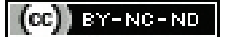


Sports and Exercise Medicine in India: The Past and the Challenges

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ABSTRACT

Sports and Exercise Medicine (SEM) started in India with Postgraduate (PG) Diploma in Sports Medicine (DSM) in 1986-87 and Doctor of Medicine (MD) more than two decades later. However, the concept of exercise is medicine can be traced back to the ancient Indus Valley civilisation. To fully develop and utilise this specialty, there is a need of continuously updating the current DSM and MD syllabus to world-class level, introduction of SEM into undergraduate curriculum, opening of SEM training-research institutes, recruitment of SEM-physicians as faculty and experts in various government and non government programmes and organisations dealing with various aspects of Sports Medicine (SM), Exercise Medicine (EM) and Sports and Exercise Sciences (SES). With only adequate development and growth of SEM and SES, will the dream of making India a fit, healthy and a world sports-giant be materialised. This review article has been compiled to provide information regarding SEM as a new medical specialty in India, its history and the current challenges.

Keywords: Charaka Samhita, Curriculum, Postgraduate course, Sports medicine, Sushruta Samhita

INTRODUCTION

Sports and Exercise Medicine (SEM) or Sports Medicine (SM) is a medical specialty dealing with promotion of health, fitness and therapeutic use of Physical Activity (PA) and exercise; and comprehensive medical care of active-exercising individuals from weekend warriors to professional elite athletes. SEM was recognised as specialty around the globe during 1980s and 1990s [1]. SEM incorporates knowledge of physiology and other Sports-Exercise (SE) and health sciences for injury illness free optimal enhancement of human performance [2]; basically, the effect of PA on human body (adaptation-maladaptation) and human structure and function for sports and performance.

SEM in Ancient India

Although modern SEM specialisation training and courses in Asian countries is rather a recent development, the origin of concept of SEM with “Exercise-Is-Medicine (EIM)” itself can be traced back to Asia [3], especially Indus Valley and Yellow River civilisations [4]. Excavation in Indus Valley revealed many statues with positions indicating the familiarity of the inhabitants with yoga [5]. Ancient Indus Valley civilisation is believed to have existed millenniums earlier than 3300 BC [5]. Exercise, sedentary living and selective food among others were considered to alter the equilibrium between the humors or “dosas” as per the “Indian humoral theory” or “tridosa or trihantu doctrine”, which was formulated as early as atleast 1500 BC, and which emphasised the concept of displacement of one or more of the three humors (vayu, pitta or pittam, and kapha or kaphah; although blood was considered as the fourth humor by Sushruta) resulting into disease [5,6]. The concept of three humors influencing health finds its mention in Rigveda also, which is the world oldest literature, the date cited of which is as early as 4000 BC [5,7].

Sushruta (600 BC), author of “Sushruta Samhita” and the “founding Father of Surgery”, was the first recorded physician cum surgeon of ancient India whose prescription for disease prevention and treatment included exercise, and he taught medicine and surgery in the ancient Indian university at Varanasi, India [5,8]. He advocated exercise for maintaining humoral equilibrium, specially “kapha”, and to minimise obesity and diabetic consequences [5]. Another famous ancient Indian physician was Charaka (250-100 BC, or as per some 800 BC), the “Indian Father of Medicine” and composer of the

treatise, called “Charaka Samhita”, who also advocated “vyayama” or exercise daily so as to alleviate dosas, specially kapha; and also had the view of beneficial effect of training, same as that of Sushruta [9-11]. Charaka Samhita contains the oldest definition of exercise, the knowledge of which percolated from much earlier, “Atreya Samhita”, considered as the oldest record of medical practice in the world [12,13], and has more than 120 slokas (aphorism) on vyayama (exercise) with exercise prescription to cure or minimise the consequences of 20 types of kaphaja (phlegm) diseases and others like obesity and diabetes, making it the world oldest living evidence of exercise therapy literature [11].

