



Prevalence Of Musculoskeletal Problems Among U-14 Karate Students

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Abstract: **BACKGROUND :** Karate is a Japanese martial art that uses striking and kicking techniques with hands, feet, elbows, and knees, as well as blocking and grappling, to develop physical and mental discipline. Karate related musculoskeletal pain are more common in students as continuous intense rhythmic movements of joints take place. Handgrip strength(HGS) is essential for the human body when performing precise hand actions. It is a low-cost method of estimating a persons total upper body strength which may reflect physical activity and general health. Hamstring muscle flexibility is the key component of martial arts training that improves performance and lowers the risk of injury .^[4]

METHOD : A cross sectional study was used. A purposive sample method, composed of 151 karate students between ages of 10 to 14 years in and around Ernakulum(Kerala). The study duration was 3 months. The outcome measures used were Modified Nordic Questionnaire for assessing musculoskeletal pain, Hand held Dynamo-meter for handgrip strength, Active Knee Extension Test(AKE) for assessing Hamstring tightness.

RESULTS : A total of 151 subjects participated in this study. Among them 92 were boys while 59 were girls. In accordance with statistical analyses there is a prevalence in musculoskeletal problems among u-14 karate students. Hips/thighs 29.8% and knees 25.1% were the most often reported pain sites, 59% had hamstring tightness, whereas 41% showed hamstring flexibility and 74% subjects showed normal strength ,21% were weak and 5% had strong handgrip strength.

CONCLUSION: The study revealed that musculoskeletal problems are common among U-14 karate students, limiting their karate involvement and shortening their careers. Understanding the prevalence can aid in preventive training and the development of strategies to reduce the prevalence of musculoskeletal diseases.

KEYWORDS: Musculoskeletal pain, Handgrip strength, Active knee extension test.

I. INTRODUCTION

Martial arts training is a fun, physically challenging sport for people of all ages and abilities. Karate, kickboxing, and other martial arts are excellent activities that can help children develop discipline, focus, strength, and confidence.

Karate is a long-distance fighting sport that typically involves strikes and kicks.[1]If karate could only be described in one statement, it might be: "You never attack first in karate." This is a rule of Gichin Funakoshi (1868-1957), the Okinawan who brought karate to Japan in 1922 and is considered the father of modern karate. Karate is derived from the Chinese characters "kara"(empty) and "te" (hand), resulting in the meaning "empty hand". This means having the freedom to use one's hands against an opponent without resorting to weapons. Karate practitioners use their palms, heels, knees, and elbows to target their opponents' weak points while blocking strikes to their own bodies.^[2]Karate fighters use hand and foot strikes, as well as blocking

skills, to battle. As a result, this sport falls within the category of fighting. Karate moves are controlled, yet there are five sorts of contact: mild, partial, knock down without striking the head, knockdown with striking the head, and free contact ^[2]. There are four main karate styles in Japan: Shotokan, Goju-ryu, Shito-ryu, and Wado-ryu.

The colors of the belts make it easy to determine a person's rank and level of proficiency in karate. The most prevalent colors we come across are white and black. Whereas white indicates the initial level, black represents the actual expert with the highest ranking. Other colors for belts include yellow, orange, red, green, and blue.^[5]

PAIN

Musculoskeletal pain affects the muscles, ligaments, tendons, and bones. Musculoskeletal discomfort can result from a variety of sources. Daily activities might cause muscle tissue injury. Musculoskeletal discomfort can also be caused by local trauma (jerking movements, car accidents, falls, fractures, sprains, dislocations, and direct impacts to the muscle). Other causes of pain include postural strain, repetitive movements, overuse, and prolonged immobilization. Poor posture or body mechanics can cause spinal alignment issues and muscular shortening, leading to pain and misuse of other muscles. While biological definitions of pain may suggest that pain is 'good' if it serves as a warning sign of damage or illness, it is 'bad' when it fails to do so and the pain persists in the absence of or out of proportion to the pathology. Karate trainees frequently experience musculoskeletal pain due to sudden injury, overload, and repetitive joint movements during training. The compliance and location of musculoskeletal pain appear to be caused by compensatory changes in the musculoskeletal structures as a result of karate training.

