

# SPORTS AND EXERCISE MEDICINE IN INDIA: LOOKING BEYOND INJURY

Hanjabam Barun Sharma

SEMS (Sports-Exercise Medicine & Sciences)

PE-FLM (Performance, Environmental-Functional & Lifestyle Medicine) Lab.

Department of Physiology, Institute of Medical Sciences (IMS), Banaras Hindu University (BHU), Varanasi, Uttar Pradesh, India

ORCID ID: 0000-0002-6910-7573 | e-mail: dr.barun.hanjabam@gmail.com

**Abstract** Sports Medicine (SM) is a new specialty in India which has been often projected as dealing only with treating musculoskeletal (MSK) sports injuries. With adequate training in medical-clinical and interventional physiological sciences, SM physicians have an important role to play as an essential part of the multidisciplinary and multispecialty team in the fight against the rise of physical inactivity, sedentary lifestyle and non-communicable diseases. Dope-free sports performance enhancement is another important aspect, which needs beyond the MSK centric approach of sports medicine. There is need for awareness and overall development of this unique specialty, with contribution from government side and non-government organizations.

**Key words** sports medicine, exercise medicine, physical inactivity, doping, sports performance

## Introduction

Sports Medicine (SM) is a relatively new medical specialty in India, which started officially in 1986–1987 with PGDSM (post-graduate diploma in sports medicine) course at NSNIS Patiala (Netaji Subhas National Institute of Sports) Patiala, followed by MD sports medicine from 2010 onwards at various medical colleges. This specialty, which also is known by the name, Sports and Exercise Medicine (SEM), deals not only with the comprehensive medical care of elite and exercising individuals, but also with the use of exercise for medical and therapeutic purpose, and for health and fitness promotion. Hence, a myopic and only sports-injury-treatment centric approach of sports medicine is outdated one.

## Sports Medicine against Non-Communicable Diseases (NCDs)

This specialty with its mother branch, Exercise Physiology or Medical-Clinical and Interventional Physiology (MCIP), has an important role for the fight against physical inactivity, sedentary lifestyle and non-communicable diseases (NCDs). Physical inactivity has been considered a global problem, a pandemic itself (Haseler, Haseler, 2022), and also the 21<sup>st</sup> century's biggest health problem in 2009 (Blair, 2009). Even though low level of physical activity (PA) is not the only leading health problem, but it is one of the most significant risk factors for NCDs (Forberger, Wichmann, Comito, 2022) and premature death, as reported in 2009 (Blair, 2009). Inactivity-induced low cardio-respiratory fitness (CRF), obesity and other adverse health effects are also significant causes of increased morbidity and NCDs (Blair, Sallis, Hutber, Archer, 2012; World Health Organization, 2010, 2013). In fact, low CRF is

the most important NCD risk factor, more important than even the combined risks of smoking, obesity and diabetes (Blair, 2009; Tew, Copeland, Till, 2012). Low CRF has been reported to associate with all-cause mortality, incidence of and mortality due to cancer, cardio-vasculo-respiratory diseases in a dose-response manner (Steele et al., 2019). The mortality rate resulting from NCDs is expected to rise from 65% of all deaths in 2010 to >75% by 2030 (Blair et al., 2012). Apart from human suffering, NCDs cause significant economic loss of the family, community and the country (Blair et al., 2012). About 31.1% (27.9% men, 33.9% women) adults ( $\geq 15$  years) and 80.3% adolescent (13–15 years) as reported in 2012 (Hallal, Andersen, Bull, Guthold, Haskell, Ekelund, 2012), and 23% adults and 81.0% (77.6% boys, 84.7% girls) adolescents (11–17 years) as reported by World Health Organization (WHO) in 2010 (Guthold, Stevens, Riley, Bull, 2019; World Health Organization, 2013, 2018) are physically inactive worldwide. India ranks 5<sup>th</sup> among South-East Asian countries and above 12 countries worldwide with 15.6% (12.7% men, 18.4% women) physically inactive adults ( $\geq 15$  years) (Hallal et al., 2012), and 73.9% (71.8% boys, 76.3% girls) physically inactive adolescents (11–16 years) (Guthold et al., 2019). India has >20.77% (>135 millions) of the world's obese adults, and has a high central obesity prevalence rate of 16.9–36.3% (Ahirwar, Mondal, 2019).

