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Prevalence of Lower Cross Syndrome in Indian Professional Jockeys

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Abstract:-
Introduction: Flat- racing is a common, non- amateur, male- dominant sport of India. The jockeys have to ride multiple times during one race, making it essential for them to maintain high levels of fitness in terms of muscular strength, flexibility, endurance and stamina. Lower cross syndrome (LCS) is characterized by specific patterns of muscle weakness and tightness. The abdominal and the gluteal muscles are commonly categorized as weak, whereas, the iliopsoas and spinal extensors are commonly categorized as tight muscles in this syndrome leading to postural imbalances which lead to non- specific Low Back Pain in future. Hence, this study aims to find out the prevalence of lower cross syndrome in professional flat- race Jockeys.

Methods: Endurance of abdominal (internal and external oblique muscles) and trunk extensor muscles, flexibility of bilateral iliopsoas muscles and hamstring muscles and strength of hip extensor and hip external rotator muscles was measured on 46 professional male jockeys. Results: The result suggests that the jockeys were found to have good relationship between the Left and Right lateral abdominal muscles (left: right side bridge test- *McGill's Criterion*), good (Grade 4; Manual Muscle Test- *Kendall scale*) strength of bilateral hip extensor and hip external rotator muscles; poor endurance of Trunk extensor muscles (Biering- Sorenson test- *Demoulin et. Al*) and tightness of bilateral iliopsoas (Modified Thomas Test) and hamstring muscles (V sit and reach Test).Conclusion: 23.9% of jockeys had lower cross syndrome, the remaining are at high risk of developing Lower cross syndrome in future. Additionally, Trunk extensor muscle endurance was predominantly poor.

Keywords:- *Jockey, flat racing, equestrian sports, Lower cross syndrome, Endurance, low back pain.*

I. INTRODUCTION

Equestrian Sports are one of the most skilful sets of sports all over the world. Flat racing is a common, non-amateur, male- dominant sport in India. It is a physically challenging sport, that requires jockeys to perform close to their physiological limit in order to be successful[17]. It tests the speed, endurance, stamina, and skill of a jockey in applying the appropriate tactics[17].

Previous studies suggest that, fall from a horse is the commonest mechanism of injury.[3] Equestrian injuries are either traumatic- when the rider falls off the horse or the horse and the rider both fall or non-traumatic when overuse causes repetitive strain and leads to chronic micro trauma.[2]The parts of the body that are most frequently injured are, in an order from the highest to lowest prevalence- spine, lower limb, pelvic, upper limb, head, chest, and abdominal.[7]

The 'Unterkreuz syndrome', also known as lower crossed syndrome is the result of muscle strength imbalances in the lower segment[6]. These imbalances can occur when muscles are constantly shortened or lengthened in relation to each other[6]. The Lower crossed syndrome is characterized by specific patterns of muscle weakness and tightness that cross between the dorsal and the ventral sides of the body[6].

In Lower Cross Syndrome there is hyperactivity and hence tightness of hip flexors and lumbar extensors[6]. Along with this, there is comparatively less activity causing weakness of the deep abdominal muscles on the ventral side and of the gluteus maximus and medius muscles on the dorsal side. The hamstring group of muscles are often found to be tight in this syndrome. This imbalance results in an anterior tilt of the pelvis, increased flexion of the hips, and a compensatory increased lordotic curvature in the lumbar spine[6]. Compared to general population, a high incidence of low back pain is found in jockeys[1.]

The muscles in the gluteal region are significant for the seat of the riders[2]. These muscles are responsible for the support of the thigh when the thigh rolls into abduction and adduction. These muscle actions are technically necessary in order to match the horse's locomotion whilst maintaining the correct posture[2].

The internal, external oblique muscles and the rectus abdominus muscles are the most important in the abdominal area. They compress a section of the abdominal wall hence, protecting abdominal cavity (Schusdziarra and Schusdziarra, 2004).[2]

Flat- racing is a risky sport making it an injury-prone occupation. Thus, there is a need to investigate methods of decreasing the risk by deliberately analysing and accounting injuries, studies should not be limited to traumatic injuries only. Repetitive strain injuries (RSIs) are equally perilous if not investigated expeditiously[1,2].

