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Prevalence of musculoskeletal disorders in Indian jockeys: An observational study

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Abstract
Background: Horse racing is an equestrian sport, which requires the jockeys to ride a horse at a particular speed and height making him/her vulnerable to musculoskeletal injuries. Previous studies conducted, have taken into consideration, "retired" jockeys and the seasonal implications have not been mentioned. There is a need to study the working/ training population of Indian jockeys performing during the "on" season of races to conclude their findings and make appropriate recommendations.
Objective: To evaluate the prevalence of musculoskeletal disorders in Indian jockeys using the Nordic musculoskeletal questionnaire and to analyze which joint(s) is/are affected the most.
Setting: Official races at Royal Western Indian Turf Club Ltd. Pune from January 1 2023 to December 31 2023.
Methods: Subjects were chosen as per the convenience sampling method, who were licensed by RWITC. Ltd. Pune. The Nordic Musculoskeletal Questionnaire was explained and data was collected and analysed further.
Results and Conclusions: Our data suggests that there is prevalence of musculoskeletal disorders in Indian jockeys involving the low back, upper back, ankle/feet, shoulder, hips/thighs, knees, neck, elbow, and wrist/hand. Efforts are required to reduce this prevalence and prevent the jockeys from musculoskeletal disorders.

Keywords: Jockeys, NMQ, MSDs, Indian jockeys, RWITC.

Introduction
Horse racing, sport of running horses at speed, mainly thoroughbreds with a rider astride or standardbreds with the horse pulling a conveyance with a driver. Horse racing is one of the oldest of all sports, and its basic concept has undergone virtually no change over the centuries [1]. Horse racing is an equestrian performance sport, typically involving two or more horses ridden by jockeys (or sometimes driven without riders) over a set distance for competition [2].
Thoroughbred horse racing is a competitive sport enjoyed around the world. In thoroughbred racing, a jockey weighing approximately 50 kg rides a horse weighing approximately 500 kg around a dirt or grass track at more than 65 km/h.2 The primary protective equipment used by the jockey is a helmet and flak jacket to protect the head and chest. The positioning of the jockey on the horse approximately 3 m above the ground in a forward stance creates a situation of dynamic imbalance and ballistic opportunity, predisposing the jockey to a forward roll in response to any sudden change in the horse's direction or velocity [3]. Horse racing is an exciting sport with a high risk of injury. The jockeys ride an average of 600 races a year. Professional horse racing is broadly divided into flat racing and jump racing (also referred to as National Hunt racing), both of which take place over a full 12-month season [4].
Flat jockeys and flat racing: Flat jockeys usually start race riding at 16-18 years of age. At this stage, they are referred to as "apprentice" riders, and the period of apprenticeship is a maximum of five years. At the age of 25 (or after five years apprenticeship) the jockey must become a full professional flat jockey or retire from the sport. Full professional flat jockeys normally retire between the age of 50 and 59. Jump jockeys and jump racing: The information is as for flat jockeys (above) except that young jump jockeys are referred to as "conditional" riders as opposed to "apprentice riders". Jump jockeys normally retire before they reach the age of 40 [4].

Jockeys have an integral role in the quality of racing and the welfare of the racehorse, so ensuring they are performing to their best potential is paramount not only for their own performance, injury risk, and career longevity, but will also impact the horses they ride [5].

Equestrian sports are unique in that they involve the participation of two athletes that differ greatly in morphology yet are able to move together harmoniously; experienced riders not only move in phase with the horse, they can even improve the consistency of the horse's movements. The motion of the horse imposes perturbations on the rider that differ in magnitude and direction according to gait [6].

EU-OSHA [7] defines MSDs as alterations, suffered by body structures, such as muscles, joints, tendon, ligaments, nerves, bones, and the circulatory system caused or aggravated, mainly by work and the effects of surroundings in which this is undertaken. These disorders can arise in any part of body, although they are more frequent in some zones. Included in the domain of job and work environment are a host of conditions, sometimes referred to as "work organization factors," which include various aspects of job content (e.g., workload, repetitiveness, job control, mental demands, job clarity, etc.); organizational characteristics (e.g., tall versus flat organizational structures, communications issues); interpersonal relationships at work (e.g., supervisor-employee relationships, social support); temporal aspects of the work and task (e.g., cycle time and shift work); financial and economic aspects (e.g., pay, benefit, and equity issues); community aspects (e.g., occupational prestige and status). These work and job environment factors are often thought of as demands, or "risk factors," that may pose a threat to health [8]

There is a need to study the working/ training population of Indian jockeys performing during the "on" season of races to conclude their findings and make appropriate recommendations. A review of the literature shows a scarcity of information on the MSDs suffered by professional jockeys and hence there is a need to study the prevalence of musculoskeletal disorders in Indian jockeys.

Materials and Methods

Appropriate and relevant literature was read with the help of PubMed and manual searches for other sports journals using the key words MSDs, jockeys, trauma, horse racing, sports injuries, equestrian injuries, etc. Ethical approval was taken. Permission was granted by RWITC, Pune. Data about the jockeys was provided by the RWITC which included their licenses and names. Subjects were chosen on basis of inclusion and exclusion criteria. Procedure was explained to subjects and written informed consent was taken. The scale was explained to the participants, data was collected and analyzed further.

Type of study: Observational study

Study setup-Pune: Race Course (RWITC Ltd. Pune)

Sampling Technique: Convenience Sampling technique

Sample size: 48 samples

Study duration: 6 months

Outcome measure: The Nordic Musculoskeletal Questionnaire.