There is rapid rise of diabetes (diabetes), hypertension and other obesity-related NCDs among South Asian countries (Misra, Khurana, 2011). India is often considered as the “diabetes capital”, having 16.63% (77 millions) of the total individuals with diabetes in the world in 2019, and it is expected to rise to 17.46%, with an increment of 31.17% individuals with diabetes in India by 2030 (Federation, 2019). One study reported 42.1% prevalence for metabolic syndrome among elderly ( $\geq 60$  years) southern Indians (Sinha, Bhattacharya, Deshmukh, Panja, Yasmin, Arlappa, 2016). India also has very high hypertension prevalence rate of 30.7% (234 million) among adults (equal to or more than 18 years) with >2 times the prevalence (22.4% vs 10.5%) of that of United States (US) among young adults (20–44 years) (Ramakrishnan et al., 2019). India was projected to have more individuals with cardiovascular diseases (CVDs) than any other region of the world by 2020 (Murray, Lopez, 1996). Of concern, the South Asians including Indians have the early onset and higher risk of NCDs even at relatively lower obesity indices (Misra, Khurana, 2011), and Indians also experience mortality due to cardiovascular events (CVEs) almost a decade earlier than developed countries with 52% CVE-related mortality for <70 years Indians as compared to 23% in those countries (Ramakrishnan et al., 2019).

Realising the need for urgent action, many international organizations have come forward with various programs to fight physical inactivity and sedentary behaviour. “WHO Global Strategy on Diet, Physical Activity and Health, 2004”, “Toronto Charter for Physical Activity: A Global Call for Action, 2010”, “Exercise is Medicine” by American College of Sports Medicine are few examples (Blair et al., 2012). WHO member states aimed in 2011 to halt rise of diabetes and obesity, and 25% reduction of hypertension prevalence by 2025 and 10% reduction of physical inactivity by 2025 with “25 by 25” goal (World Health Organization, 2013), and 15% by 2030 under “Global Action Plan on Physical Activity 2018–2030” (Carrard et al., 2019; World Health Organization, 2018). United Nations (UN) member states aimed to reduce premature mortality from NCDs by one-third by 2030 (United Nations Population Division, 2015). Government of India (GOI) launched “Fit India” movement, among others, to take the nation towards fitness and wellness, and make it healthier on 29<sup>th</sup> August 2019, the national sports day of India, celebrated in the honour of the hockey “wizard” or “magician”, Major Dhyan Chand who was born on 29<sup>th</sup> August 1905 (Fit India, 2019; International Olympic Committee, 2019a).

WHO, with the support of GOI, is establishing the WHO Global Centre for Traditional Medicine (GCTM) in Gujarat, India (World Health Organization, 2022). Various lifestyle interventions in the form of Yoga, dietary changes

and exercise form an integral part of Indian traditional medicine system including ayurvedic medicine. In fact, the origin of exercise-is-medicine has been proposed by some to be from Indian Indus Valley and Chinese Yellow River civilisations (Sharma, 2022). SEM physicians, with adequate training in MCIP or Interventional Clinical Physiology (ICP) in the form of diet/nutrition, exercise, sleep and other lifestyle and functional interventions, can work in an integrated and holistic manner with traditional medicine practitioners to tackle the pandemic of physical inactivity, obesity and NCDs (Sharma, 2022). This is especially important since traditional medicine is used by about 80% of the world's population, and is also the first line of treatment for many diseases (World Health Organization, 2022).