The Rise of SEM as Medical Specialty in India

Specialisation course in SM was started for the first time in India in 1986-87 at Netaji Subhas National Institute of Sports (NSNIS), Patiala after Faculty of Sports Sciences was established in 1983, as a PG Diploma course in SM (PGDSM/DSM) for only Registered Medical Practitioners (RMPs) having the primary medical degree of MBBS recognised by Medical Council of India (MCI), the medical education regulating body of the country under the Ministry of Health and Family Welfare (HFW), Government of India (GOI) [14-17]. Although lectures on SM had been going on much before 1986 at NSNIS, Patiala [18]. NSNIS, which was established in 1961, is the academic wing of Sports Authority of India (SAI), and is not only the premier sports institute of the country, but is also considered the largest of its kind in Asia [15].

DSM was conducted in collaboration with Government Medical College and Rajindra Hospital, Patiala and affiliated to Punjab University (PU), Patiala upto 1999 and from 2000 onwards, affiliated to Baba Farid University of Health Sciences, Faridkot, and is recognised by MCI/NMC (National Medical Commission) [14,15,19]. After more than two decades, MCI recognised PG degree or MD course in SM was started in 2010 [19]. GOI under the scheme of National Centre of Sports Sciences and Research (NCSSR) is funding to support SM Department in various medical colleges throughout the country [20], and the number of SM Department may rise further in the country in the coming years. Such system of postgraduate specialisation in SM which can be done after the primary medical degree without any prerequisite of other primary medical specialties is also followed in many countries like Brazil [21] and Turkey [22] etc.

PRESENT SCENARIO OF SEM: SCOPE OF UPGRADATION

Curriculum

MCI/NMC has laid down well worked out guidelines for competency based postgraduate training programme for both DSM and MD in SM [23,24], although further improvement and updating should be done based upon the latest SEM curriculum of those countries where it is well developed. First of all, the term "SM" should be changed to "SEM". International Syllabus in Sport and Exercise Medicine Group (ISSEMG) has agreed upon atleast 11 major domains for SEM specialist training, with each domain having a number of General Learning Areas (GLA) and each GLA having various specific learning areas [25]. Some of the key domains are listed below [25-29]:

1. PA and health, including exercise prescription in health and chronic disease states.
2. SE related medical issues and injuries including "return-to-sport/play" decision making.
3. Enhancing performance by training, nutrition and psychology etc.,
4. Sports and Exercise Pharmacology, antidoping, drug/substance abuse in sports and other ethical issues, which may include personal-physician versus team-physician concept etc.,
5. Sports team and event medical care including pre participation physical examination, emergency SEM, and team travel etc.,
6. PA and medical care in challenging environments and situation of altered physiology (like at extreme altitude or depth, or extreme environments etc.,).
7. SE in specific-groups or special-subpopulations, and intrinsic and extrinsic skills of SEM specialist as described by ISSEMG.

Even though the core underlying concept remains the same, some differences in syllabus, scope and curriculum for SM or SEM do exist in different countries [2,3,21,30-37], for example SEM curriculum in UK contains 15 modules with a defined set of expected knowledge, experience and skills in each module [3]. The orientation of SEM in UK is relatively more towards public health concepts, emphasising the role of exercise for health-promotion, chronic-disease prevention and management at a population level; whereas exercise-injury-illness/medical problem is the focus in Australia, New Zealand and USA, with clinical competency more dedicated for exercise-related medical problems or treating complex medical problems using exercise [2,3].

Faculty

For successful running of medical training institutes, the role of faculty is critical. The requirement of teaching faculty increases with the opening of new SM Departments in India. Unfortunately, there is acute shortage of medical teachers in India, due to the disproportionate rise between PG seats and medical colleges, and the stringent eligibility criteria of medical-teachers and its archaic regulation [38,39]. The situation is further worsened with the non eligibility of PG diploma qualification for medical teachers [40], nor RMPs with MCI recognised PG diploma are allowed for super-specialisation courses like DM/MCH [17]. The irony is that, the current medical education system in India is facing acute shortage of teaching faculty on one hand, failing to address which the entire medical education system has risk of crumbling to failure [38]; and on the other hand, there is restriction of large number of RMPs with MCI recognised PG diploma in the specialty to join medical colleges as teaching faculty, or get promoted above senior resident due to set eligibility criteria [40,41].