The inclusion criteria follow

1. Age: 25-45 years
2. Gender: male
3. Type: flat racers as well as jump racers
4. The candidate should hold a professional license
5. Riding experience of minimum 5 years.

The exclusion criteria follow

1. Apprentice riders
2. Conditional riders
3. Recent musculoskeletal injury due to fall within a year
4. Any diagnosed systemic musculoskeletal condition

Results

Demographics

Age

Figure shows that out of 48 subjects: 67% are between age 25-35 and 33% are between the age 36-45. Out of 48 subjects: 32 are between age 25-35 and 16 are between the age of 36-45.

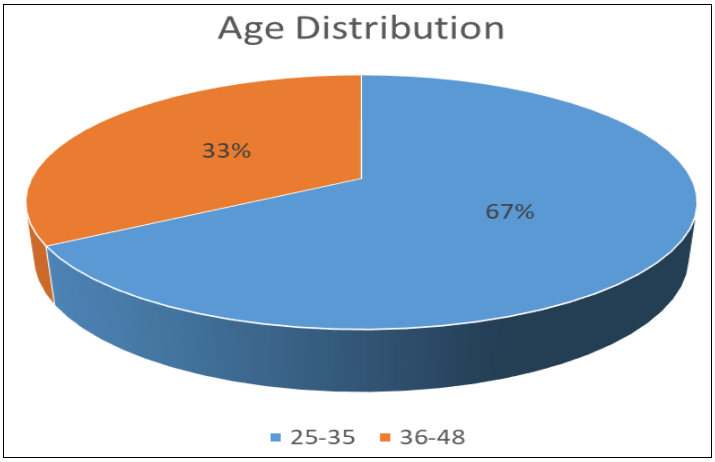

Fig 1: Age distribution among participants.

BMI

Figure 2 shows that out of 48 subjects: 10% are underweight, 37% are normal and 2% are overweight. Out of 48 subjects: 10 are included in the underweight category of BMI, 37 are included in the normal category of BMI and 1 is included in the overweight category of BMI.

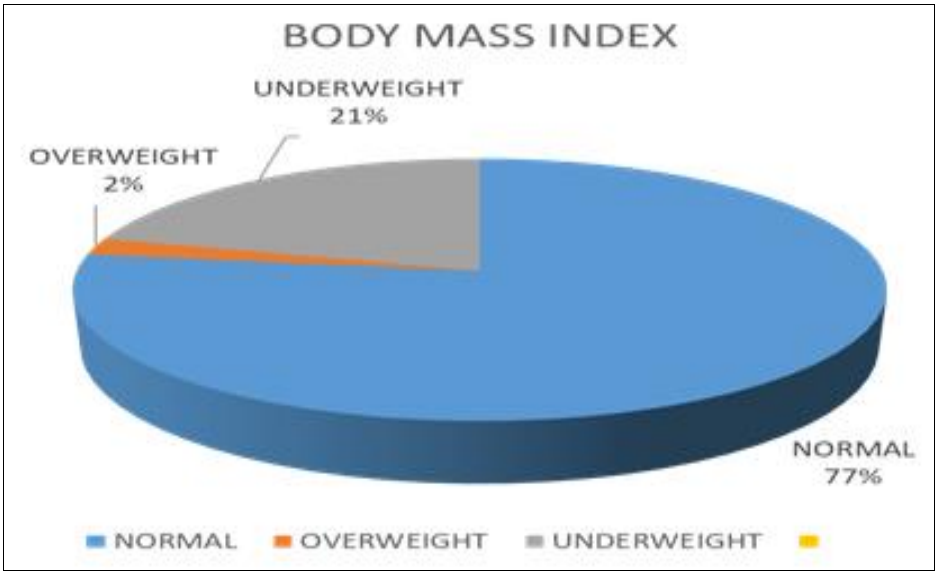

Fig 2: BMI distribution among participants.

Age group-25-35 years

Figure 3 shows that out of 48 subjects: neck 8% (3), shoulder 13%(5), upper back 13%(5), elbow 8%(3), wrist/hand 11%(4), lower back (24%), hips/thighs 8%(3), knees 0, ankle/feet 14%(6) experienced pain, ache, discomfort, numbness in the last 12 months.