Adequate training in sports medicine, exercise medicine and clinical-interventional exercise physiology is absolutely essential, which will help in identification and correction of various lifestyle abnormalities using physiological approach before pharmacotherapy or surgical intervention. Being physically active is not enough but one has to reduce the amount of being sedentary too. Those who are physically active but spend too much time in prolonged sedentary behaviour like uninterrupted sitting, are still at high risk, which is the so called "active couch potato" phenomenon (Owen, Healy, Matthews, Dunstan, 2010). The physiological effects due to prolonged sedentary time (inactivity physiology) is not same as that of too little PA. The adverse health effects of prolonged sitting time are independent of the protective effect of regular PA (Owen et al., 2010). A physician, with deep understanding of both exercise physiology and sedentary physiology, can therefore help in fight against physical inactivity and sedentary behaviour effectively. Hence, recruitment, engagement and attachment of trained physicians should be done in all national and state programs related with health, PA, exercise, fitness, lifestyle change and NCDs etc; and in appropriate organizations, bodies or institutions or departments including government health service and public hospitals. They should not be restricted to only sports and military sectors (Sirisena, Lim, Teh, 2016).

### **Sports Medicine for Dope-Free Performance**

Increasing doping with use of banned substances/methods among athletes is unfortunately not uncommon. Even, in some countries, in the past, there were reports of medically-supervised and controlled use of performance enhancing drugs or methods, and also state-sponsored doping. This is because performance comes as the first priority above healing and health for most elite athletes (Hoberman, 2002; Speed, Jaques, 2011; Wiesing, 2011). World Anti-Doping Agency (WADA) was formed in 1999, which revises WADA code regularly. The code contains banned substances and practices (Speed, 2013; World Anti-Doping Agency, 2019b).

The global percentage of analytic anti-doping rule violations (A-ADRVs), which is the violation of WADA code article 2.1 dealing with athletes, out of total adverse analytical findings (AAFs) decreased from 66.42% in 2013 to 43.73% in 2016. AAFs in athletes with valid therapeutic use exemptions (TUEs) increased from 8.78% in 2013 to 11.18% in 2016 (World Anti-Doping Agency, 2019a). However, the percentage of non-analytical ADRVs (NA-ADRVs), which is the violation related to WADA code article 2.2 to 2.8 (2009 WADA code) and 2.10 (2015 WADA code) and applies to medical staff and other athlete support personnel (ASP) apart from the athletes, out of total ADRVs increased from 13.62% in 2013 to 16.87% in 2016 with 7.81% NA-ADRVs by ASPs in 2016 (World Anti-Doping Agency, 2019a).

The situation for India is quite worrisome which needs urgent and effective action from all sides. The percentage of ADRVs (A-ADRVs, NA-ADRVs) out of global ADRVs for India was 4.86 (5.39, 1.50)% in 2013, 5.67 (6.29, 1.73)% in 2014, 6.07 (6.97, 0.71)% in 2015 and 4.33 (5.13, 0.37)% in 2016 (World Anti-Doping Agency, 2019a). In fact, India has been consistently on the top as the country with most ADRVs in Asia from 2013 to 2016; and in the world as 4<sup>th</sup> in

2013, 3<sup>rd</sup> in 2014 and 2015, and fortunately dropped to 6<sup>th</sup> in 2016 with a total of 69 ADVRs (68 A-ADVRS, and 1 NA-ADVR in wrestling). Maximum ADVRs were in athletics (30.43%) followed by powerlifting and weightlifting (20.29% each), kabaddi (13.04%) and wrestling (7.25%) (World Anti-Doping Agency, 2019a). National Anti-Doping Agency (NADA) of India, which is affiliated to WADA and was established on 24<sup>th</sup> November 2005 by GOI with a mission of dope free sports in India, reported a total of 187 (4.30% of total sample analysed) AAFs and 18 (0.41% of total sample analysed) TUEs from April 2018 to March 2019. Maximum AAFs were in bodybuilding (32.09%), followed by weightlifting (21.93%), athletics (9.63%), powerlifting (6.95%), wrestling (3.21%), and kabaddi and Judo (2.67% each) (National Anti Doping Agency, 2017, 2018).

