Effect of Kinesio taping on calf muscle fatigue and functional performance in amateur athletes

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Abstract-
Background: Athletes encounter fatigue both in ordinary life and in sports. Fatigue can be defined as the reduced ability of a muscle to generate force during a contraction that gradually develops after the onset of prolonged physical activity.
The potential mechanisms of muscle fatigue include the accumulation of metabolites within the muscle and the generation of insufficient of motor commands from the motor cortex during the exercise. Severe muscle fatigue can significantly reduce sports performance and joint stability as well as increases risk of sports injury. Kinesio tape is becoming popular among athletes to improve their performance, especially after Olympic athletes started using it.
Methodology: There were total 50 participants 25 in each group. Group A was experimental group in which the kinesiotaping was done over calf muscle with 50% tension & in group B kinesiotaping with 0% tension was done. Pre and post heel rise test was done in both the groups. In both the groups kinesio taping with Y strip facilitatory technique is used.
Results: Mean and standard deviation for group A post 0 (10.56±2.96), post 5 (3.92±2.71) and group B post 0 (3.6±2.24) post 5 (2.28±1.37). P value is <0.0001 which is extremely significant.
Conclusion: The present study concludes that the Kinesio taping application with 50% tension has immediate as well as long term effects in reducing fatigability in calf muscle when compared to no tension Kinesio taping.

Keywords: **Kinesio tape, athletes, fatigue.**

INTRODUCTION

Muscle fatigue is defined as a transient reduction in the capacity to perform physical action. Kinesio Taping Method is a therapeutic tool utilized by rehabilitation specialists in all programs (paediatric,[1] geriatric, orthopaedic,[2] neurological, oncology and others) and levels of care (acute care,[3] inpatient rehabilitation,[4] outpatient, home care and Day Rehab).
The idea of using elastic tape to mimic the therapist's hands was first presented by Dr Kenzo Kase in the 1970s.
Four different types of Kinesio Tex Tape are used with the Kinesio Taping Technique, each with unique qualities made for use on delicate, sensitive skin or applied with higher tensions.
The tape can be applied using various shapes, such as an “I”, “Y”, “X”, “fan”, “web”, and “donut”. The “Y” technique is the most common used when facilitation or inhibition of a muscle is desired. Depending on the intended outcome, the "Y base "'s is applied around 2 inches beyond the muscle's insertion or origin. The "Y" tails are then inserted so that they enclose the muscle.(5) Taping is frequently used to treat muscles, either from the insertion to the origin or from the origin to the insertion. the modulation of muscle activity by two inhibitory and facilitatory techniques. Thus, the application of KT from insertion to origin is postulated to inhibit muscle activity by stretching the Golgi tendon organ. In contrast, applying KT from origin to insertion can facilitate muscle activity by stimulating the muscle spindle.[6,7]The muscle would be taped from insertion to origin to restrict muscle function in cases of muscle spasms or fatigue. [8] In both daily living and athletic competition, athletes experience tiredness.
With the start of sustained physical exercise, fatigue is the steadily declining ability of a muscle to generate force during a contraction.(9) The buildup of metabolites within the muscle and insufficient motor cortex-generated signals during exercise are two proposed reasons for muscle fatigue.(10) In addition to increasing the risk of sports injuries, severe muscular tiredness can drastically lower sports performance and joint stability. Fatigue has a number of detrimental effects, including lower strength, agility, balance, and a higher chance of injury, all of which contribute to poor sports performance. Athletes are increasingly using kinesio tape (KT) to boost their performance, especially since Olympic athletes started using it. KT reduces inflammation and promotes joint movement by improving blood flow and lymph circulation.