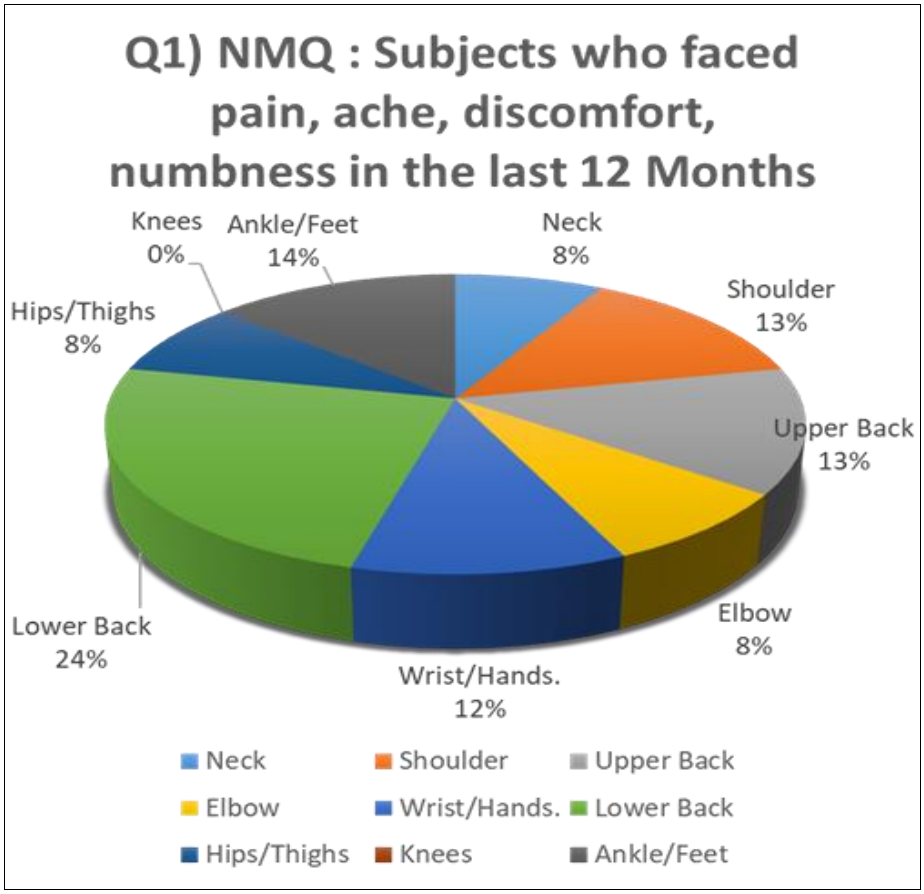

Fig 3: Subjects who faced pain, ache discomfort, numbness in the last 12 months in the agre group og 25-35 years.

Figure 4 shows that out of 48 subjects: Elbow 25% (1) lower back 25% (1) were prevented from carrying out normal activities because of pain, ache, discomfort, numbness in the last 12 months whereas other joints did not cause the same.

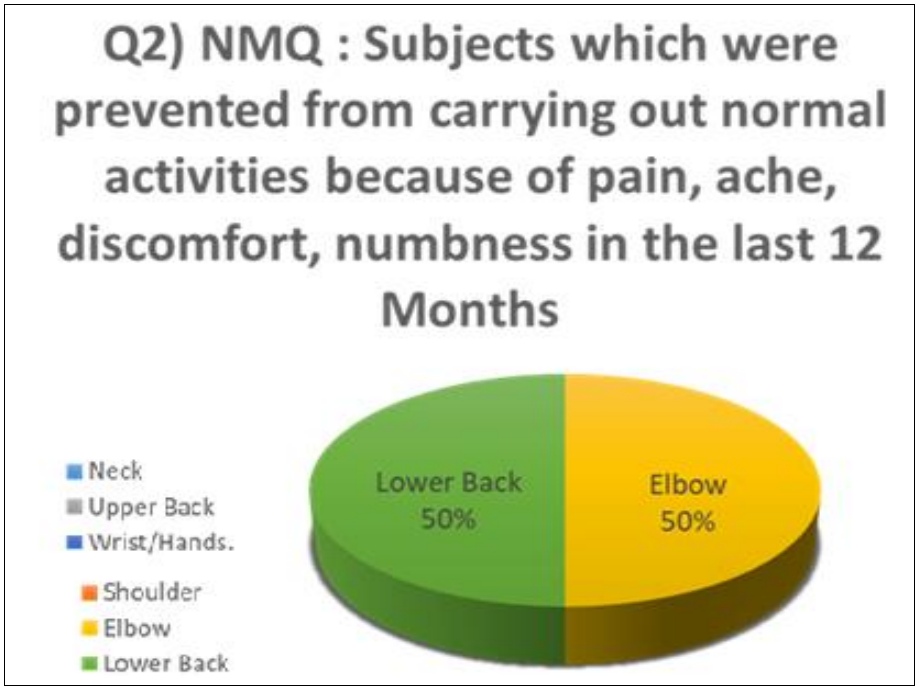

Fig 4: Subjects which were prevented from carrying out normal activities because of pain, ache, discomfort, numbness in the last 12 months in the age group of 25-35 years.

Subjects who visited the physician for pain, ache, discomfort, numbness in the last 12 Months

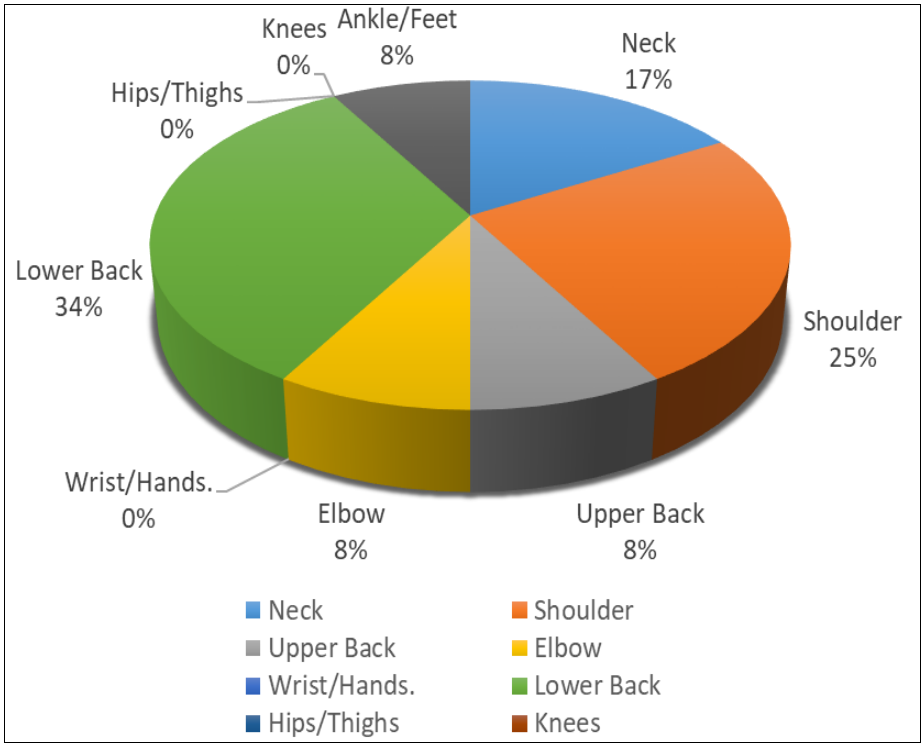

Fig 5: Subjects who visited the physician for pain, ache, discomfort, numbness in the last 12 months in the age group of 25-35 years.