Although NADA has conducted many anti-doping awareness programmes in the country, active involvement of SEM physicians by the concerned authority is unfortunately lacking (National Anti Doping Agency, 2017). SEM physicians are specially trained in anti-doping science and most knowledgeable among ASPs (Mazanov, Backhouse, Connor, Hemphill, Quirk, 2014). SEM physicians should be in the front line for the fight against doping menace and have major and lead role in anti-doping education and awareness campaign. This is also important as the extent of “accidental” doping seems to be high, which can be approximated from the WADA statistics of 4.17%, 13.66% and 8.78% in 2013; 5.77%, 13.86% and 9.79% in 2014; 7.69%, 7.06% and 11.90% in 2015 for “no sanction”, cases with valid reason without TUE, and those with valid TUEs respectively (Chan, Tang, Yung, Gucciardi, Hagger, 2019). Recruitment, attachment and engagement of SEM physicians should be done in all appropriate programmes, organizations, bodies, institutions or universities which deal with anti-doping, sports, performance and physical education etc including sports federations, and national and state government youth affairs and sports departments.

Apart from fighting doping, the relatively poor international sporting-performance to population ratio needs urgent focus. The sports medicine component of SEM and performance-related sports and exercise physiology (pSEP) are particularly important in context of India. India is the second populous country at 1.21 billion (Office of the Registrar General & Census Commissioner, 2019), out of which 65% are under 35 years and 27.5% between 15–29 years, making it also one of the most youngest nations (Department of Sports, 2018). Unfortunately, Indian performance at international sports, specially summer Olympics is not so good. From Paris 1900 to Rio 2016 summer Olympic games, Indian had won only 9 gold, 7 silver and 12 bronze medals, out of which only one sports discipline, men’s hockey, is credited for 8 gold, 1 silver and 2 bronze medals (Indian Olympic Association, 2018; International Olympic Committee, 2019b). In the last summer Olympics in Rio 2016, India sent its 117 athletes contingent which was the largest up to now but managed to pick two medals (1 silver and 1 bronze) (Indian Olympic Association, 2018; International Olympic Committee, 2019b). Relative to its huge population, the amount of money India spent on sports is meagre, and was Rs.1393.21 crores or about 3.196 paise per person per day for 2017–2018, which has fortunately been increased to some extent now (Parliament of India Rajya Sabha Department-Related Parliamentary Standing Committee on Human Resource Development, 2018). Another major concern which has been repeatedly raised is the non-presentation of sportspersons in, and heading and managing of sports institutes, including Sports Authority of India (SAI), by persons without any sports background and in a strict unwieldy and monolithic bureaucratic manner (Parliament of India Rajya Sabha Department-Related Parliamentary Standing Committee on Human Resource Development, 2015).

After the dismal performance at Rio 2016, the GOI is actively working from the grassroots to elite levels, specially under the national programme, “Khelo India”, for the promotion and development of sports, creating sporting culture and hence improving the country’s international sporting performance (Department of Sports, 2018;

Parliament of India Rajya Sabha Department-Related Parliamentary Standing Committee on Human Resource Development, 2018). Target Olympic Podium Scheme (TOPS) was established in 2014 for providing assistance to top elite athletes who are potential medal winners in Olympic Games (Sports Authority of India, 2019). A task force was also constituted for preparing action plan for the next three Olympic Games (2020, 2024 and 2028) in 2017 by GOI (Press Information Bureau, 2017). However the engagement of SEM physicians who are the specialists in this field is unfortunately lacking. This needs to be addressed for the long-term success. Also, there is inadequate number of SEM physicians in the country, who are well trained in pSEP, MCIP and sports and exercise sciences (SES).

GOI under the Scheme of Human Resource Development in Sports is focusing on the academic and intellectual aspect of sports development (Department of Sports, 2019). Central institutes/universities of national importance and excellence, based on the model of All India Institute of Medical Sciences (AIIMS), exclusively focusing on Sports-Exercise Medicine and Sciences (SEMS) and MCIP should be set-up throughout the country, so are national centres similar to the United Kingdom (UK) National Centre for Sport and Exercise Medicine (NCSEM) which was launched in 2012 in UK for delivering an Olympic health legacy (Tew et al., 2012). Recruitment of SEM physicians and scientists and development of world-class SEMS and MCIP departments should be there in National Sports University (NSU), the first central sports university in India which was set up in 2018 in Imphal, Manipur by the GOI for promoting sports education and functioning as the national training centre for selected sports disciplines (National Sports University, 2019). This is to uplift the nation to be among the world's sports superpowers, instead of running the university in a physical education centric manner only, similar to other already existing physical education institutes and universities in the country.