Sports performance is hampered by fatigue because it reduces muscle strength, balance, agility, and has higher chance of injury. Many researches have looked at how Kinesio Tape (KT) application affects muscular fatigue, although conflicting results have been found. According to certain studies, regardless of subject deception and variations in tape tension, KT administration does not immediately improve functional performance in healthy people who are pain-free from muscle exhaustion. This could be as a result of the individuals' superior functional performance and absence of pain. Nonetheless, KT has an impact on functional performance in people with pain brought on by muscular fatigue, and KT may assist alleviate pain.

Another claimed property of KT, given its application direction, is the modulation of muscle activity by two inhibitory and facilitatory techniques. Thus, the application of KT from insertion to origin is postulated to inhibit muscle activity by stretching the Golgi tendon organ. In contrast, applying KT from origin to insertion can facilitate muscle activity by stimulating the muscle spindle.[6,7]

NEED FOR STUDY

Due to the lack of sufficient clinical and scientific evidence, the effects of KT on functional performance, particularly on muscular strength, endurance, and fatigue, remain debatable. As a result, no definitive scientific evidence has yet been reached regarding the impact of KT.

However, there is little research and literature on the long-term effects of kinesiology taping and on gender comparisons.

RESEARCH QUESTION

Does Kinesio taping have any effect on calf muscle fatigue in amateur athletes?

HYPOTHESIS

Null Hypothesis:

There was no significant difference in effect of kinesio taping on calf muscle fatigue in amateur athletes.

Alternate Hypothesis:

There was significant difference in effect of kinesio taping muscle fatigue in amateur athletes.

AIMS AND OBJECTIVES

Aim of the study:

1. To find out immediate and long-term effect of kinesiotaping on calf muscle in both amateur male and female athletes.

Objective of the study:

1.To find out immediate effect(30min) of 50% tension of kinesiotape on calf muscle fatigue in amateur athletes.
2.To find out long term effect(120 hrs) of 50% tension of kinesiotape on calf muscle fatigue in amateur athletes.
3.To compare immediate and long term effects of kinesiotape in both male and female amateur athletes.

METHODOLOGY

Source of Data: Students of Pravara institute of medical sciences, Loni.
Study setting: DR. APJ Abdul Kalam College of Physiotherapy
Study Design -Pre post study
Study Type- Experimental Study
Sample size: 50
Target population: Athletes of age group between 18-25 years (both male and female) having calf muscle fatigue.
Sampling Method: Simple Random Sampling
Study Duration: 6 months
Materials to be Used:

- Kinesio tape
- Metronome

SELECTION CRITERIA

- **Inclusion Criteria:**

ːipants were ready to give written consent
ipants with calf muscle fatigue
ːur athletes
8-25 year old
ɡenders