Figure 5 shows that out of 48 subjects: Neck 2(17%), Shoulder 3(25%), Upper Back 1 (8%), Elbow 1(8%), Wrist/Hands 0, and Lower Back 4 (34%) Hips/Thighs 0, Knees 0, Ankle/feet 1 (8%) visited the physician for pain, ache, discomfort, numbness in the last 12 months.

Figure 6 shows that out of 48 participants: neck 3(8%), shoulder 3(8%), upper back 7(17%), elbow 2(5%), wrist/hand 3 (8%), lower back 8(20%), hips/ thighs 5(13%), knees 3(8%), ankle/feet 5(13%) faced trouble in the last 7 days.

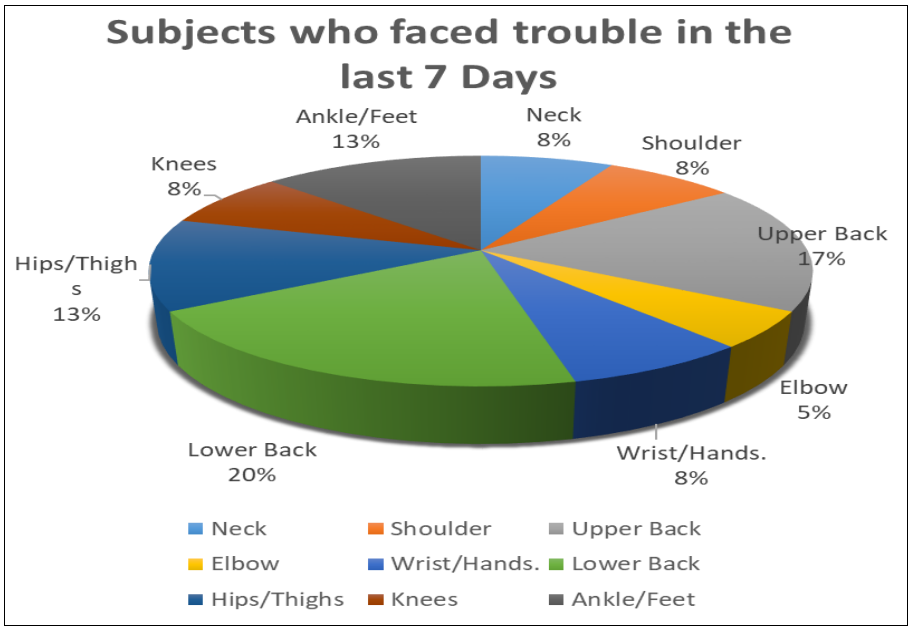

Fig 6: Subjects who faced trouble in the last 7 days in the age group of 25-35 years.

Age group-35-45 years

Figure 7. shows that out of 48 subjects: neck 2% (7), shoulder 10% (3), upper back 14% (4), elbow 7% (2), wrist/hand 3% (1), lower back 3(10%), hips/thighs 21% (6), knees 4(14%), ankle/feet 14%(4) experienced pain, ache, discomfort, numbness in the last 12 months.

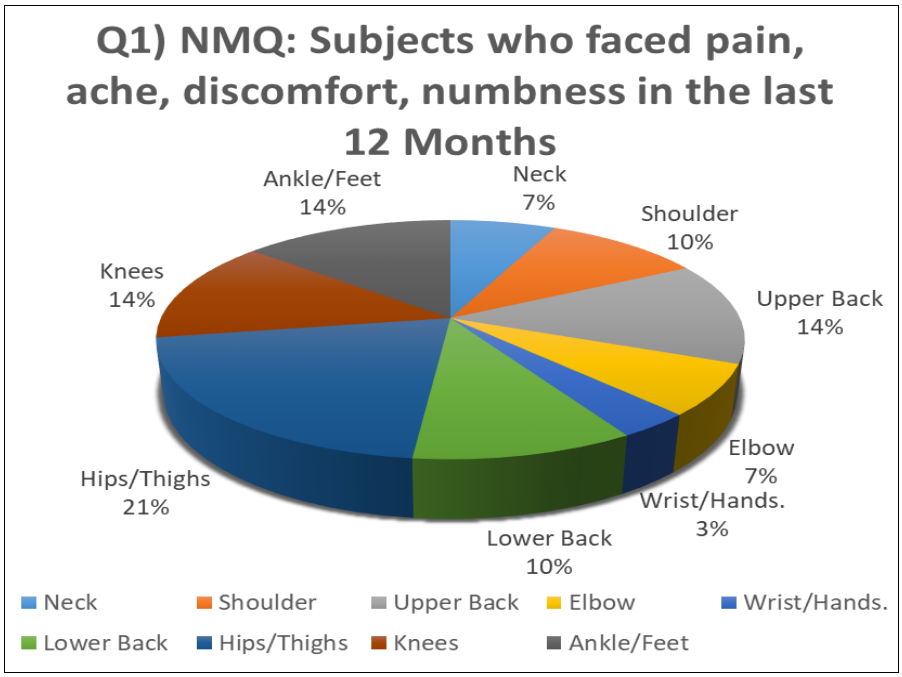

Fig 7: Subjects who experienced pain, ache, discomfort, numbness in the last 12 months in the age group of 35-45 years.