Acknowledging the problem, the Parliamentary Standing Committee (PSC) on HFW in its 109th report on the NMC Bill, 2017 suggested

to abolish PG diploma while increasing the number of PG degree, and that PG degree should be awarded after submission of thesis report to those RMPs with PG diploma who had worked in the teaching hospital for two years [42]. The only difference between the two PG-courses is the course duration- 2 years for PG-diploma and 3 years for PG degree, submission of thesis report in PG degree, and the number of final theory examination papers- 3 for PG-diploma and 4 for PG degree, with the extra paper in PG degree mostly related with recent advances [17,43]. Subsequently, PG-diploma courses at various colleges have been converted to equal number of PG degree courses for 2019-20 academic-session onwards [44]. However, no similar attempt has been made for the conversion of DSM course into corresponding PG degree course for facilitating SEM.

Also, no adequate funding or attempt for developing Department of SM at NSNIS, Patiala is being done currently by the government, not even under the NCSSR scheme [20]. The irony is that NSNIS, Patiala is the country's premier sports institute and the academic wing of SAI, with two among its aim and objectives being the conduction of various academic courses in sports coaching, sports sciences and other related fields which would definitely include SM; and providing scientific back-up to elite sports person for achieving high performance [15], but its medical education setup for SEM is still not being upgraded. Development has to be done in line with similar institutes of other countries like Australian Institute of Sports (AIS) and English Institute of Sports (EIS) etc., where Sports-Exercise Medicine and Sciences (SEMS) is given the required importance and resources.

The other recommendation of the PSC on the awarding of PG degree to RMPs with PG-diploma, to increase the strength of eligible teaching faculty, has not been put into action yet [42]. The annual seats of MCI recognised PG-diploma were 1900, as on 2017 [19], and the total number of RMPs with PG-diploma may be assumed to be more than 50,000 [45,46], who can easily solve the present crisis of teaching-faculty shortage to great extent if allowed to work as teaching-faculty either directly or after upgrading to degree level as per suggestion of PSC as described above. However, the situation is grave in case of SM, which has been introduced relatively recently in India with only about 140 sports-physicians at present (as on 2019) in the entire country [47]. With the extremely important role of SEM-physicians in overall health promotion by increasing and facilitating PA, prevention and management of Non Communicable-Diseases (NCDs) and achieving sports excellence; immediate and ground level actions should be taken to provide them with adequate opportunities and infrastructure.

The term sports physician or "sportarzt", which was used for the first time by the Germans in 1904 [8,48], is used here for those RMPs who have done MCI recognised DSM or MD in SM. The terms, "SM/SEM specialists/physicians/doctors/experts, or Sports/SE physicians/doctors, or similar terms", are also used for them. About 16% sports physicians have MCI recognised MD in SM [47], and hence are eligible for Medical-Teaching-Faculty (MTF) posts above senior-resident [40,41]. The remaining 84%, which also includes most of the senior and experienced SM specialists in India at present are, however, DSM holders, due to the long two decades gap between the initiation of DSM and MD in SM in the country [14-17,19], who unfortunately, are not able to give their service as medical teachers and transmit the knowledge, skills and other competencies, specific to core SEM, to the next set of doctors, causing a huge loss for the entire SEM community. Also, due to eligibility criteria issue, many DSM doctors having more interest in teaching along with research are forced to leave this field of their choice, or work in unrelated or alternative fields. In addition, there is no post MBBS or postdiploma DNB broad-specialty course in SM at present unlike other medical specialties

[49], which is also considered eligible for MTF [40]. Therefore, to facilitate SEM branch, revision of the MTF minimum eligibility criteria with adequate and necessary relaxation should be done on priority basis in India, as it is common in many other countries to exempt candidates with outstanding merit, competence and aptitude for teaching, patient care and research from the minimum requirements for MTF [38].

Even though acquiring knowledge and ability for conceptualising and writing research proposal is one of cognitive domain competencies in DSM course, and research and educational methodology is taught as a part of the curriculum [24], the lack of practical research component in PG-diploma is considered to be the major difference between PG-diploma and degree [17,42,43]. Therefore, RMPs with PG-diploma, who have published good research papers in any reputed and recognised journals, or who have done substantial research or project work, preferably under any recognised postgraduate teacher [42], or who have done additional qualification(s) having research component like PG degree in related and allied medical specialty or PhD etc., or who have adequate postdiploma experience, should be made directly eligible for MTF posts above senior resident. Alternatively, PG-diploma should be made eligible for MTF of undergraduate medical courses (MBBS or equivalent), with further promotion to higher and PG teaching faculty posts after good research output and publication.

