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Original articles

Musculoskeletal Pain and Training Characteristics Among Karate Athletes in Sri Lanka: A Cross-Sectional Study

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Abstract

Introduction: Karate is used as a sport and a self-defense technique. It provides physical exercises for the entire body.

Objective: This descriptive cross-sectional study was carried out in two karate clubs in Colombo, Sri Lanka, to compare the types of musculoskeletal pain and training habits of karate athletes.

Methods: This descriptive, cross-sectional study was carried out using a structured, pretested, interviewer-administered questionnaire which included questions related to demographic data, types of musculoskeletal pain and details related to training. Their heights and weights were also measured. Karate athletes aged 18 to 44 years were recruited from two clubs in the Colombo district of Sri Lanka.

Results: Thirty-four athletes were recruited (mean age [SD] 27.2[7.3] years, males 91% [n=31]). Chronic pain (duration > 12 weeks) was present in 21 (62%), and among them, the lower back, knee and thigh were affected in 10 (48%), 7 (33%), and 5 (24%), respectively. Athletes without a chronic pain were included in the control group. There were 13 (38%) in the control group. Nineteen (91%) with chronic pain had previous injuries not fully rehabilitated. Athletes with chronic pain had significantly higher mean daily duration of warm-up (P = < 0.001), and training (P = 0.020), the time period involved in the sport (P= 0.008) and number of previous injuries (P = < 0.001), compared to the athletes in the control group.

Conclusions: Approximately two thirds of athletes were affected with chronic pain and more than ninety percent of them had previous injuries not completely rehabilitated. The most common site of chronic pain was lower back. The time involved in sport, training duration and the number of previous injuries were significantly higher in athletes with chronic pain.

Introduction

Karate is practiced both as a competitive sport and as a method of self-defence. Training is structured into three main divisions: kihon (the performance of individual techniques or combinations by a group of athletes), kata (formalized sequences of movements incorporating offensive and defensive postures), and kumite (sparring). All three divisions involve a range of techniques, including punching, kicking, knee strikes, elbow strikes, and various blocking methods [1]. Among these, kumite is performed at higher intensity and speed, resulting in greater physical stress compared to kihon and kata [2].

A study conducted during the 2014 World Karate Championship reported that, within the kata group, 28.7% of athletes required treatment for knee pain and 22.9% for shoulder pain. In the kumite group, 26.7% required treatment for knee pain and 21.8% for ankle pain. Elbow pain was more frequently observed in kata athletes, whereas hand pain was more common among kumite athletes [3].

Combat sports are characterized by body contact through striking, kicking, and/or throwing. Taekwondo is another combat sport similar to Karate. A study conducted by Park and Song (2018) on the prevalence of injuries in Taekwondo reported

that 65% of injuries occurred in the lower extremities, while the trunk (16%), upper extremities (14%), and head and neck region (4%) were also affected [4].

A systematic review of nine prospective studies examining chronic injuries lasting twelve weeks or more in combat athletes across different disciplines highlighted sport-specific injury patterns. In boxing, the most frequently injured areas were the head/face (45.8%), wrist (12.0%), and lower back (7.8%). In judo, the lower back (10.9%), shoulder (10.2%), and knee (9.7%) were the most affected areas. In Taekwondo, the fingers (22.8%) and thigh (9.1%) were most frequently injured, while in wrestling, the knee (24.8%), shoulder (17.8%), and head/face (16.6%) were the predominant injury sites [5].

Pain arises as a consequence of actual or potential tissue damage and is characterized by both unpleasant sensory and emotional components. In some cases, individuals may report pain due to psychological factors even in the absence of tissue damage. Distinguishing such experiences from pain caused by tissue injury is often difficult. Nevertheless, if individuals describe pain in a manner consistent with that typically associated with tissue damage, it should be regarded as pain [6].