Table 7 shows that out 48 subjects: no subject was prevented from carrying out normal activities because of pain, ache, discomfort, numbness in the last 12 months.

Table 1: Subjects that were prevented from carrying out normal activities because of pain, ache, discomfort, numbness in the last 12 months in the age group of 35-45 years.

Joint	No of Subjects (Out of 48)
Neck	0
Shoulder	0
Upper Back	0
Elbow	0
Wrist/Hands	0
Lower Back	0
Hips/Thighs	0
Knees	0
Ankle/Feet	0

Figure 8 shows that out of 48 subjects: neck 0, Shoulder 0, Upper Back 1 (17%), Elbow 0, Wrist/Hands 0, Lower Back 1 (17%), Hips/Thighs 0, Knees 2 (33%), Ankle/feet 2 (33%) visited the physician for pain, ache, discomfort, numbness in the last 12 months.

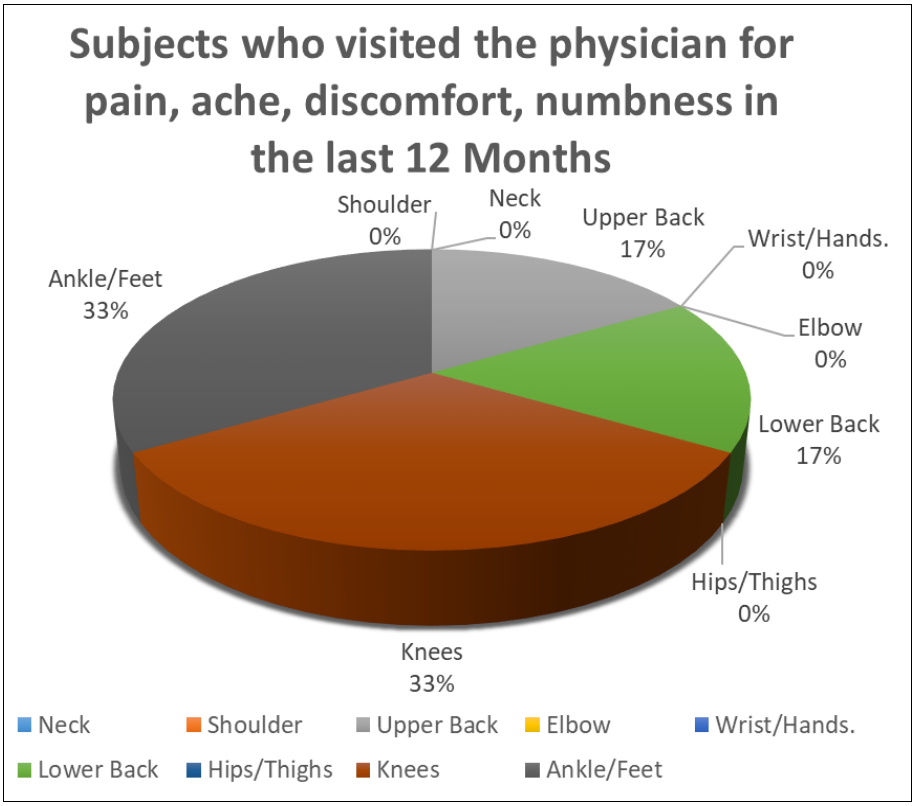

Fig 8: Subjects who visited the physician for pain, ache, discomfort, numbness in the last 12 months in the age group of 35-45 years.

Figure 9 shows that out of 48 participants: neck 3(13%), shoulder 2(8%), upper back 5(22%), elbow 3(13%), wrist/hand 2 (8%), lower back 0, hips/ thighs 1(4%), knees 5(22%), ankle/feet 2(8%) faced trouble in the last 7 days.

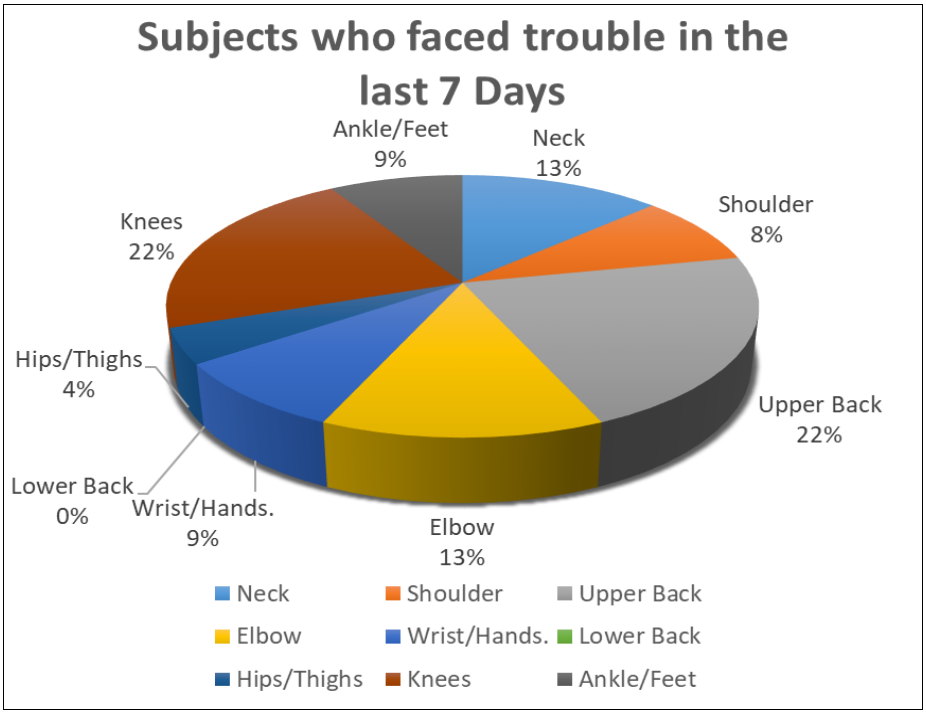

Fig 9: Subjects who faced trouble in the last 7 days in the age group of 35-45 years.