➢ **Exclusion Criteria:**

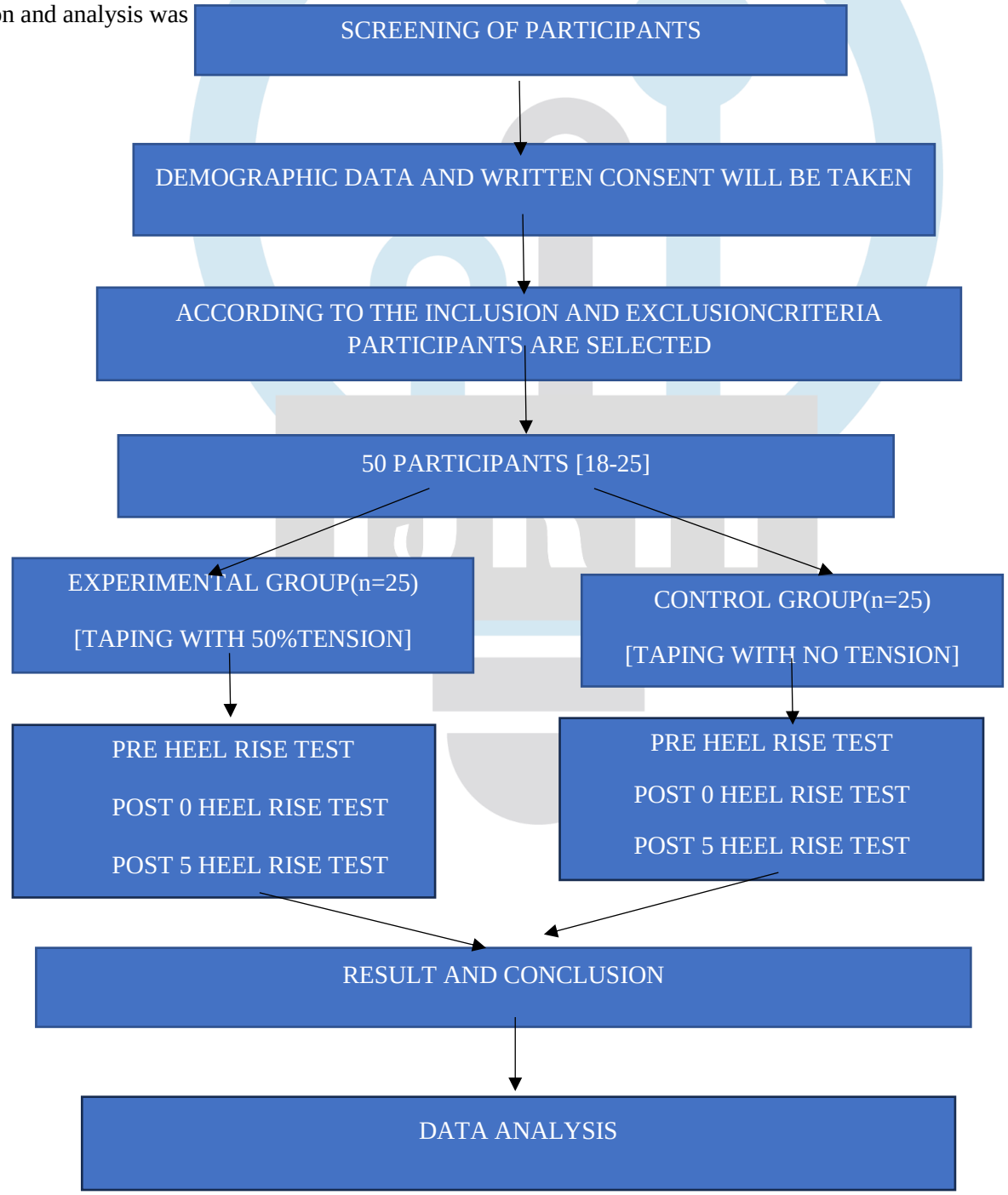
- Open wounds
- Allergies to kinesiotaping

OUTCOME MEASURES

1. Heel Rise Test

PROCEDURE

Protocol was prepared and ethical approval was taken from the institutional ethicalcommittee. 50 participants were included according to the inclusion criteria. All the participants were explained about the study and written inform consent form was signed by each one of them. 50 Participants were included and were randomized into two groups. Out of 50, 25 participants were divided into GROUP A i.e., experimental group and 25 were divided into GROUP B i.e., control group. Pre intervention data was collected. Post data of all outcome measures was collected after 5 days of duration and analysis was



INTERVENTION

50 Participants were selected according to the inclusion criteria and randomizedinto two equal groups. Group A which was experimental group and Group B was control group. Informed consents were taken from all subject from both the groups. The Heel Rise Test was measured before the intervention. Experimental Group received kinesiotaping with 50% tension. Control group received only kinesiotaping with 0% tension.