HANDGRIP STRENGTH

Grip strength refers to the hand's ability to pull or suspend items, and is a subset of overall hand strength. It can be used as a screening tool to assess upper-body and overall strength. Handgrip strength (HGS) is a measure of overall strength. It is an essential component of several combat sports. Strength, particularly handgrip strength, plays a crucial role in combat sports. Karate includes kata, punches, and kick strikes. Higher HGS correlates with more assaults and increased effectiveness in karate contests.^[1] Strength is an important statistic in karate that serves to quantify fighting performance as well as upper-limb strength. Gender and hand dominance influence the strength of a person's grip. Regular participation in hand sports can strengthen one's non-dominant hand, regardless of gender.^[1] To throw powerful high kicks with precision, a martial artist must be both strong and flexible. Proper hip and hamstring flexibility allows for the execution of outstanding head-level kicks and full-range moves at rapid speeds, giving you a strategic advantage in karate.^[4]

II.NEED OF THE STUDY

Karate is a long-distance combat sport, primarily using strikes and kicks. Top level karate performance require a high fitness level. The compliance and location of musculoskeletal pain seem to result from compensatory changes that occur in the musculoskeletal structures as a result of karate training^[3]. Handgrip strength is an important metric used in karate and helps to measure their performance in fighting and strength of their upper limb. Gender and hand dominance impact the strength of a person's grip. Participating in hand sports regularly can increase the strength of a person's non-dominant hand, regardless of gender^[1]. Karate kicks include all attacks performed with the legs or feet. Since the muscles of the leg are much larger and stronger than the muscles of the arm, kicking techniques are generally more powerful than hand technique. It is very important to practice proper kicking techniques as incorrect technique can cause knee injuries. Hamstring flexibility is important for the execution of high kicks and adequate range of action at high speeds^[4] We focus on the awareness of the prevalence, mechanisms, and effects of injuries, which aims to take children under 14 to the next level by reducing the tendency to quit, as many children leave sessions due to a lack of knowledge about warm-ups and proper flexibility training, which eventually leads to injuries and pain. As we aim to continue the success of karate at the first-class multi sport event in the continent, like the Asian Games 2022. It's our responsibility to make them aware of the proper ergonomics and interventions to prevent injuries so that they can be more efficient in this sport event to represent India in the upcoming Olympic games. There is scarcity of literature about U-14 karate students. Thus it raises the importance of this study to find out the prevalence

of musculoskeletal pain, hand grip weakness and hamstring tightness between boys and girls karate students of white, yellow and orange belts among U-14 age category.

III. RESEARCH METHODOLOGY

- ❖ **STUDY SETTING** :- Alan Thilak International Karate school (Affiliated by kerala karate association, Recognized by: kerala state sport council & kerala Olympic association)
- ❖ **STUDY DESIGN** :-Cross sectional study
- ❖ **SAMPLING TECHNIQUE** :-Purposive sampling
- ❖ **SAMPLE DURATION** :-3 Months
- ❖ **SAMPLE SIZE** :-151

IV. CRITERIA

INCLUSION CRITERIA

1. Age – Under 14
2. Both genders
3. Subjects with White, yellow and orange belt.
4. Subjects who are willing to participate.

EXCLUSION CRITERIA

1. Karate students who are not within the age limit.
2. Subjects having any congenital, neurological conditions.
3. Subjects who underwent surgeries or recent fractures.

V. OUTCOME MEASURES

- ❖ **MODIFIED NORDIC QUESTIONNAIRE**
- ❖ **HAND GRIP STRENGTH DYNAMOMETER**
- ❖ **ACTIVE KNEE EXTENSION TEST**

PROCEDURE

We collected our data from ALAN THILAK INTERNATIONAL KARATE SCHOOL (Affiliated by Kerala karate association, recognized by: Kerala state sport council & Kerala Olympic association), ERNAKULAM DISTRICT OPEN KARATE CHAMPIONSHIP-2024 and ST. GEORGE'S UP SCHOOL POONITHURA. The subjects were carefully selected based on the inclusion and exclusion criteria, and the respondent provided consent to participate in the study. We introduced ourselves individually and briefly discussed the goal of the study to the subjects who fit the criteria. The individuals were initially requested to fill out a demographic questionnaire (including the belts of Karate training and years of practice). The Modified Nordic questionnaire was used to quantify musculoskeletal discomfort, a hand-held dynamometer to assess hand grip weakness, and an active knee extension test for hamstring flexibility.

MATERIALS USED

1. Pen
2. Demographic sheet
3. Copy of Modified Nordic questionnaire
4. Goniometer
5. Hand Held Dynamo-meter
6. Yoga Mat

MODIFIED NORDIC QUESTIONNAIRE

The 40 forced choice items in the Modified Nordic Questionnaire (NMQ) are a generic questionnaire designed to identify the parts of the body that are responsible for musculoskeletal issues. A body map that shows the nine symptom sites -the neck, shoulders, upper back, elbows, low back, wrists and hands, hips and thighs, knees, and ankles and feet – helps with completion. Questioners are asked if they have experienced any musculoskeletal problems in the past week or 12 months that have interfered with their ability to do daily tasks. Further inquiries about the shoulders, lower back, and neck elucidate crucial matters. A set of twenty-five forced-choice questions is used to extract information about any incidents that have affected each area, the functional impact at work and home (such as a change in job or duties), the length of the problem, and the best way to diagnose MSD complaints.