Figure 10 shows overall prevalence of MSDs in Indian jockeys.

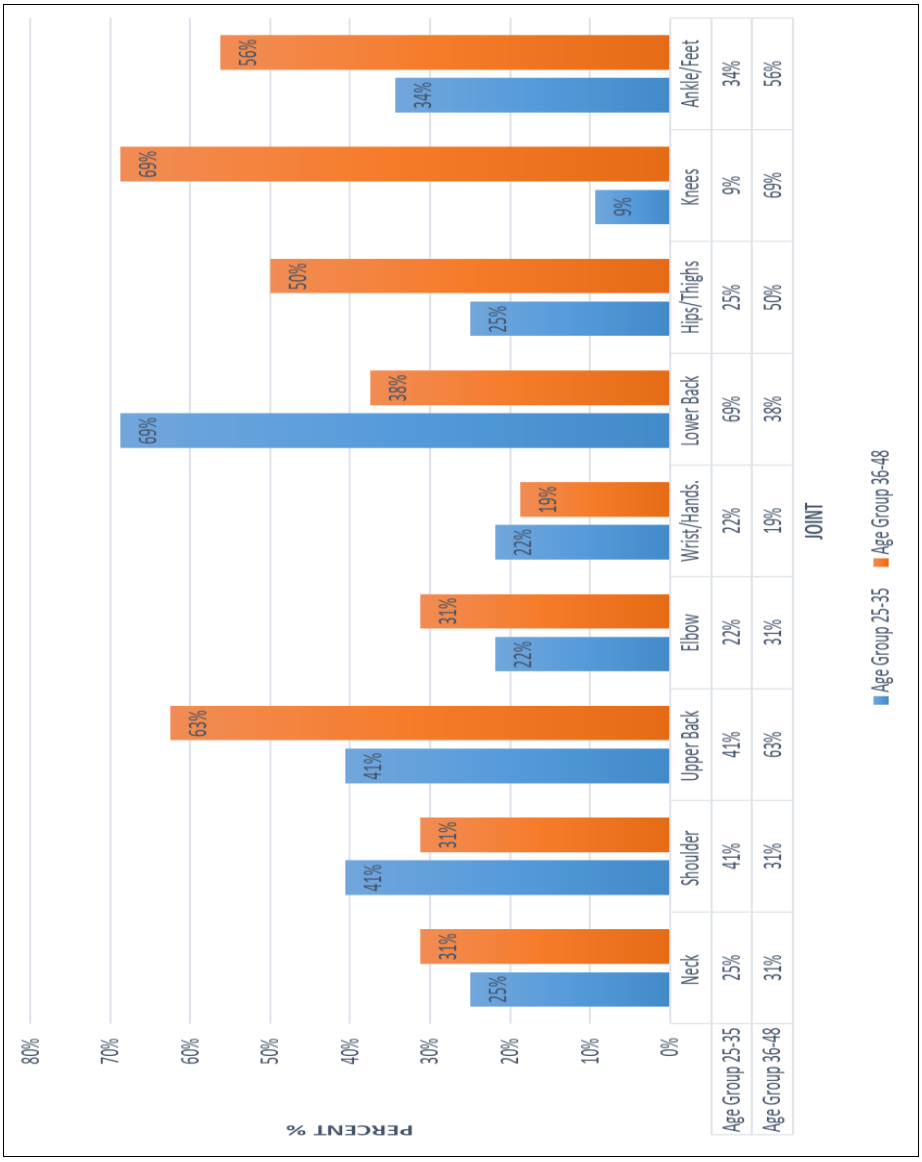

Fig 10: Overall prevalence of musculoskeletal disorders in Indian jockeys.

Discussion

Horseracing is a high-profile and high-risk sport, in which optimising the safety alongside performance of participating horses and jockeys is paramount [9]. Maintaining a harmonious interaction between horse and jockey is one key aspect influencing safety, as biomechanical instabilities are the trigger behind most horse falls and jockey injuries [10]. Equestrian sports are unique in that they involve the participation of two athletes that differ greatly in morphology yet are able to move together harmoniously experienced riders not only move in phase with the horse, they can even improve the consistency of the horse's movements. The motion of the horse imposes perturbations on the rider that differ in magnitude and direction according to gait. In faster gaits where suspension phases are present, the rider must accommodate greater vertical and horizontal accelerations of the horse's trunk through three-dimensional movements of their axial body segments. The rider, in turn, can improve the horse's performance through correct training, or cause it to deteriorate through faults in the rider's position or incorrect application of the aids. In racing, a jockey positions themselves off the saddle in a two-point seat and their leg joints flex and extend in a rhythmical manner that aligns with the vertical oscillations of their horse's trunk [11]. Their body moves only a small amplitude with respect to a world inertial frame and is decoupled from the movements of the horse [12]. The horses' limbs act in sequence to redirect their centre of mass (COM) [13]. The first footfalls (hindlimbs) accelerate the horse, propelling the COM forwards, and the later ones (forelimbs) decelerate the horse and apply vertical impulse to the COM [14]. Energy is lost during the stance phase of the limbs and is a function of the change in the angle of the COM trajectory [13]. The leading forelimb is thought to be the most important for redirecting the COM, as a result of cranio-caudal (CC) deceleration, vertical acceleration, and an increase in potential energy of the COM occurring during the stance phase of this limb [15]. On a stride per stride basis, jockey kinematics adjust to accommodate the changes in translational and rotational upper-body movements of the horse and thereby maintain stability [16].