Acute pain generally results from a noxious stimulus produced by injury and/or disease and is limited in duration. In contrast, chronic pain persists beyond the expected course of an acute injury or illness, often due to an underlying pathological process. This type of pain may last for months or years and can present either intermittently or continuously [7].

Several factors are recognized as being associated with musculoskeletal lesions. These include inadequately treated or rehabilitated previous injuries, improper technique, and rapid increases in training load in terms of intensity, weekly frequency, and daily duration. Additional contributing factors are the use of inappropriate equipment, training on unsuitable surfaces, exercising under extreme weather conditions, muscle imbalances, errors in nutritional intake, and inadequate fluid management [8].

Musculoskeletal pain in athletes is commonly attributed to the extensive training programs they undergo. Inappropriate training habits are known to contribute to the development of chronic injuries, which not only cause pain but can also lead to physical and psychosocial disabilities. However, the association between training practices and musculoskeletal pain have not been fully evaluated in Karate athletes, especially in South Asia, including Sri Lanka. Even studies conducted in other regions have not provided specific figures on the number of athletes affected by chronic pain or detailed accounts of their training practices.

Therefore, this study aimed to assess the prevalence of chronic musculoskeletal pains among Karate athletes and to examine their association with training habits.

Methodology

A descriptive, cross-sectional study was conducted among adult karate athletes from two clubs in the Colombo district of the Western Province, Sri Lanka. In this district, there are eight registered clubs supervised by four registered instructors. Each instructor supervised two clubs. Two of these clubs, supervised by the same instructor, were selected randomly. All trainee athletes registered in these two clubs, who had participated in national and international-level competitions during the previous year, were recruited after obtaining informed written consent.

Data collection

The data was collected over six days within a two-week period during a screening clinic for the presence of musculoskeletal pain. All karate athletes from these two clubs, who fulfilled the inclusion criteria, participated in these clinics, regardless of whether they presented with symptoms. A structured, pretested, interviewer-administered questionnaire was used for data collection. Their demographic information, the period involved in the sport, symptoms and durations, past medical and surgical history, training habits, fluid intake and nutritional intake were recorded [9]. In addition to the questionnaire, the information on athletes' training habits was gathered by studying their training diaries. A complete physical examination, including measurement of weight and height, was performed in all athletes and recorded on a data sheet

Assessment of symptoms

A 10-point numerical rating scale (NRS) (e.g. 0 to 10-point scale. “0” equals no pain, “1-2” equals very

mild pain, "3-4" equals mild pain, "5-6" equals moderate pain, "7-8" equals severe pain, "9-10" equals very severe pain) [7 6] was used to measure the prevalence and intensity of pain among the participants. The pain that lasted for three months or more (continuously or intermittently) was considered chronic pain [10]. Athletes who experienced no pain or had a pain duration of less than three months were considered as controls. Athletes with a pain intensity of equal to or less than 2 in the NRS scale were considered as athletes with no pain.

Assessment of training habits

The total training duration/day, warm-up duration/day, stretching duration/day, timing of fluid intake and food intake before and after the training session, and training frequency/week were measured in minutes and days/week. The period involved with the sport up to the time of the interview was measured in months [8]. The height was measured in centimetres, and the weight was measured in kilograms.

For an injury to be considered fully rehabilitated, the athlete must be pain-free, demonstrate a complete range of joint movements, possess strength equal to at least 90% of the pre-injury level, exhibit normal proprioception, and perform sport-specific skills effectively [8]. If these criteria were not met, the injury was considered not fully rehabilitated.

Data analysis

Quantitative data were described using means, standard deviations and percentages. The Shapiro-Wilk test was used to determine whether the data were symmetrically distributed. To compare the training habits of the chronic pain group and the control group, the Independent t-test, the Mann-Whitney U test, and the chi-square test were used.

Ethics approval and Informed consent

The research protocol was approved by the Ethical Review Committee of the Faculty of Medicine, University of Kelaniya, Sri Lanka. The study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki (revised in Brazil, 2013) and complies with the ethical standards specified in the IJSM's ethical standards document [11]. Written informed consent was obtained from all participants prior to their inclusion in the study.