It was found that over activity of muscles might be the actual predisposing factor in serious injuries[2]. Lower back pain without any previous history of trauma is usually linked with muscle imbalances[1,2].

Non- specific Lower back pain continues to remain common among professional jockeys. Hence, making it essential to study the prevalence of lower cross syndrome

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which is frequently associated with non-specific lower back pain.

II. MATERIALS AND METHODS

The research design used for this study was observational study. Participants included in the study were male jockeys within the 18 to 55years of age and minimum 5years of experience in flat racing who were willing to participate. The sample size included in the study was 46 jockeys with convenient sampling. **Equipment:** the equipment was used for measuring hip flexion angle. For this purpose universal goniometer was used. A digital stopwatch was used to record the endurance. **Selection criteria:** The inclusion criteria for the study were: age between 18 to 55years, minimum 5years of professional experience in flat racing. The exclusion criteria for the study were: Individuals not willing to participate, recent history of musculoskeletal disorder and recent spine surgery.**Outcome measures:** Left, right side bridge test: to assess endurance of abdominal muscles, Sorenson Test: to assess the endurance of trunk extensor muscles, Modified Thomas test: to assess flexibility of bilateral iliopsoas muscle, VSR (V-Sit and Reach) Test: to assess lumbar extensors, hamstring flexibility, Manual muscle testing: hip extensor and external rotator Muscle strength was measured via Kendall scale.

III. PROCEDURE

The study was received approval by ethical committee of Tilak Maharashtra Vidyapeeth, Pune. The participants were selected on the basis of the inclusion and exclusion criteria and were requested to participate in the study. An informed consent form was obtained from the participants. The demographic data was obtained and detailed assessment was carried. Tests were carried to assess the endurance, flexibility and strength of each participant.

Side Bridge test

Biering- Sorenson test

IV. DATA ANALYSIS AND RESULTS

Age group of 18-55yrs of professional jockeys were included in the study. The mean age of the jockeys was 29.47 (±7.926) years, with an estimate experience of 12.826 (±6.925) years.

Side bridge test for core muscle endurance: The mean value for the right side core endurance obtained was63.826 ±24.244 seconds and the mean left side core endurance was 72.239 ±25.268 seconds. On obtaining a ratio of the right: left a mean value of 0.9095 ±0.276 was obtained.

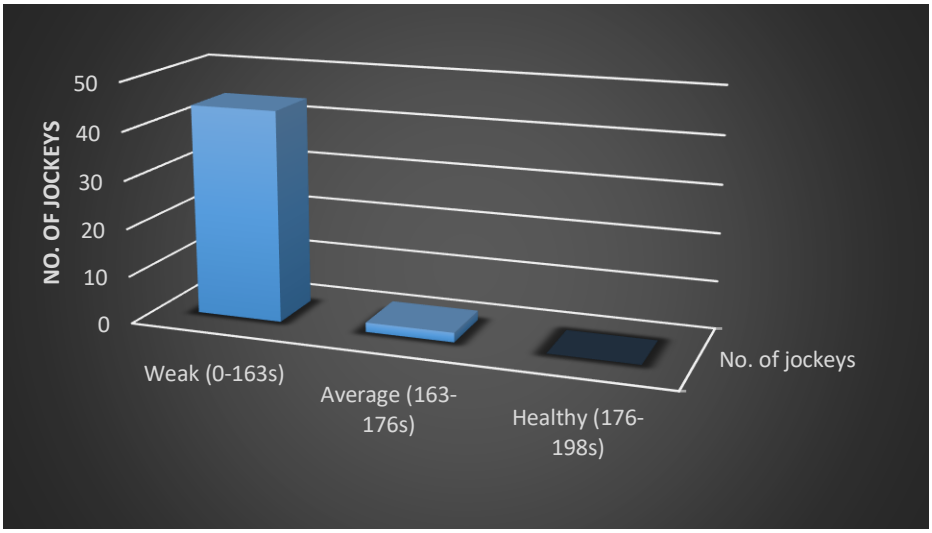
Side bridge test	Mean ± SD
Left	72.239 ± 25.268
Right	63.826 ± 24.244
Ratio (right: left)	0.9095 ± 0.276

Table 1: Side Bridge Test

Biering Sorenson test for Trunk extensor muscle endurance: 44 out of 46 participants recorded time ranged between 0-163seconds and remaining 2 participants recorded time ranged between 163-176seconds.