Another possible measure to overcome the crisis is awarding PG degree to RMPs with PG-diploma based on the recommendation of the PSC [42]; or based on the seniority or number of years of post diploma experience; or after undergoing a short and practical research-oriented course resulting into paper publication or thesis report submission etc. Post diploma DNB-course in SM should also be started to strengthen SEM. RMPs with MBBS degree who have done specialised courses in SEM from other countries, recognised by the apex medical education regulating bodies of those countries, or who have vast clinical and research experience and practical knowledge and skills in the field of SEM, or who were the senior pioneers/torchbearers and proponents of SEM in the country, can also be granted permission to be atleast visiting faculty for SM as per the requirement.

Although, MCI/NMC also allows RMPs with PG degree in other primary medical specialties, namely Orthopaedics and Physical Medicine and Rehabilitation (PMR) to be MTF in SM Departments [50]. With the recognition of SM as a distinct medical specialty in many countries [37], a recognised, formal and specialised training in SEM of atleast two years duration having standardised examinations (like DSM), post PG degree should be made mandatory for becoming MTF or practising SM if the PG degree is not in SM, as it is done elsewhere [2,29,32,36]. The multidisciplinary and interdisciplinary nature of SEM should be recognised and appreciated, and SEM should not be hijacked by any particular competing primary traditional medical specialties with no specialisation in SEM [2]. SEM, being a holistic practice with the incorporation and more prominent role of EM, and SEM physicians being well trained in medical as well as SES and other allied health disciplines, should not be limited or restricted or confined to, or projected as a specialty dealing with only musculoskeletal (msk) system, or any other systems or organs [2,31,51,52].

One of the risks to SEM, as reported earlier, is the increasing dominance of SEM governance by those in traditional primary medical specialties, mostly those related to msk medicine/surgery, without much conceptual understanding of the underlying nature of SEM itself [2]. Reactive, hospital and injury only centric approach for medical care of athletes and exercising individuals by focusing only on few selected medical specialties and restricting teaching faculty posts of SEM to them, would definitely lead to negligence

of significant contribution to health and performance by non msk and other medical conditions (like acute or chronic infections, asthma and allergy, concussion and other head injuries, nutritional issues including but not limited to vitamin D and iron deficiency etc., other medical conditions like diabetes etc., and unexplained underperformance syndrome and overtraining syndrome etc.) and chronic-injuries etc., [29,53], and also the issue of sudden cardiac death, which is the most common medical cause of sudden death among players [54]; so is the negligence of physiological aspect of health and wellness promotion, injury/illness prevention, EM and SES [2,31,55].

With the current perception, it is not surprising that SEM doctors are often confused with msk medical and health professionals like Orthopaedic Surgeons or Physiatrists or Physiotherapists/Physical therapists, both by doctors and general public alike [31,56]. This relative unfamiliarity of SEM specialty, and the provision of some of the SEM services by other medical specialties advertised as SEM specialists without having any formal SEM training may cause difficulty not only in patient referral to SEM specialists but also some resistance in the acceptability of SEM physicians by the system in hospitals, clinics and sometimes even in sports fields [22,30]. The role of SEM doctors within the msk medicine, in a very simplistic and gross manner, has been considered by some to lie between practitioners like Orthopaedic Surgeons and Rheumatologists or general medical practitioners/family physicians [56-58]; and with majority or almost about 90% of all sports injuries requiring non surgical management only, SEM doctors play an important role in providing specialised cost-effective conservative input which is not available within the setting of primary care [29, 56], specially when there is shortage of the other specialists with long waiting lists for patients and rapidly increasing healthcare costs [58].

