher levels of mental resilience.

Merging biomechanical knowledge with modern-day tools for optimizing movement; nutritional science for developing personalized systems to maximize nutritional intake; and performance analytics for making data-based decisions in conjunction with those; will create richer coaching models or methods of coaching athletes. The result of incorporating IKS in sport education will produce individuals that are both scientifically competent and culturally connected.

There are many different ways to achieve this by combining national programs like NEP 2020, Khelo India, and IKS-focused research with international partnerships and increased investment in higher education (including research). Moving forward, we need to focus on intentional integration while using mixed-methods research to validate the work completed through these projects. Collaboration is also imperative in order to achieve success in this initiative.

In India, combining traditional wisdom with current scientific understanding can potentially create an example for the rest of the world regarding how to develop a global standard for athletic performance and well-being that draws on thousands of years of history but is also adaptable to meeting the present-day needs for both individuals and society.

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