It is worth emphasizing that the jockey does not "sit" on the horse but rather grips the horse with knees, ankles, and thighs and leans forward over the horse's wither. The jockey's back is parallel to that of the horse. Because of this seating position, if the horse stops suddenly the jockey is usually propelled forward over its neck into the rail or on to the track and into the path of other horses. Riding in this position ("riding short") may also cause specific overuse soft tissue

injuries [17]. Only a few studies on professional horse racing have been published but have not particularly considered the Indian jockeys who are still into racing and practicing in a different demographic.

The present study aimed at finding the prevalence of MSDs in Indian jockeys and which joint is affected the most. In this study a total of 48 subjects were selected based on inclusion and exclusion criteria. The procedure and purpose of study were explained to the subjects and prior consent was taken from all the subjects. The demographic data was collected and later the questionnaire was filled by each subject.

Press *et al.* [18] reported a retrospective questionnaire study of 706 experienced professional jockeys and their injuries and health concerns. These jockeys ride an average of 600 races a year. In this study, a total of 1757 injuries were reported. Of these, fractures were the most common (64% of total injuries) followed by concussion (8%) and joint dislocation (7%). Of the fractures, 41% were upper limb, 24% were lower limb, 12% were rib fractures, 10% were spinal fractures, and 9% were skull fractures, and 3% were hip/pelvis fractures.

Waller AE, *et al.* [3] conducted a study on Jockey injuries in the United States suggesting that the injury rates remain high, with about 20% being head or neck injuries and 20% being upper limb injuries. In a survey of about 2700 licensed jockeys, most injuries (42%) were the result of being thrown from the horse or struck by the horse's head (23%). Being thrown from the horse accounted for most of the severe injuries. Interestingly 35% of injuries occurred at the starting gate, including 30% of head injuries, 40% of upper limb injuries, and 52% of lower limb injuries.

This contrasts with the results of this study, which revealed that the majority of injuries were soft tissue injuries affecting different parts of the jockey's body. This could be partly attributed to the types of surfaces used in horse racing; however, it is more probable that jockeys consider soft tissue injuries a normal aspect of their daily lives and frequently neglect to mention these details when discussing their health history.

The results of this study revealed that there is a prevalence of MSDs in Indian jockeys showing prevalence in low back, upper back, ankle/feet, shoulder, hips/thighs, knees, neck, elbow, and wrist/hand. In the age group of 25-35(according to Fig.10) since the prevalence of lower back pain (69%) is more such jockeys are more prone towards lower back related musculoskeletal issues. Due to pain in lower back and elbow subjects were prevented from carrying out everyday activities which involved use of these joints. The prevalence follows for shoulder 41%) and upper back (41%) corresponding to issues they might encounter related to shoulder and upper back musculoskeletal issues which may then be followed by issues related in the ankle/feet (34%), hips/thighs (25%), neck (25%), elbow (22%), wrist/hand (22%) and knees (9%) respectively. In the age group of 36-45 (according to Fig.10), since the prevalence of disorders in the knees (69%) is more such jockeys are more prone towards knee related musculoskeletal issues.

We observed that participation in this sport was significantly related to higher risk for knee problems. The prevalence follows for upper back (63%) and ankle/feet (56%) corresponding to issues they might encounter related to ankle/feet and upper back musculoskeletal issues which may then be followed by issues related in the hips/thighs (50%), lower back (38%), elbow (31%), shoulder (31%), neck (31%) and wrist/hand (19%) respectively.

Neck and Upper Back

Axial loading is considered the most common pathophysiologic factor of injury in sport. Under normal circumstances, with the neck in an anatomical position and slightly extended due to cervical lordosis, the cervical muscles are responsible for dissipating the forces transmitted to the cervical spine. However, when the neck is slightly flexed, the muscular damping capacity decreases and the result of compression is usually a disc, ligament, or bone injury [19]. There are less frequent mechanisms of injury such as hyperflexion (due to the rupture of the posterior longitudinal ligament, which can cause a reduction of the spinal canal), rotation (in which a subluxation is generated by misalignment of the vertebrae) and lateral flexion (which produces excessive traction on the nerves and can cause a neurapraxia) [20].

Shoulder

The shoulder is a joint that is stabilized by the surrounding soft tissues. When repetitive loads produced during sporting activity exceed its physiological limits, the stabilizing tissue gets destroyed [21]. The main mechanism of injury in athletes is a traumatic event (96%), commonly unilateral and usually requiring surgical treatment. The remaining 4% are produced by repetitive microtraumas, resulting in multidirectional instability with underlying ligamentous laxity [22, 23].

Elbow

The forearm extensor muscles are involved in many daily tasks. Lateral epicondylitis is often caused by repetitive use of these muscles, especially the extensor carpi radialis brevis [24]. Most common causes of lateral elbow tendinopathy include excessive load, inadequate material, or poor technique. Shock transmission also plays an important role in the development of this disorder [25]. Lateral elbow tendinopathy is characterized by pain over the lateral elbow, often radiated into the forearm, when loading the wrist extensors. This usually affects the grip strength [19].