Range of Trunk extensor endurance time (in seconds)	No. of Jockeys
Healthy (176-198s)	0
Average (163-176s)	2
Weak (0-163s)	44

Table 2: Biering- Sorenson Test



Graph 1: Trunk extensor muscle testing via Biering- Sorenson test

Thomas test for iliopsoas muscle flexibility assessment: The mean value for the right hip flexion angle obtained was 4.652 (±1.791) degrees and the mean left hip flexion angle obtained was 4.130 (±1.681) degrees.

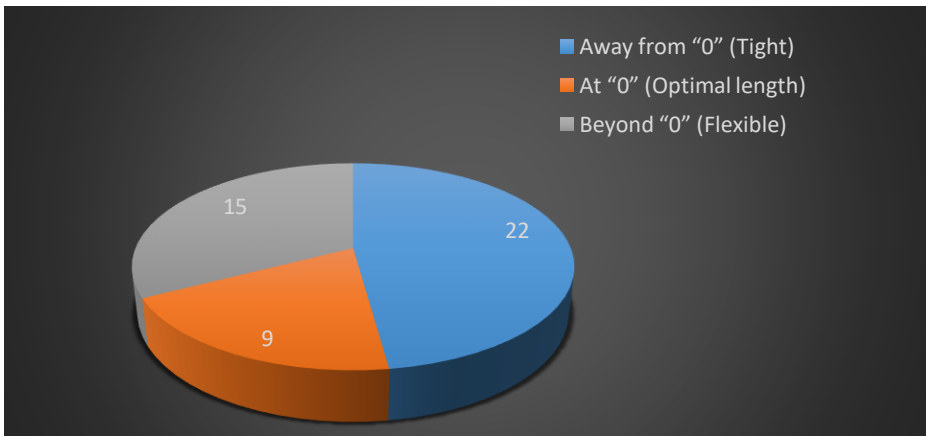
Test Limb	Mean Hip Flexion angle ± SD (in degree)
Left	4.130 ± 1.681
Right	4.652 ± 1.791

Table 3: Modified Thomas Test

V- sit and reach test for lumbar extensor, hamstring muscle flexibility assessment: Out of 46, 22 jockeys reached away from baseline mark, 15 reached beyond baseline mark and 9 jockeys reached baseline mark.

Distance from "0" baseline mark	**No. of Jockeys**
Away from "0" (Tight)	22
At "0" (Optimal length)	9
Beyond "0" (Flexible)	15

Table 4: V-Sit and Reach Test



Graph 3: Lumbar extensors, Hamstring muscle flexibility assessment via v-sit and reach test

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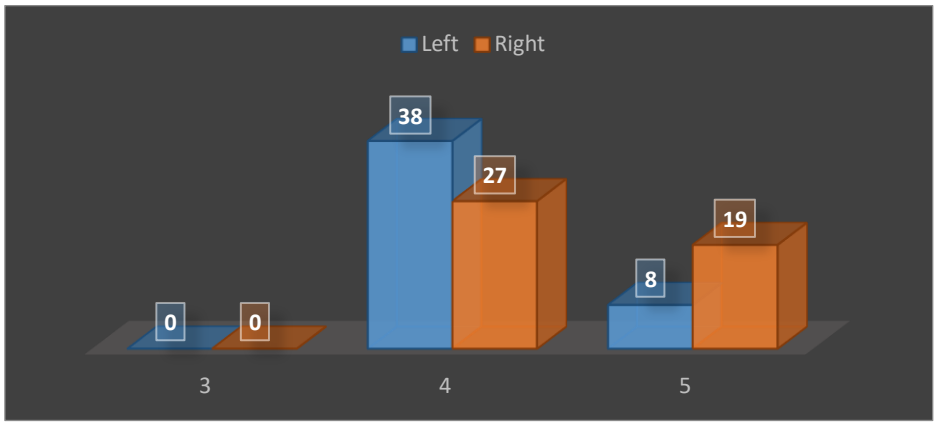
Manual Muscle testing of Bilateral hip extensors and external rotators for strength grading via Kendall scale: 37 jockeys were Graded-4 and 10 jockeys were Graded-5 for the strength of the left hip extensors; whereas, 36 jockeys were Graded-4 and 09 jockeys were Graded-5 for strength of right hip extensors on Kendall Scale.