Results

A total of 34 athletes were recruited for the study, of whom 31 (91%) were male. The age range of participants was 18–44 years. The mean age (SD) of athletes with chronic pain was 27.5 (5.1) years, while the mean age (SD) of athletes without chronic pain (control group) was 26.7 (9.6) years. Overall, 21 athletes (62%) were affected by chronic pain. The mean pain intensity (SD) among those with chronic pain, measured using the NRS scale, was 3.9 (0.9). Previous injuries that had not been fully rehabilitated were reported by 19 athletes (91%) with chronic pain. Among those affected with chronic pain, the pain was most frequently localized to the lower back (48%), followed by the knee (33%) and thigh (24%) (Table 1).

In this study, 41% of participants reported not consuming any water within the 30 minutes preceding training, and 21% did not consume food within the three hours prior to training (Table 2).

The mean warm-up duration per day ($P < 0.001$), training duration per day ($P = 0.020$), total time involved in the sport ($P = 0.008$), and the presence of inadequately rehabilitated previous injuries ($P < 0.001$) were all significantly higher among athletes with chronic pain compared to those without chronic pain (Table 2).

Discussion

Research on chronic musculoskeletal pain among Karate athletes in Sri Lanka and other countries in the world is limited. Findings from the present study indicate that chronic musculoskeletal pain is prevalent among Karate practitioners, affecting approximately 62% of athletes. Among those, low back pain (48%) and knee pain (33%) were the most common sites of pain. Notably, 91% of athletes with chronic pain reported previous injuries that had not been fully rehabilitated. Furthermore, the mean duration of warm-up, overall training time, years of involvement in the sport, and the presence of inadequately rehabilitated injuries were significantly higher in athletes with chronic pain compared to the control group.

Injuries and pain are frequently reported among Karate players. In this study, athletes described chronic pain in the lower back (48%), knees (33%),

thighs (24%), feet (19%), and neck and shoulders (19%). None reported pain in the head, arms, elbows, forearms, wrists, hands, chest, fingers, hips, ankles, or toes. Supporting these findings, another study involving 100 individuals practising Kyokushin Karate (aged 18–44) also demonstrated that low back pain is common among Karate practitioners [12]. Similarly, a study conducted among 12 athletes from the Polish National Karate team revealed a marked increase in the prevalence of lumbar hypolordosis and posterior pelvic tilt following Karate training sessions and kata stances. These movement patterns were associated with disturbances in the range of internal and external hip joint rotations, reduced lumbar lordosis depth, altered pelvic tilt, and restricted range of motion. Such biomechanical changes may contribute to the development of low back and thigh pain [13]. The findings of Gawel and Zwierzchowska (2024) [13] highlight probable mechanisms underlying the high prevalence of lower back pain observed in the present study.

Some other previous studies have reported different results. According to Tischer et al. (2016), the most affected regions in Karate athletes are the knees (29%), shoulders (23%), and ankles (22%) [3]. Another study involving Karate practitioners reported pain in several body regions, including the arms (30%), neck (18%), head (14%), hands (9%), wrists (8%), shoulders (5%), thighs (4%), forearms (3%), feet (2%), fingers (2%), knees (1%), legs (1%), ankles (1%), back (1%), toes (1%), trunk (1%), and hips (1%), while no pain was reported in the elbows (0%) [12]. Although the prevalence of pain across different body sites in our study shows both similarities and differences compared to previous findings, certain regions—such as the lower back, knees, thighs, feet, and shoulders—emerge as commonly affected. Variations in the prevalence of musculoskeletal injuries among different martial arts disciplines may be attributed to differences in punching, blocking, and grappling techniques, the use or nonuse of protective equipment, training methods, training volume, training conditions, and the availability of medical care. Importantly, injuries in martial arts can be minimized through the use of personal protectors, careful target selection during striking, adherence to proper technique in punching and blocking, and avoidance of training-related errors [8, 14, 15].