Wrist and Hand

Sports that require repeated radial/ulnar deviation and pronosupination of the wrist are a risk factor to develop to ulnar sided wrist pathology [26]. The triangular fibrocartilage complex acts as a shock absorber of the wrist. When injured, it can lead to decreased grip strength and distal radioulnar joint instability [27].

Lower Back

Low back injuries can originate from direct trauma to the spine, as well as muscle imbalance derived from muscle fatigue or repetition of complex movement patterns at high intensity or volume. In this direction, the scientific literature identifies injuries due to direct traumatic events or injuries due to mechanical overuse and repetitive stress [28, 29]. Despite the importance of exercise in the prevention and treatment of low back pain, high-intensity exercise and handling heavy loads have been associated with increased risk of injury. Elite athletes have a higher risk of suffering low back pain, depending on the intensity, volume, workloads, type of sport, level of competition and experience, and the competitive moment of the season [30]. There is a high correlation in the appearance of low back pain with mechanisms of hyperflexion or repetitive flexion with light loads, for example in sports such as rowing. Likewise, combat and opposition sports have also shown a higher prevalence in the

appearance of lumbar symptoms [30, 31]. Numerous conditions can be classified as the etiology of low back pain. Vertebral bone injuries associated with direct trauma or compression fractures from falls and blows usually occur with associated symptoms of the periarticular soft tissue. Root compression of the lumbosacral roots as a consequence of herniated discs, more frequently, or stenosis of the intervertebral foramina in early degenerative conditions in the athlete's spine, are related to the appearance of neuropathic symptoms. Radiating pain to the lower extremity, alterations in reflexes, dysesthetic symptoms such as paraesthesia's are some symptoms that can frequently appear. Other conditions subclassified within the patterns of low back pain, such as sacroiliac pain, are related to impact sports that involve braking and changes of direction. Likewise, pain in the sacroiliac territory is typically recognized by patients with various conditions that affect the lumbar spine, such as referred pain in degenerations or damage to the lumbar intervertebral disc, somatic pain of muscular origin such as in myofascial or mechanical pain syndrome of the sacroiliac joint [32].

Lower limbs (Hips/Thighs, Knee, Ankle/Feet)

The lower limb supports the weight of the body, so the bone mass in this area is greater compared to the upper limb. In addition, the joints are, in turn, more stable due to joint congruence and their ligamentous system [33]. However, it is in the lower limb that most musculoskeletal disorders also occur in sports [34, 35]. However, although perhaps the most serious injuries occur at the ligamentous level, most of the injuries suffered by athletes are muscle-tendon injuries [36, 37]. These musculoskeletal disorders involve damage caused by trauma, overload, or overuse, and can be acute or chronic, which means that the athlete must stay away from physical activity for a certain period, at least 24 h, or completely abandon sports practice [38]. Muscle injuries include contusions or lacerations caused by a direct mechanism and elongations (strains and tears), delayed onset muscle soreness and compartment syndrome, among others, produced by an indirect mechanism [39]. At the joint level, the injuries that could occur are dislocations or dislocations, bursitis, sprains, arthritis, or impingement such as femoroacetabular impingement. For example, in sports such as karate, it has been observed that the most frequent alteration in the hip joint is arthritis, followed by femoroacetabular impingement and bursitis [40]. Tendon injuries-One of the characteristics of the tendon is its scarce vascularization, being the area of the body of the tendon the most affected. This is reflected in the injuries caused in this structure. Tendon injuries or tendinosis are very frequent in the practice of high-performance athletes, being the patellar and the Achilles tendons the most affected tendons of the organism in sports such as soccer, rugby, or basketball [41, 42]. Degenerative tendon rupture can occur in advanced and untreated tendinosis or in older athletes and in the sporting context, Achilles tendon rupture has been noted to be one of the most common tendon injuries affecting athletes [19]. Long-term engagement in high-level competitive sports has been shown to be associated with a higher risk for some musculoskeletal disorders, especially in the knee and hip region, [43-45] however there has been demonstrated some controversial data from prospective studies. A higher risk for osteoarthritis in ex-athletes is mediated by different mechanisms, including previous injuries and overloading [43, 44, 46]. Thus, excessive participation in high level sports can increase the risk of developing osteoarthritis. The continuous physical stress on the joints can result in microtrauma and degeneration of the articular cartilage. There is evidence that the onset of osteoarthritis appears to depend on the frequency, intensity, and duration of physical activity [47].

Conclusion

The study "Prevalence of musculoskeletal disorders in Indian jockeys" concludes that there is prevalence of MSDs in Indian jockeys that can be seen in neck, upper back, shoulders, elbows, wrists/hands, lower back, hips/thighs, knees, ankle/feet.

To reduce this prevalence and to prevent jockeys from any musculoskeletal disorders we can educate them about ergonomics (proper riding positions). We can train the most affected areas and design appropriate exercise programs that can be structured and inculcated in the fitness programs of Indian jockeys for better efficiency while riding thus improving their performance.

Further studies with the help of this research can be performed in various aspects such as the study can be conducted in female jockeys, the study can be conducted in a larger group of population, observational studies like assessing the posture of the jockeys, assessing the quality of life of jockeys can be conducted, intervention-based studies can also be conducted, studies can also be performed during both, on and off season and later be compared for further conclusions.

Declaration

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Conflicts of interest: None.

Ethical approvals: Duly taken from both RWITC and college ethical committee.

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