Realising the importance of unique and truly novel model based on wellness or physiology rather than sickness or pathology which should be adopted by SEM physicians [3], MD in physiology in addition to orthopaedics and PMR was considered for teaching faculty position in SM by MCI [40] until recently when it was dropped all of a sudden without any valid reasoning on 7th June 2019 notification [50]. Many teaching faculty in the Department of SM of various medical colleges in India, where PG-courses in SM are running currently, have only MD physiology as their primary specialised medical qualification. Among all the subject specific learning objectives in the guidelines for competency-based postgraduate-training programme for MD in SM given by MCI/NMC connecting directly or indirectly to SES, Physiology relates directly to 8 out of 10 objectives [23]. MD in physiology, as an allied subject, should be included among the other medical specialties considered for teaching faculty in SM, as it was before 7th July 2019, with the addition of a mandatory PG formal and recognised specialised training in clinical SEM of atleast two years duration having standardised examinations (like DSM).

Acknowledging the critical role of physiology in SM, physiologists along with Orthopaedic Surgeons and Physiatrists were the only health professionals allowed to attend SM training programme during the earlier days of SM in Turkey, before it was accepted as a medical specialty in 1989 by the Turkish Ministry of Health, after which also subspecialisation in SM was allowed for Physiologists and Orthopaedic Surgeons [22]. The Turkish Society of Sports Physicians and the Coordination Council of Medical Specialty Societies have included physiology in the new Turkish SM specialisation curriculum which is in equal duration to orthopaedics and PMR [22]. Consideration should be taken towards the initiation of recognised and formal super or sub specialisation course in clinical SEM or clinical Sports and Exercise Physiology (SEP) for

RMPs having MD physiology independently or as a part of clinical and interventional physiology which will address the relative shortage of trained medical professionals in this field at present in India.

Indepth understanding, knowledge, skills and competency in clinical Sports and Exercise Physiology (SEP), form the basis of SEM [2,3,25,29,31,59,60]. In fact, SM evolves on the foundation of Exercise Physiology (EP) [8,35,48,61]. Many advances were already there in EP before the starting of the professional and formal SM course, namely DSM, in India, and few of the institutes creditable were Punjabi University, Patiala, and Sports Medicine and Pulmonary Physiology Unit, under Department of Physiology, Institute of Medical Sciences (IMS), Banaras Hindu University (BHU), Varanasi etc. [18]. Clinical EP (CEP) and Performance-related Sports and Exercise Physiology (pSEP) are the two main subspecialties of human and medical physiology which are vital for SEM, with CEP underpinning EM, and pSEP for SM with a primarily focus on maximising athletic performance [3,59,62]. Sufficient training and knowledge of human physiology is, therefore, central for the wellness approach adopted by SEM physicians, which is ideal for managing numerous health problems resulting from inactive lifestyle, including diabetes and other NCDs [3].

SEM trained MD physiologists having special background and experience in scientific research, can play an important role in bridging the gap between applied SES research and practice of clinical SEM. Incorporation of latest biochemical, pharmacological and physiological practical laboratory methodologies will open an entirely new window and competency; e.g., differentiating intended from unintended doping or physiological conditions, gender issues in sports, developing highly sensitive and specific doping detection methods and techniques, as well as designing and development of ergogenic and human performance aids and exercise-mimetics, or investigating their mechanism of actions etc. Providing training of SEM students by such faculty would pave the way for cutting edge research and innovations in SEMS, when combined with substantial financial investment and allocation of fund. Infact, medical doctors with specialisation in physiology were among the pioneers of SM

in India, the prominent being late Dr. DN Mathur, who was the then dean of Faculty of Sports Sciences, when DSM was introduced at NSNIS Patiala around 1986. His idea of SM, as a branch of sports sciences dealing with athletes, focusing on three important aspects: Preserving health, Increasing physical performance and Preventing diseases is included as a part of physical and health education at intermediate school level in India [63].

There is ever increasing medicalisation and scientisation of sports, and athletes are increasingly depending on sophisticated medical and scientific support. Therefore, research, innovation and advances in SEMS are extremely crucial and have to be one step ahead for management and maximisation of talent, asset and “on-field” performance, and hence SEMS team is aptly called as “the team-behind-the-team” [64]. It is the lack of drive to engage in basic science, including physiology (CEP and pSEP), which is the limitation for progress at cutting edge SEM [65]. An easily accessible translational research along with education is thus, the main determinant for the success of SEM professionals [48].