## **Sports Medicine towards Development & the Future**

Recently, sports medicine specialty has been gaining popularity among medicos, SES community and general public. This is due to the effort from the government as well as from various non-governmental organizations (NGOs). There are three main national level non-governmental organizations (NGOs) working in the above area in India – Indian Association of Sports Medicine (IASM), Indian Federation of Sports Medicine (IFSM) and Indian Society of Sports and Exercise Medicine (ISSEM). IASM is a society of professionals from various fields of sports sciences which was established in 1971 (Indian Association of Sports Medicine, 2012), whereas IFSM was established in 2004 as a trust of doctors of modern medicine for sports (Indian Federation of Sports Medicine, 2013). ISSEM is a relatively young national society, formed and registered on 9<sup>th</sup> July 2019 by SEM specialists primarily for them, but was subsequently expanded to include all SEMS and MCIP professionals, acknowledging the multi- and interdisciplinary nature of SEM (Indian Society of Sports and Exercise Medicine, 2020). With the increasing scientific and medical information and the huge magnitude of research available, these organisations are helping SEM physicians to keep updated or incorporate best evidences into the practice, and hence use of evidence-based SEM (EBSEM). Collective, collaborative and cooperative constant effort is needed among the organizations to establish SEM as a well-developed specialty, to popularise and make sure SEMS and MCIP are utilized to the fullest; to spearhead the EIM movement for the fight against physical inactivity and NCDs, making India fit and healthy; and to effectively convert the huge youth population and potential of India into sporting excellence by providing evidence-based scientific and medical inputs.

With advancement of medical field, personalized medicine and expectations of enhanced human and sports performance, SEM speciality is the need of the future. Advanced research in the field needs attention, which will surely prove fruitful in the future by leading to discoveries and inventions of newer and better methods of athletes selection, nutrition, care and training; ergonomic, supportive and protective devices related to physical activity and sports performance etc. Thus, SEM specialists who are active in research in this field, or who want to pursue research should be adequately recruited and funded. It is time to move beyond the myopic and outdated, musculoskeletal-injury-treatment-centric only model of sports medicine to a physiology-centric, human performance, sports performance, fitness and overall health based model. The general unfamiliarity of SEM and confusion of it with other traditional medical and allied health specialties like orthopaedics, physical medicine and rehabilitation (PMR) or physiotherapy/physical therapy is slowly disappearing, with emergence of SEM as a fully-fledged specialized medical field. This will ultimately serve as booster for enhanced human and sports performance, reduced injuries and disabilities related not only to sports and physical activities but also to sedentary lifestyle.

As the determinants of health, fitness and dope-free human and sports performance are multifactorial, there is need of multidisciplinary-multispecialty and holistic approach. Strengthening of SEMS and MCIP with SEM physicians working closely with other related & allied professionals is definitely going to make a major impact. The “integrated performance health management and coaching model” has been adopted recently which highlights the importance of integrated approach (Brukner et al., 2018). With promotion and wide spread access of SEM specialized services, sports performance of athletes in national and international competitions will also improve. Active engagement and recruitment of SEM specialists should therefore be done in both government and non-government sectors, and adequate research facilities and infrastructure should also be provided for the development of SEM.

## Conclusion

Sports Medicine or SEM is not confined only to treating musculoskeletal injuries, but has a much larger role to play. It has potentially significant contribution in the fight against the rise of physical inactivity, sedentary lifestyle and NCDs, and also doping and low sports performance to population ratio. Awareness and development of this important and unique speciality is the need of the present, with its prominent role in the multidisciplinary and multispecialty team approach to the health, fitness and dope-free human and sports performance.