TROUBLE WITH THE LOCOMOTIVE ORGANS														
To be answered only by those who have had trouble														
Have you at any time during the last 12 months had trouble in:			Have you at any time during the last 12 months been prevented from doing your normal work because of the trouble?		Have you had trouble at any time during the last 7 days?		Have you ever hurt your body part in an accident?		What is the total length of time that you have had trouble during the last 12 months?				Have you been seen by a doctor because of trouble during the last 12 months?	
	YES	NO	YES	NO	YES	NO	YES	NO	17 days	1-30 days	More than 30 days	Empty	YES	NO
Neck	YES	NO	YES	NO	YES	NO	YES	NO					YES	NO
Shoulders	YES	NO	YES	NO	YES	NO	YES	NO					YES	NO
Upper Back	YES	NO	YES	NO	YES	NO	YES	NO					YES	NO
Elbows	YES	NO	YES	NO	YES	NO	YES	NO					YES	NO
Wrists/Hands	YES	NO	YES	NO	YES	NO	YES	NO					YES	NO
Lower Back	YES	NO	YES	NO	YES	NO	YES	NO					YES	NO
Hips/Thighs	YES	NO	YES	NO	YES	NO	YES	NO					YES	NO
Knees	YES	NO	YES	NO	YES	NO	YES	NO					YES	NO
Ankles/Feet	YES	NO	YES	NO	YES	NO	YES	NO					YES	NO

HANDGRIP STRENGTH MEASUREMENT

By using **HANDHELD DYNAMOMETER**, With the elbow by the side of the body and the arm at a straight angle, the subject holds the dynamometer in the hand that will be tested. The dynamometer’s handle can be adjusted as needed; the handle should lie in the middle of the four fingers, while the base should rest on the first metacarpal, or palm heel. When prepared, the individual applies maximum isometric force to the dynamometer and holds it there for approximately five seconds. Other motions of the body are prohibited. It is important to aggressively encourage the subject to put up their best effort.



For boys:-

AGE	WEAK	NORMAL	STRONG
10 – 11	<12.6	12.6 – 22.4	>22.4
12 – 13	<19.4	19.4 – 31.2	>31.2
14 – 15	<28.5	28.5 – 44.3	>44.3

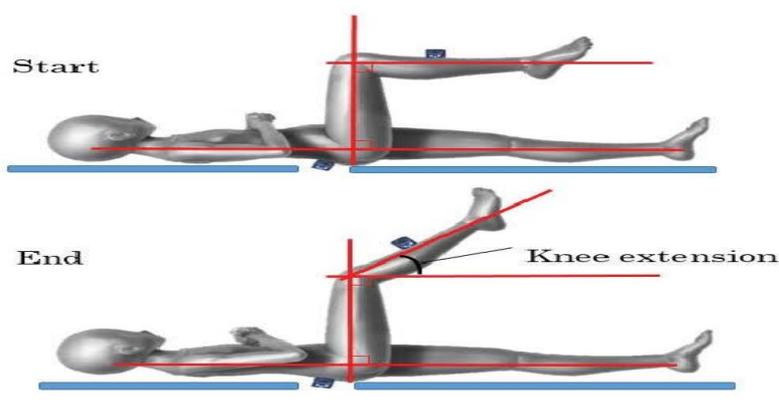
For girls:-

AGE	WEAK	NORMAL	STRONG
10 – 11	<11.8	11.8 – 21.6	>21.6
12 – 13	<14.6	14.6 – 24.4	>24.4
14 – 15	<15.5	15.5 – 27.3	>27.3

ACTIVE KNEE EXTENSION

TEST

The active knee extension test (AKE Test) measures hamstring muscle tightness. The subject should lie supine, with their hips and knees flexed to 90 degrees and the lumbar spine as neutral as possible. Ask the patient to hold their legs in this posture by holding the back of the thigh (just above the back of their knee). Ask the person to actively extend (straighten) their knee. A lag of 20 degrees from full extension is regarded normal, but less than 20 degrees indicates hamstring tightness.

