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Research Article

Risk Factors Associated With Chronic Pain Of Post Injured Knee Among Male Kadets And Junior Fencing Athletes

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ABSTRACT

Muscle strength played a role in stabilizing the knee post injury. It reduced the load on the knee joint when carrying weight or during activities. Lower load on the knee would reduce pain post injury history. Muscle strength was essential for adaptation during recovery post injury history in maintaining balance and improving performance to chronic pain. This study was aimed to analyzed risk factors who believed associated with chronic pain of post knee injury. It was observational analytic study with a cross-sectional design. Subjects were 35 male fencing athletes from East Java, categorized as cadets and juniors, experienced with chronic pain post knee injury histories. Chronic pain was measured using knee injury and osteoarthritis outcome scores (KOOS) questionnaire and muscle strength was measured using leg dynamometry. Pearson test confirmed a positive correlation between chronic pain score and the athlete age ($p = 0.04$; $r = 0.367$). Spearman test confirmed a closed negative association between chronic pain score and the muscle strength ($p < 0.01$; $r = -0.778$). Chronic pain was found more at weak leg muscle and aged athletes. Both, age and muscle strength were primary risk factor of chronic pain post knee injury history among fencing athletes.

Keywords: *Knee Injury, Pain, Muscle Strength, Fence, Athlete.*

INTRODUCTION

Sports injuries are injuries to the integumentary system, muscles, and skeleton caused by sports activities (Maralisa & Lesmana, 2020). Injuries are grouped into acute and overuse injuries (Setiawan, 2011). Sixty percents of sports-related injuries were found at the lower limbs, especially knee injury (Lambers et al., 2019). Knee ligament tear was commonly found following sport activities. ACL injuries were the most among other knee injuries found in sports activities involving squatting, twisting, stopping, and jumping (Wiratna, 2015). The incidence rate of ACL injuries occurs in 38-78 out of 100,000 people/per year (Gans et al., 2018).

Leg injuries were most experienced sport injury among fencing athletes. Thompson et al. (2021) revealed that 69% of the United States national team fencing athletes had at least one leg injury, especially the dominant knee (front). The most common knee injuries experienced by fencing athletes are anterior cruciate ligament and meniscus (tear/degeneration). Corry's research (2000) also revealed the worst injuries suffered in a fencer's career due to knee injury (19%) and ankle injury (15%). Specific knee injuries are found in lateral epicondylitis, patella, tendinopathy, and patellofemoral pain syndrome. Most knee injuries were found with anterior cruciate ligament (ACL) tearing. These produced chronic pain with leveling of mild, moderate, until severe.

Knee injuries in fencing occurred due to movement mechanisms during exercise or training (Corry, 2000). Patellar tendinopathy was common in fencers due to the striking, jumping, and lunging movements that activate the patella tendon when the quadriceps muscles are used. The patella tendon was responsible for knee extension when kicking, jumping, striking, and running. These muscle strengths were the foundation of fencing in basic techniques, squatting, forward positions, and almost all leg movements (Giulio, 2008).

Muscle weakness induced patellofemoral syndrome, so the kneecap incorrectly points outside the knee (Kirill Alekseyev, 2016). It produced chronic pain during recovery post knee injury history (Michael and Tammara, 2005). Better muscle strength was believed to support on better adaptation during recovery and risk of chronic knee pain (Abdurachman, 2017). Measurement of muscle strength and other characteristics among fence

athlete proposed to explain more about the risk of chronic pain post knee injury history. Until now, the associated risk factor of chronic pain among post injured fence athlete was questionable. This study was aimed to analyze the association between chronic pain post knee injury history with leg muscle strength and fencing athlete characteristics.

METHODS

Subject

The research was an observational analytic study with a cross-sectional design. Subjects were 35 male cadet and junior, aged 18-20, fencing athletes from 4 regencies in East Java province: Situbondo, Banyuwangi, Probolinggo, and Malang. All subjects were experiencing with post knee injury history. We excluded subject with other and co-injury history, such as back, ankle and hip problems. Age, body weight and height were determined as subject characteristics.

Chronic knee pain evaluation

They were asked to fill knee injury and osteoarthritis outcome scores (KOOS) questionnaire to evaluate chronic pain sensation. Subject with score of questionnaires lower than 50 had tolerable pain sensation. On the opposites, subject with score of questionnaires higher than 50 had non-tolerable pain sensation. Subjects were distributed into two different groups based on the scores: tolerable and non-tolerable pain sensation groups.

Muscle strength evaluation

Measurement of muscle strength was using leg dynamometer. The evaluation was conducted to evaluate quadriceps femoris muscle strength of injured knee history. The muscle strength measurement was in kg. Subjects were prior asked to bend their knee above dynamometer. Under specific direction, they asked to extent their leg as much as they can. Number of kilograms was noted and collected as muscle strength measurement result.

All protocols were ethically approved by the Animal Care and Use Committee, Faculty of Medicine, Universitas Airlangga in letter no. 287/EC/KEPK/FKUA/2021. This ethical approval was performed to avoid animal abuse and distress during the study. Data were analyzed using statistic to evaluate data distribution, comparison and association.

RESULTS AND DISCUSSION

The scores of KOOS questionnaire were categorized as non-tolerable and tolerable chronic pain. Subject with non-tolerable pain was 42.9% and subjects with tolerable pain was 57.1%. Distribution of categorized KOOS scores were seen at table-1 as follows. Age, weight and body height were not different between subjects who pain tolerated versus non-tolerated. It was only muscle strength was different between group of subjects. Characteristic comparison between group of subjects were seen at table-2 as follows.