## References

- Ahirwar, R., Mondal, P.R. (2019). Prevalence of obesity in India: A systematic review. *Diabetes Metab Syndr*, 13 (1), 318–321. DOI: 10.1016/j.dsx.2018.08.032.
- Blair, S.N. (2009). Physical inactivity: the biggest public health problem of the 21st century. *Br J Sports Med*, 43 (1), 1–2.
- Blair, S.N., Sallis, R.E., Hutber, A., Archer, E. (2012). Exercise therapy – the public health message. *Scand J Med Sci Sports*, 22 (4), e24–28. DOI: 10.1111/j.1600-0838.2012.01462.x.
- Brukner, P., Clarsen, B., Cook, J., Cools, A., Crossley, K., Hutchinson, M., Khan, K. (2018). *Brukner & Khan's Clinical Sports Medicine* (5th ed. Vol. 1 Injuries). Chennai: McGraw Hill Education.
- Carrard, J., Pandya, T., Niederhauser, L., Infanger, D., Schmidt-Trucksass, A., Kriemler, S. (2019). Should sports and exercise medicine be taught in the Swiss undergraduate medical curricula? A survey among 1764 Swiss medical students. *BMJ Open Sport Exerc Med*, 5 (1), e000575. DOI: 10.1136/bmjsem-2019-000575.
- Chan, D.K.C., Tang, T.C.W., Yung, P.S., Gucciardi, D.F., Hagger, M.S. (2019). Is unintentional doping real, or just an excuse? *Br J Sports Med*, 53 (15), 978–979. DOI: 10.1136/bjsports-2017-097614.