SEMS in Undergraduate Curriculum

There is immediate need to introduce SEM and CEP in undergraduate medical curriculum; which is, extremely important for public health, yet is much lacking globally [55,57,66-71]. Since exercise is medicine, there should be exercise in medicine [66]. This is of concern for India, which has 68.86% (68.64% men, 69.09% women) of the total population [72] in rural areas, the basic SEM needs of whom these medical graduates who might work as RMPs in rural areas [22] can serve where there is lack of SEM physicians. With the successful implementation of SEM which focuses on EM in undergraduate curriculum of various countries and places like Nottingham (UK), South Carolina (USA) and Tehran (Iran) [69,71,73-75], and the enthusiastic attitude of medical students on learning SEM [69,71,76]; it is high time that SEM is incorporated actively as compulsory teaching in Indian undergraduate medical curriculum with the recruitment of SEM physicians as teachers and faculty. Milestones of development of SEM have been enlisted in [Table/ Fig-1] [3-5,7-9,11-19,47,77-79].

S. No.	Year	Major milestones in the development of SEM in India	Reference
1	During or before 3300 BC	Origin of concept of EIM: Indus Valley Civilisation.	[3-5]
2	4000 BC and before 1500 BC	The concept of “Indian humoral theory” or “tridosha or trihautu doctrine” influencing health finds its mention in Rigveda. Exercise, sedentary living and selective food among others were considered to alter the equilibrium between the humors/dosas, resulting into disease.	[5,7]
3	Before 800 BC	Atreya Samhita: The oldest record of medical practice in the world, and also the world’s oldest living evidence of exercise therapy literature.	[11-13]
4	800 BC or >250-100 BC	Charaka, the Indian father of medicine, and composer of “Charaka Samhita” advocated “vyayama” or exercise daily. The oldest definition of exercise is in Charaka Samhita.	[9,11]
5	>600 BC	Sushruta, the founding father of surgery, and author of “Sushruta Samhita”, included exercise in the prescription for disease prevention and treatment.	[5,8]
6	1961	Establishment of NSNIS, Patiala.	[15]
7	1971	Establishment of IASM at NSNIS, Patiala.	[77]
8	1970s-1980s	Work and advances in EP in many universities, including IMS-BHU and PU.	[18]
9	1983	Establishment of Faculty of Sports Sciences at NSNIS, Patiala.	[14-17]
10	1986	Starting of DSM at NSNIS, Patiala.	[14-17,19]
11	2004	Establishment of IFSM.	[78]
12	2010 and afterwards	Starting of MD (SM) at SRMCRI, Chennai in 2010; in 2011 at GNDU, Amritsar; in 2014 at AFMC, Pune; in 2015 at VMMC and SH, New Delhi. MD (SM) was started in many other medical colleges subsequently.	[19]
13	2018	Establishment of National Sports University as the first central sports university in Imphal, Manipur by the GOI for promoting sports education and functioning as the national training centre for selected sports disciplines.	[79]
14	2019	Establishment of ISSEM.	[47]

[Table/Fig-1]: Milestones of development of Sports and Exercise Medicine (SEM) in India [3-5,7-9,11-19,47,77-79].

SEM: Sports and Exercise Medicine; EIM: Exercise is Medicine; IASM: Indian Association of Sports Medicine; NSNIS: Netaji Subhas National Institute of Sports; EP: Exercise Physiology; IMS-BHU: Institute of Medical Sciences, Banaras Hindu University; PU: Punjabi University; DSM: Post-Graduate Diploma in Sports Medicine; IFSM: Indian Federation of Sports Medicine; GOI: Government of India; MD (SM): Doctor of Medicine in Sports Medicine; SRMCRI: Sri Ramachandra Medical College and Research Institute; GNDU: Guru Nanak Dev University; AFMC: Armed Forces Medical College; VMMC and SH: Vardhman Mahavir Medical College and Safdarjung Hospital; ISSEM: Indian Society of Sports and Exercise Medicine

CONCLUSION(S)

Sports and Exercise Medicine (SEM) is the answer for the current crisis of NCDs, dismal sporting-performance and doping, which India is facing. There is a need for updating current SM syllabus in India to world class level, incorporation of SEMS into undergraduate medical curriculum, opening of more training and research institutes for SEMS, and the recruitment and utilisation of specialist SEM physicians, including DSM holders as MTF and experts in various government/non government programmes, organisations/institutions dealing with various aspects of SM, EM and SES.

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