Previous injuries appear to be the most common cause of chronic musculoskeletal pain. Any sport-related injury that is inadequately rehabilitated can contribute to the development of chronic pain [8]. Studies conducted in other countries on the prevalence of sports injuries often fail to provide details regarding the number of athletes who complete rehabilitation programs or how many subsequently develop chronic pain. In the present study, 62% of athletes were affected by chronic pain, and among them, 91% had a history of inadequately rehabilitated injuries. The primary reasons for poor rehabilitation were that athletes' inability to adhere to rehabilitation programs due to limited time and financial constraints. Consistent with these findings, another study reported that Karate practitioners rarely seek treatment for pain, with only a small proportion utilizing physiotherapy or pharmacological interventions [12]. Notably, in the present study, 10% of athletes with chronic pain did not have a history of previous injuries, suggesting that repetitive stresses sustained during training may also contribute to the onset of chronic pain.

The effect of exercise volume on muscle activity is one of the most important factors in training, management of injuries and injury risk reduction [16]. In the current study, the mean duration of training session/day (157 minutes/day) and the time period involved with the sport (134.6 months) in athletes with chronic pain was significantly higher [(P= 0.020); (P= 0.008)] than the mean duration of training session/day (117 minutes/day) and the time period involved with the sport (71.6 months) in athletes without chronic pain (Table 2).

Warm up consists of a sub maximal aerobic activity, which helps to increase body and muscle temperature, muscle compliance and efficiency of physiological responses. The aim of warming up prior to training and competition is to maximise performance and prevent injuries. In the current study, the mean duration of warm-up/session in athletes with chronic pain (23 minutes/session) was significantly higher (P = 0.002) than the mean duration of warm-up/session in athletes without chronic pain (15 minutes/session) (Table 2).

The period involved in the sport, total training duration/day and total warm-up duration/day contribute to the training load [8]. High training load, together with the high prevalence of previous injuries

not fully rehabilitated, may be the cause for the development of chronic pain in the present study.

Halabchi et al. (2007) reported that age and weight did not show any association with injury rates among Karate athletes [17]. Fortina et al. (2017) found that height had a negative correlation with the number of injuries in Taekwondo, a sport similar to Karate [18]. They suggested that taller athletes in Taekwondo can reach their opponents more easily while maintaining a safer distance, thereby reducing injury risk [18]. In the present study, however, no significant differences were observed in the mean height and weight of athletes with and without chronic pain (Table 2).

The main pre-training meal should be consumed approximately 180 minutes before commencing physical activity to allow adequate time for digestion and absorption [19]. According to IFSM guidelines, athletes are also advised to have a snack about 30 minutes prior to training to prevent hunger during exercise [20]. Post-training, it is recommended that the main meal be consumed within two hours of completing the session [20]. In the present study, 21% of athletes reported not consuming any meal three hours before training, while 27% did not consume their main meal within the first two hours after training. Nutrients such as proteins and carbohydrates play essential roles in metabolic and physiological processes that enhance performance and support recovery. Importantly, the timing of nutrient intake influences both training outcomes and recovery [21]. Therefore, athletes should be educated on the significance of maintaining a nutritious diet and adhering to proper meal timing.

According to the International Federation of Sports Medicine guidelines, it is useful to consume 500 ml of fluid 2 hours before exercise and again 30 minutes before exercise to minimise the effects of water loss during training [22]. In the present study, 41% of athletes from both groups reported they were not consuming water or fluids within 30 minutes prior to training. Karate involves both endurance and high-intensity exercise, during which dehydration and overhydration are common concerns arising from disturbances in fluid-electrolyte balance. Both conditions can impair exercise performance and may lead to hydration-related illnesses, including hyponatremia [23]. Evidence suggests that a 5% reduction in body mass due to dehydration negatively impacts both dynamic and isometric limb strength [24]. Given the considerable inter-individual variability in sweat rate and electrolyte loss, it is recommended that athletes adopt personalized hydration strategies, regardless of environmental conditions. Such strategies help maintain hydration status between dehydration and over hydration, thereby optimizing physical performance and preventing adverse physiological consequences during high-intensity exercise [25].