38 jockeys were Graded-4 and 08 jockeys were Graded-5 for the strength of the left hip external rotators; whereas, 27 jockeys were Graded-4 and 19 jockeys were Graded-5 for strength of right hip external rotators on Kendall Scale.

	No. of jockeys	
Kendall scale grade	Left	Right
3	0	0
4	37	36
5	10	09

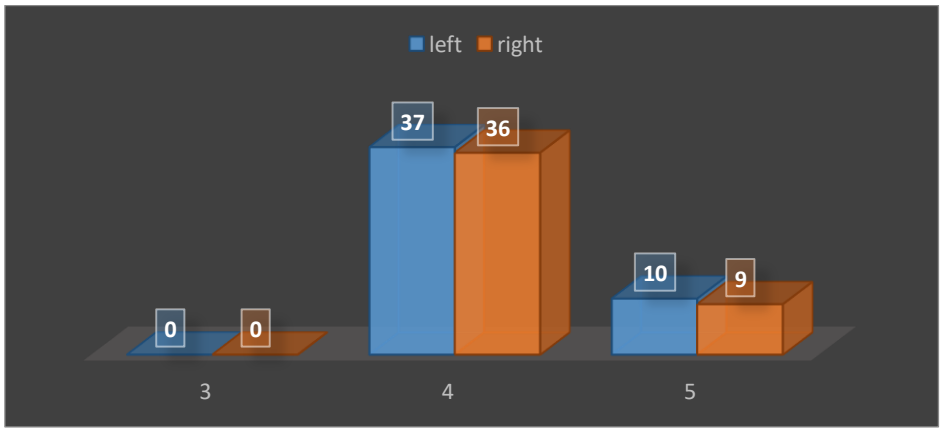
Table 5: MMT of bilateral Hip extensors



Graph 5: Manual muscle testing of bilateral hip extensors graded via Kendall scale.

	No. of jockeys	
Kendall scale grade	Left	Right
3	0	0
4	38	27
5	8	19

Table 6: MMT of Hip external rotators



GRAPH 6: Manual muscle testing of bilateral hip external rotators graded via Kendall scale.

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V. DISCUSSION

The purpose of this study was to examine the muscle imbalances due to the riding posture of a professional flat race jockey on the horse, which may lead to severe repetitive strain injuries over a period of time.

It was found that the participants were within the range of McGill's criteria of Right: Left Side Bridge ratio being- 0.909 (±0.276). On performing the Modified Thomas test for the flexibility of the iliopsoas muscle it was found that an average of 4.130 (±1.681) degrees for Left and 4.652 (±1.791) degrees for Right hip flexion angle was present in the Jockeys. Similarly, it was found that 63% of jockeys had tightness of Lumbar extensors and hamstring muscle. The results for Manual Muscle Testing of hip extensors and hip external rotators using Kendall scale were inconclusive as it was found that 82.6% of jockeys scored Grade-4 and 17.4% of jockeys scored Grade-5 and 58.7% of jockeys scored Grade-4 and 41.3% of jockeys scored Grade-5, respectively. Additionally, on performing the Sorenson test- 95.7% of the jockeys were proven to have poor trunk muscle endurance, and only 4.3% have fair trunk muscle endurance.

The above findings are consistent with the observation made by C N Kraft et. Al in the article "Influence of the riding discipline and riding intensity on the incidence of back pain in competitive horseback riders" they found that the incidence of back pain in horse riders was 72.5% irrespective of the type of equestrian sport. They concluded that there is a high incidence of back pain amongst horse riders irrespective of the type of equestrian sport compared to the general population.