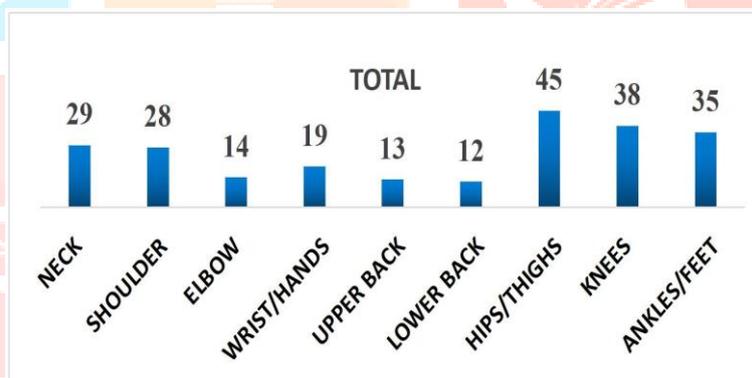


VI. STATISTICAL ANALYSIS

PREVALENCE OF MUSCULOSKELETAL PAIN

REGION	FREQUENCY	PERCENTAGE
NECK	29	19.2%
SHOULDERS	28	18.5%
ELBOWS.	14	9.2%
WRISTS/HANDS	19	12.5%
UPPER BACK	13	8.6%
LOW BACK.	12	7.9%
HIPS/THIGHS	45	29.8%
KNEES	38	25.1%
ANKLES/FEET	35	23.1%

TABLE 1: Distribution of prevalence and location of musculoskeletal pain.

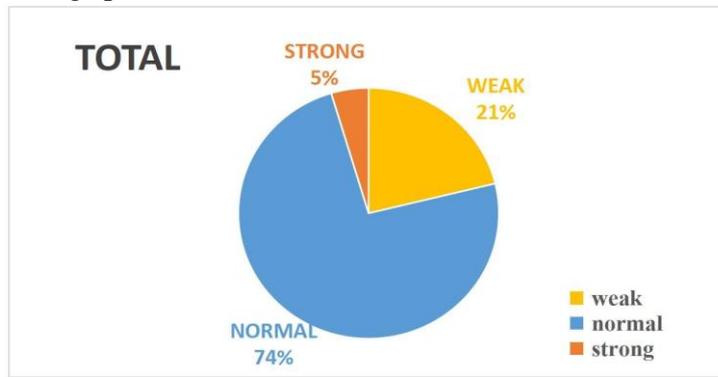


GRAPH-1: Distribution of prevalence and location of musculoskeletal pain. The above graph shows frequency of MSK pain among different body regions.

PREVALENCE OF HANDGRIP WEAKNESS

HAND GRIP STRENGTH	FREQUENCY	PERCENTAGE
WEAK	32	21%
NORMAL	112	74%
STRONG	7	5%

TABLE 2: Prevalence of handgrip weakness

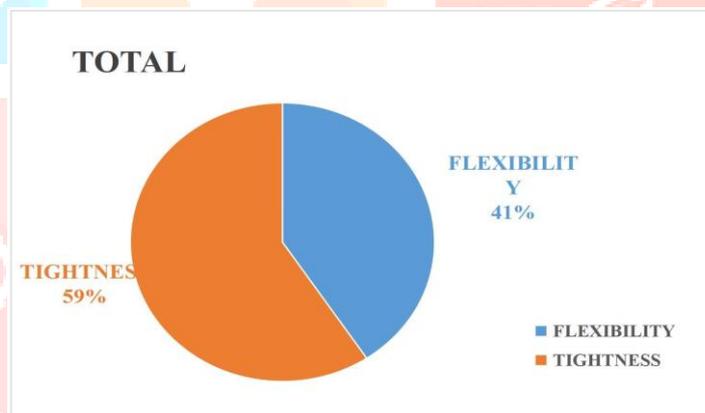


GRAPH 2: Prevalence of handgrip weakness in percentage

PREVALENCE OF HAMSTRING TIGHTNESS

HAMSTRINGMUSCLE PERCENTAGE	FREQUENCY	
FLEXIBILITY	61	41%
TIGHTNESS	90	59%

TABLE 3: Prevalence of hamstring tightness



GRAPH 3: Prevalence of hamstring tightness in percentage

VII.RESULT

- 1) This study was carried out in 151 karate students between ages of 10 to 14 years in and around Ernakulum(Kerala).
- 2) Modified Nordic Questionnaire demonstrate that musculoskeletal pain occurred in 83.4% of U-14 Karate students out of 151 subjects.
- 3) HGS was assessed using dynamometric hand force measurements. Out of 151 participants ,21.1 % had weak ,74.1% had normal and 4.6 % had strong HGS.
- 4) Hamstring flexibility using an active knee extension test. Out of 151 participants, 60% had hamstring tightness, whereas 40% have hamstring flexibility.