Strengths and Limitations of the Study

There is a scarcity of published research on the prevalence of chronic pain among Karate athletes, and no prior studies have been conducted in Sri Lanka on this topic. This study is the first to compare the training characteristics of Karate athletes with chronic pain to those without chronic pain.

However, several limitations must be acknowledged. Due to the absence of advanced radiological investigation methods such as Magnetic Resonance Imaging (MRI) and the high cost associated with such procedures, athletes were not subjected to these investigations. Consequently, the specific anatomical structures involved, and the severity of injuries could not be assessed. Additionally, the inability to directly observe Karate training sessions was another limitation of this study.

Conclusions

This study demonstrates a high burden of musculoskeletal pain among karate athletes, with a substantial proportion experiencing chronic pain. Notably, more than four-fifths of athletes with chronic pain reported previous injuries that were inadequately rehabilitated, emphasizing the critical importance of appropriate injury management and structured rehabilitation. Athletes with chronic pain also reported significantly longer training durations, suggesting that excessive or poorly regulated training loads may contribute to pain chronicity and injury risk. The lower back and knee were the most commonly affected regions, indicating key anatomical areas of vulnerability in karate.

Identifying sport-specific patterns of musculoskeletal involvement provides valuable insights for clinicians, coaches, and trainers, supporting the development of targeted injury prevention, load management, and rehabilitation

strategies to reduce injury risk and long-term morbidity among athletes.

Declarations

The research was funded by the corresponding author's personal funds. We declare that there are no financial or non-financial interests directly or indirectly related to the work submitted for publication.

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Table 1. Comparison of sites of musculoskeletal pain among karate athletes with or without chronic pain

Regions of the body affected with Pain	**Chronic pain present(n=21)**		**Chronic pain absent (n=13)**	
	Number	**%**	**Number**	**%**
Head	0	0	0	0
Neck and shoulder region	4	19	3	23
Lower back	10	48	0	0
Arm	0	0	0	0
Elbow	0	0	0	0
Forearm	0	0	0	0
Wrist	0	0	0	0
Hand	0	0	0	0
Hip and Thigh	5	24	0	0
Knee	7	33	0	0
Leg	0	0	1	8
Ankle	0	0	1	8
Foot	4	19	1	8
Chest	1	5	0	0
Abdomen	0	0	0	0

Table 2. Comparison of age, anthropometric parameters, training habits and prevalence of previous injuries of karate athletes with and without chronic pain

Parameter	**Chronic pain present (n=21**		**Chronic pain absent (n=13)**		**T value**	**P value**
	Mean	**SD**	**Mean**	**SD**		
Age	27.5	5.1	26.7	9.5	0.33	0.74
Mean height in centimeters	166.2	7.1	164.4	7.5	0.71	0.49
					Z value	**P value**
Mean weight in kilograms	64.5	9.7	66.8	12.2	-0.76	0.46
Duration involved in the sport in months	134.6	61.5	71.6	101.6	-2.52	0.008
Training frequency (days/week)	3.1		2.4		-0.59	0.58
Total training duration (minutes/day))	157.1	54.4	117.7	31.1	-2.36	0.020
Total warm up duration (minutes/day)	23.3	9.9	14.5	2.1	-4.02	<0.001
Total stretching duration (minutes/day)	15.5	9.1	13.5	3.2	-0.019	0.998
	Number	**%**	**Number**	%	**Chi Square**	**P value**
Any fluids taken 30 minutes before the event	14	67	6	46	0.559	0.455
Any meals taken 3hours before the event	14	67	13	100	5.457	0.019
Previous Injuries	19	91	1	8	22.7	<0.001