Jo Anne Caitlin in their article "A profile of horse riding injuries in adult horse riders registered with the Kwa Zulu Natal Horse Society." concluded that, horse riders were at a high risk of injury and there is a need to investigate ways of decreasing the risk by accounting injuries. Injuries due to horse riding were highly prevalent. They found that muscle strains were the most frequent type of injury 62.5%, followed by fractures which were also common 50.6%. The overall prevalence of injury was 90.3% as only 9.7% had not had an injury due to riding. They also found some common sites of injuries in jockeys, among them head injuries were the most common with 46.7% of all injuries being of that nature, followed by 43.7% of injuries being low back injuries[2].A similar study in 2019 on horse-related spine and spinal injuries found that the rate of incidence of musculoskeletal injuries was 46.9% of the overall injuries and of which 72.4% were spine and spinal cord related injuries. There were no statistically remarkable variations found regarding the frequency of injuries between apprentice and professional equestrian athletes. Although, the study suggests that apprentice equestrian athletes are at a higher risk of injury in terms of frequency. The study concluded that Thoracic and Lumbar spines are most frequently injured sites of the trunk[8]. Frank Liaw et. Al in their article "Injury Patterns of Equine-Related Trauma" found that most frequent presenting age group was 20-29, although most injuries occurred with patients of ages 50-59. 41% of Spinal injuries were accounted and the occurrence was in a similar proportion in all age groups. They concluded that Spinal injuries were found to be the new leading zone of injuries.

Sarah Jane Hobbs et. Al in their article "Posture, flexibility and grip strength in horse riders" found that Right-left differences were explored in relation to experience in years of riding and rider competitive experience. There was significant asymmetry in the sitting posture at the iliac crest height in the riders that had greater years of experience. They concluded that the demands on horse-back riders competing at higher levels may lead these riders to a greater risk of developing asymmetry, hence potentially developing chronic back pain.

This study found that the core muscle endurance of the jockeys was proportionate according to McGill's criteria[12] that implies that the Right and Left trunk muscles are in good synergy with each other. It was also found that the bilateral hip extensor and external rotator strength in the jockeys is optimal. Although, when assessed for the trunk extensor strength using the Sorenson test none of the jockeys could hold the test position for more than 175 seconds, which was also the highest value recorded; the mean timing being 125.09 (±15.5) seconds (n=46 jockeys). According to Demoulin, C. et. Al in 2006; 198 seconds is the normative value for healthy males for isometric endurance testing of trunk extensor muscles using the Biering-Sorenson test. Their study predicts low back pain in a year for hold-time of less than 176 seconds. Hence, making the jockeys prone to have prior low back pain or low back pain in a year. It was also found on assessing for the Iliopsoas muscle flexibility using Modified Thomas test that the mean values of the hip flexion angle were 4.13 (±1.68) degree in the left hip and 4.65 (±1.79) degree in the right hip; which indicates slight tightness of the iliopsoas muscles (Right>left). Similarly, on assessing for flexibility of the hamstring muscles using V sit and reach test a negative mean value of -1.49 (±7.84) cm was noted; which suggests slight tightness of hamstring muscles in the jockeys was found.

A study concluded that there is remarkable amount of research study regarding catastrophic injuries but scarce literature that addressesrepetitive strain injuries and its effects on the horse-back riders. It is important that Sports physicians treating equestrian athletes understand the posture and biomechanics during riding the horse in the saddle and the postural alterations, thereby leading to muscular imbalance and injuries. The highest forces during horse riding are absorbed through the rider's ischial tuberosity, pelvis, sacrum, and the lumbar spine[14].

Low back pain was the most common complaint amongst riders and leads to countless, missed competitions, training sessions and problems during training. Hence, there is a need for awareness among jockeys and the institutions responsible for organizing racing events, about the risk of repetitive strain injuries and the means needed to prevent them.

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VI. CONCLUSION

23.9% jockeys have Lower cross syndrome and the remaining jockeys are at a risk of developing Lower cross syndrome in future. Trunk extensor muscle endurance was predominantly the lowest compared to other Trunk muscle endurance tested. Tightness of the Hamstring muscles and the Iliopsoas muscles was prevalent in the Indian Jockey population as well which explains the cause of chronic low back pain in Indian jockey population.

This study goal is to create awareness amongst the apprentice as well as professional jockeys about proper warming up and stretching techniques pre and post a riding training session or between races.

A comparative study can be done where the endurance of apprentice jockeys is compared to professional jockeys. The study can also be done on Equestrian athletes of younger age groups than adult of different disciplines.More study is needed to determine proper protocols in order to ensure prevention of the most common injuries among professional flat race jockeys.

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