Table 1 Score distribution of chronic knee pain among subjects

Chronic knee pain scores	Frequency	Percentage (%)
Non-tolerable (> 50)	15	42.9%
Tolerable (< 50)	20	57.1%
Total	35	100%

Table 2. Subject's characteristic comparison between severe and mild chronic pain

Variables	Group	N	*Mean*±SD	*Shapiro-Wilk*	*p value*
Age (years)	Non-tolerable	15	19.30±0.86	0,004	0,079(1)
	Tolerable	20	18.80±0.77	0,002	
Weight (kg)	Non-tolerable	15	60.76±6.15	0,447	0,814(2)
	Tolerable	20	61.24±5.60	0,977	
Height (cm)	Non-tolerable	15	167.06±5.56	0,133	0,654(2)
	Tolerable	20	166.30±4.47	0,533	
Muscle strength (kg)	Non-tolerable	15	113.20±9.54	0.235	0.001(2)
	Tolerable	20	161.75±3.22	0.467	

*Significantly difference at p< 0.05; (1) Mann-Whitney test result; (2) independent t-test result

It was only muscle strength which different between groups. Muscle strength was a candidate of pain associated risk factor found among fence athlete with post knee injury history. The Spearman test result confirmed that muscle strength was associated with chronic pain among fence athlete with post knee injury history. Muscle strength was primary risk factor for the incidence of chronic pain. Negative coefficient described that tolerated pain was found among subject with higher muscle strength.

Table 3. The association test between chronic knee pain score and the characteristics of subject

Chronic knee pain score with...	*Kolmogorov-Smirnov*	*p value*	*Correlation Coefficient*
Muscle Strength*	0,023	0,001	-0.778
Age*	0,142	0,030	0.367
Body weight	0,200	0,802	0.044
Body height	0,200	0,339	-0.167

*Significantly difference at $p < 0.05$ on Spearman test result

Age was surprisingly also associated with chronic pain sensation among fence athlete with post knee injury history. Non tolerated pain was found among older subject. Body weight and height was not associated risk factor for chronic pain sensation among fence athlete with post knee injury history. It was only muscle strength and age which associated with chronic pain sensation among fence athlete with post knee injury history.

Tolerated chronic pain was mostly experienced among fence athletes with knee injury. It was associated with muscle strength and age. Non tolerated pain was experienced mostly by subject with older age. Even though the difference between group was not significant. It supported Marlina (2015) study which revealed that age did not influence on the pain intensity. Pain perception was influenced by human development stage (Sudoyo, 2009). Human development influenced the perception and expression of pain (Smeltzer et al., 2008). Older people were more sensitive to pain than young adults and middle adults (Kozier et al., 2010). Older people had more experience to deal with pain (Wandner et al., 2012).

Knee injury induced cartilage damage, reduced vascularization and perfusion. It resulted a narrow joint space between bone edge of knee. The bone friction became more frequently and easier to stimulate chronic knee pain (Marlina, 2015). Aging decreased muscle strength, loss of proprioception and induced degenerative process of meniscus, ligaments, and joint tissue (Arissa, 2013). Unfortunately, this study was explored chronic knee pain among cadets and junior stage of adolescent.

The result showed a significant association between score of chronic knee pain with the muscle strength. It was a strong negatively relationship. Tolerated chronic pain was found among subject with stronger muscle. Non tolerated chronic pain was found among subject with muscle weakness. Muscle strength was primary associated risk factor for chronic pain among fence athlete with knee injury history.

This study's results align with the research of Sharma et al. (2017), which revealed that knee injury reduced in the stability of the knee joint due to insufficient leg muscle strength, pain, and changes in joint structure. strengthening exercise on leg muscle increased muscle strength, reduced pain complaining and improved functional ability in patients with knee osteoarthritis (Istianah et al. 2020). Quadriceps muscle strength was the main force to prevent ACL tear in knee injuries. Quadriceps were supported one of the main producers of anterior knee strength when doing a full extension. Research by Withrow et al. (2008) said the strength of leg muscle contractions is a protective mechanism for the ACL.

Complaints of pain from knee injury sufferers will result in a reduction in activity. Limiting activities for a long time can cause problems such as impaired flexibility and stability, reduced muscle mass, decreased endurance, and decreased leg muscles (Kutono, Haryatno, & Parjoto, 2013). The leg muscle groups control the movement and stability of the knee in the front and the back (Hafez et al., 2013). Disability and pain in the knee joint will increase with the appearance of leg muscle weakness because muscles are an essential component in stabilizing the joint. Leg muscle weakness will impact individuals who experience knee injury, such as patients with osteoarthritis (OA) (Kuntono, Haryatno, & Parjoto, 2013). Leg muscle weakness can be caused by muscle atrophy and complete inactivity, so that muscle strength will decrease by as much as 5% per day (approximately 50% after two weeks).

Leg muscle strength plays a role in stabilizing the knee because it can reduce the load on the knee joint when carrying weight or during activities (Marlina, 2015). Reducing the load on the knee joint can reduce pain due to knee injury (Sharma et al., 2017). Leg muscle strength plays a role in maintaining balance and improving muscle performance to reduce the risk of knee injuries (Fatimah, 2020). Increasing the flexibility of the leg muscles will reduce joint stiffness so that correct movement patterns can be corrected, leading to an increase in functional ability (Sharma et al., 2017).

An optimal muscle strength training program can reduce pain, increase the knee's range of motion, and improve general function. The training program should focus on increasing leg muscle strength or lower extremity performance and aerobic capacity (Khairurizal, 2019).

CONCLUSION

Muscle strength and age were two associated risk factors of chronic pain among fence athlete with knee injury history. Future, athlete need to strengthening the quadriceps femoris muscle to prevent osteoarthritis and reduce in pain complaining. Muscle strengthened exercise should done during recovery post knee injury history. Knee supported was suggested to use during recovery as long as the quadriceps strengthening developed.

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