VIII.DISCUSSION

The primary purpose of this study was to determine the prevalence of musculoskeletal problems among U-14 karate students. There are few research on karate students in India, despite the fact that many championships and tournaments are held in our country and thousands of students participate in this sector. The present study provides insights into the prevalence of musculoskeletal pain, prevalence of handgrip weakness and prevalence of hamstring tightness among u-14 Karate students.

Our findings while assessing with Modified Nordic Questionnaire demonstrate that musculoskeletal pain occurred in 83.4% of U-14 Karate students out of 151 subjects. In our NMQ-7-based study, thighs and knees are the most often reported regions of pain, which is compared with the findings of a previous study conducted by Eliza Gawel et al.^[3] On the topic “Acute and long-term effects of Olympic Karate kata Training on structural and functional changes in the body posture of Polish National Team Athletes” found knees and wrists to be the most frequently reported locations of pain, followed by the lower back and ankles/foot. The study came to the conclusion that the location of the long-term musculoskeletal symptoms appeared to be caused by compensatory modifications brought about by karate training in the musculoskeletal Structure.

Handgrip strength is an essential metric used in sports to assess athletes' conditions. It is a popular fitness test in judo and karate that assesses upper limb strength. It is influenced by a variety of factors, including athletes' age, talents, and years of training. In our study, we evaluated 151 Karate players based on their age, years of training, and skills (belt grade). HGS was assessed using dynamometric hand force measurements. Out of 151 participants, 21.1 % had weak, 74.1% had normal and 4.6 % had strong HGS. A study by Dariusz S Bajkowski^[1] examined factors affecting hand grip strength in martial arts. It found that age, training history, and ability level affect HGS. Years of practice resulted in higher scores. Older athletes had lower effects on HGS, while younger athletes benefitted from longer preparation periods and more intense training.

In this study, we assessed hamstring flexibility using an active knee extension test. Out of 151 participants, 60% had hamstring tightness, whereas 40% have hamstring flexibility.

Hamstring tightness also limits knee flexion during activities and increases quadriceps efforts to overcome the hamstring's passive resistance this can increase the response forces at the patellofemoral joint, resulting in knee pain. Hamstring tightness were more in U-14 karate students (60%) and this maybe due to prolonged sitting and sedentary lifestyles in children of this age group[Nesma M Allam]^[8]. This is an issue which needs immediate attention or it can lead to bigger health issues in adulthood. In a research on the topic of “physical and physiological profile of elite karate athletes,” Helmi Chaabene et al^[4]. They assessed knee flexion and extension, hip flexion and extension, hip medial rotation, hip lateral rotation, dorsiflexion, plantar flexion, and foot inversion and eversion in both karate practitioners and control subjects. In terms of other measured variables, especially the hamstrings, they found that the karate group was no more flexible than the control group. Additionally, a study conducted by Dr. Kiran Jeswani et al^[7]. On topic “prevalence of hamstring tightness among school children between 7-15 years of age” discovered that the prevalence of hamstring tightness was significantly higher in girls than in boys, with a total frequency of 88.2% and 84.6%, respectively.

According to our study, the most painful locations were the hips/thighs(29.8%) and knees(25.1%). It could be due to compensatory changes that occur in the musculoskeletal structures due to karate training[Eliza Gawel]^[3] or it could be related to hamstring muscle tightness(60%). Hamstring tightness also limits knee flexion during activities and increases quadriceps efforts to overcome the hamstring's passive resistance this can increase the response forces at the patellofemoral joint, resulting in knee pain. Hamstring tightness were more in U-14.

IX.CONCLUSION

The study revealed that musculoskeletal problems are common among U-14 karate students, limiting their karate involvement and shortening their careers. Understanding the prevalence can aid in preventive training and the development of strategies to reduce the prevalence of musculoskeletal diseases. Proper knowledge of warm-up sections, flexibility training, and strengthening exercises helps to prevent injuries, so improving their career.

X. LIMITATION

- ❖ Less availability of getting pure amateur karate students
- ❖ Unwillingness of the participants was a major problem in conducting the study.
- ❖ Age group below 10 and above 14 were not considered in our study.
- ❖ The study is conducted only in Ernakulam.
- ❖ Manual errors may have been present while conducting the study
- ❖ The collected data consisted of majority of male population, Females were less in number.

XI. FUTURE SCOPE

- ❖ Study can be conducted by including age groups of above 14 and below 10
- ❖ Separate correlation can be done for boys and girls
- ❖ Study can be conducted all over other places including other districts of Kerala
- ❖ Subjects of other color belts in karate can also study together.
- ❖ Sample size can be increased
- ❖ Core muscle strength can be measured as students complained about pain in the abdominal region

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