- Department of Sports (2018). Khelo India-National Programme for Development of Sports. Retrieved from <https://yas.nic.in/sports/khelo-india-national-programme-development-sports-0> (3.12.2019).
- Department of Sports (2019). Scheme of Human Resources Development in Sports. Retrieved from <https://yas.nic.in/sports/scheme-human-resources-development-sports-0> (6.12.2019).
- Federation, I.D. (2019). *IDF Diabetes Atlas* (9th ed.). Brussels, Belgium: International Diabetes Federation.
- Fit India (2019). What is Fit India Movement? Retrieved from <http://fitindia.gov.in/about> (30.11.2019).
- Forberger, S., Wichmann, F., Comito, C.N. (2022). Nudges used to promote physical activity and to reduce sedentary behaviour in the workplace: Results of a scoping review. *Prev Med*, 155, 106922. DOI: 10.1016/j.ypmed.2021.106922.
- Guthold, R., Stevens, G.A., Riley, L.M., Bull, F.C. (2019). Global trends in insufficient physical activity among adolescents: a pooled analysis of 298 population-based surveys with 1.6 million participants. *Lancet Child Adolesc Health*. DOI: 10.1016/S2352-4642(19)30323-2.
- Hallal, P.C., Andersen, L.B., Bull, F.C., Guthold, R., Haskell, W., Ekelund, U. (2012). Global physical activity levels: surveillance progress, pitfalls, and prospects. *Lancet*, 380 (9838), 247–257. DOI: 10.1016/S0140-6736(12)60646-1.
- Haseler, T., Haseler, C. (2022). Lack of physical activity is a global problem. *BMJ*, 376, o348. DOI: 10.1136/bmj.o348.
- Hoberman, J. (2002). Sports physicians and the doping crisis in elite sport. *Clin J Sport Med*, 12 (4), 203–208. DOI: 10.1097/00042752-200207000-00002.
- Indian Association of Sports Medicine (2012). Indian Association of Sports Medicine. Retrieved from <http://www.iasm.co.in> (15.12.2019).
- Indian Federation of Sports Medicine (2013). Indian Federation of Sports Medicine. Retrieved from <http://www.ifsm.co.in> (15.12.2019).
- Indian Olympic Association (2018). International Games. Retrieved from <https://olympic.ind.in/gamesathletes> (15.12.2019).
- Indian Society of Sports and Exercise Medicine (2020). Indian Society of Sports and Exercise Medicine. Retrieved from <https://issem.in> (1.05.2020).
- International Olympic Committee (2019a). 17 May 1928 at the Games in Amsterdam: When the world discovered Magician Dhyana Chand. Retrieved from <https://www.olympic.org/news/17-may-1928-at-the-games-in-amsterdam-when-the-world-discovered-magician-dhyana-chand> (6.12.2019).
- International Olympic Committee (2019b). Olympic Games. Retrieved from <https://www.olympic.org/olympic-games> (5.12.2019).
- Mazanov, J., Backhouse, S., Connor, J., Hemphill, D., Quirk, F. (2014). Athlete support personnel and anti-doping: Knowledge, attitudes, and ethical stance. *Scand J Med Sci Sports*, 24 (5), 846–856. DOI: 10.1111/sms.12084.
- Misra, A., Khurana, L. (2011). Obesity-related non-communicable diseases: South Asians vs White Caucasians. *Int J Obes (Lond)*, 35 (2), 167–187. DOI: 10.1038/ijo.2010.135.
- Murray, C., Lopez eds, A. (1996). *The Global Burden of Disease: A Comprehensive Assessment of Mortality and Disability from Diseases, Injuries, and Risk Factors in 1990 and Projected to 2020*. Boston: Harvard School of Public Health.
- National Anti Doping Agency (2017). National Anti Doping Agency. Retrieved from <https://www.nadaindia.org> (9.12.2019).
- National Anti Doping Agency (2018). Annual Statistical Report of NADA 2018–2019. Retrieved from [https://www.nadaindia.org/upload\\_file/document/1564572411.pdf](https://www.nadaindia.org/upload_file/document/1564572411.pdf) (9.12.2019).
- National Sports University (2019). National Sports University, Imphal. Retrieved from <http://www.nsu.ac.in> (14.12.2019).
- Office of the Registrar General & Census Commissioner (2019). Census of India 2011 (Final Population Totals). Retrieved from [http://www.dataforall.org/dashboard/censusinfoindia\\_pca](http://www.dataforall.org/dashboard/censusinfoindia_pca) (30.11.2019).
- Owen, N., Healy, G.N., Matthews, C.E., Dunstan, D.W. (2010). Too much sitting: the population health science of sedentary behavior. *Exerc Sport Sci Rev*, 38 (3), 105–113. DOI: 10.1097/JES.0b013e3181e373a2.
- Parliament of India Rajya Sabha Department-Related Parliamentary Standing Committee on Human Resource Development (2015). Two Hundred Seventieth Report on Performance of National Sports Development Fund and Recruitment and Promotion of Sportspersons (Part I) (Presented to the Rajya Sabha on 13th August, 2015) (Laid on the Table of Lok Sabha on 13th August, 2015). Retrieved from <http://164.100.47.5/newcommittee/reports/EnglishCommittees/Committee%20on%20HRD/270.pdf> (5.12.2019).
- Parliament of India Rajya Sabha Department-Related Parliamentary Standing Committee on Human Resource Development (2018). Three Hundred and Third Report on Demands for Grants 2018–2019 (Demand No. 99) of the Ministry of Youth Affairs and Sports (Presented to the Rajya Sabha on 8th March, 2018) (Laid on the Table of Lok Sabha on 8th March, 2018). Retrieved from [http://164.100.47.5/committee\\_web/ReportFile/16/98/303\\_2018\\_6\\_17.pdf](http://164.100.47.5/committee_web/ReportFile/16/98/303_2018_6_17.pdf) (5.12.2019).

- Press Information Bureau (2017). Ministry of Youth Affairs and Sports: National Centre of Sports Sciences and Research For High Performance of Elite Athletes. *Government Constitutes Task Force for preparing Action Plan for Next three Olympic Games: Vijay Goel*. Retrieved from <https://pib.gov.in/newsite/PrintRelease.aspx?relid=157775>.
- Ramakrishnan, S., Zachariah, G., Gupta, K., Rao, J.S., Mohanan, P.P., Venugopal, K., Sateesh, S., Sethi, R., Jain, D., Bardolei, N. (2019). Prevalence of hypertension among Indian adults: Results from the great India blood pressure survey. *Indian Heart Journal*, 71 (4), 309–313.
- Sharma, H.B. (2022). Sports and Exercise Medicine in India: The Past and the Challenges. *J Clin Diagn Res.*, 16 (2), CE01–CE06.
- Sinha, N., Bhattacharya, A., Deshmukh, P.R., Panja, T.K., Yasmin, S., Arlappa, N. (2016). Metabolic syndrome among elderly care-home residents in southern India: A cross-sectional study. *WHO South East Asia J Public Health*, 5 (1), 62–69. DOI: 10.4103/2224-3151.206556.
- Sirisena, D., Lim, S., Teh, K.C. (2016). Sports medicine in Singapore: integrating into public hospitals and secondary care. *Br J Sports Med*, 50 (20), 1234–1235. DOI: 10.1136/bjsports-2016-096072.
- Speed, C. (2013). High-performance sports medicine. *Clin Med (Lond)*, 13 (1), 47–49. DOI: 10.7861/clinmedicine.13-1-47.
- Speed, C., Jaques, R. (2011). High-performance sports medicine: an ancient but evolving field. *Br J Sports Med*, 45 (2), 81–83. DOI: 10.1136/bjism.2010.075325.
- Sports Authority of India (2019). Target Olympics Podium Scheme. Retrieved from [https://sportsauthorityofindia.nic.in/index1.asp?ls\\_id=3812](https://sportsauthorityofindia.nic.in/index1.asp?ls_id=3812) (16.12.2019).
- Steell, L., Ho, F.K., Sillars, A., Petermann-Rocha, F., Li, H., Lyall, D.M., Iliodromiti, S., Welsh, P., Anderson, J., MacKay, D F., Pell, J.P., Sattar, N., Gill, J. M., Gray, S.R., Celis-Morales, C.A. (2019). Dose-response associations of cardiorespiratory fitness with all-cause mortality and incidence and mortality of cancer and cardiovascular and respiratory diseases: the UK Biobank cohort study. *Br J Sports Med*, 53 (21), 1371–1378. DOI: 10.1136/bjsports-2018-099093.
- Tew, G.A., Copeland, R.J., Till, S.H. (2012). Sport and exercise medicine and the Olympic health legacy. *BMC Med*, 10, 74. DOI: 10.1186/1741-7015-10-74.
- United Nations Population Division (2015). *The World Population Prospects: 2015 Revision*. New York, NY: United Nations.
- Wiesing, U. (2011). Should performance-enhancing drugs in sport be legalized under medical supervision? *Sports Med*, 41 (2), 167–176. DOI: 10.2165/11537530-000000000-00000.
- World Anti-Doping Agency (2019a). Anti-Doping Rule Violations (ADRVs) Report. Retrieved from <https://www.wada-ama.org/en/resources/general-anti-doping-information/anti-doping-rule-violations-adrvs-report> (9.12.2019).
- World Anti-Doping Agency (2019b). World Anti-Doping Code. Retrieved from <https://www.wada-ama.org/en/resources/the-code/world-anti-doping-code> (11.12.2019).
- World Health Organization (2010). *Global recommendations on physical activity for health*. Geneva, Switzerland: World Health Organization.
- World Health Organization (2013). *Global Action Plan for the Prevention and Control of Noncommunicable Diseases 2013–2020*. Geneva, Switzerland: World Health Organization.
- World Health Organization (2018). *Global Action Plan on Physical Activity 2018–2030: More Active People for a Healthier World (Licence: CC BY-NC-SA 3.0 IGO)*. Geneva, Switzerland: World Health Organization.
- World Health Organization (2022, 2022). WHO establishes the Global Centre for Traditional Medicine in India. Retrieved from <https://www.who.int/news/item/25-03-2022-who-establishes-the-global-centre-for-traditional-medicine-in-india> (20.05.2019).

**Cite this article as:** Sharma, H.B. (2022). Sports and Exercise Medicine in India: Looking Beyond Injury. *Central European Journal of Sport Sciences and Medicine*, 4 (40), 53–60. DOI: 10.18276/cej.2022.4-06.