GROUP A (Experimental Group)

Participants were asked to lie prone on a couch with both lower limbs straight and feet off the edge of the couch with a towel placed underneath the feet. Kinesio tape was applied in the form of a Y-strip with 50% stretch over the calf muscle region. Three points, that is, proximal, mid, and distal, were marked with a pen over the skin with the ankle at maximum dorsiflexion. The proximal point marked 4cm below the popliteal line, which denoted the origin of the calf muscle, and the distal point at 3cm below the upper part of the posterior tuberosity, which indicates the insertion of the calf muscle, and the midpoint at the mid of proximal and distal points. The following sequence was used for tape application: the tape must cut into a Y strip, the ankle joint kept in a neutral position, and both proximal ends of the Y strip placed at the proximal line over the lateral borders of the calf muscle, now participants were asked to perform maximum dorsiflexion at the ankle, then the proximal halves of both strips should be stretched to 50% and placed up to the midpoint, while maintaining ankle dorsiflexion, the distal halves of the Y strip also stretched to 50% and placed from the midpoint to the upper part of the posterior tuberosity of the calcaneus and now ankle brought to the neutral position, and distal ends of the strip placed without any tension at the distal line.[11]

GROUP B (CONTROL GROUP)

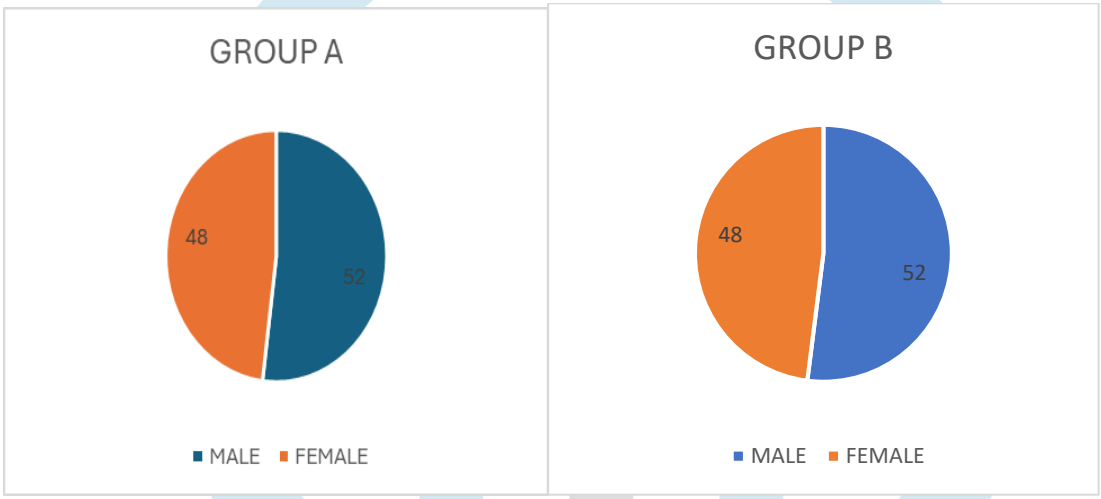
Y-strip KT was applied similarly as in group A from the origin of calf muscle near the knee joint to its insertion near the heel but without any tension. The same reference points were marked and used for tape application.

DATA ANALYSIS

Results were analyzed on basis of data obtained pre and post intervention using Graph Pad Instat application. Descriptive statistics for all outcome measures expressed as means, standard deviations and test significance such as paired t test used to compare data within each group and unpaired t test for comparing the databetween groups. Total 60 participants were selected according to the inclusion criteria. Participants were divided into two groups 30 each. Group A (Experimental Group) received Elasticband exercises and Conventional Stretching. Group B (Control Group) received only Conventional Stretching Exercises.

TABLE NO 1 Gender distribution of participants in both the group.

e	A	B



Graph No 1: - Graph showing distribution of male and female in group A and group B

TABLE NO 2: AGE WISE COMPARISON OF MEAN SCORE OF GROUP A AND GROUP B

	P A	P B
	2.07	2.06

Graph No 2 Graph showing comparison of age in group A and group B

TABLE NO 3: - PRE AND POST COMPARISON OF MEAN-SCORE OF HEEL RISE TEST OF GROUP A

ne Measure	±SD)	±SD)	±SD)		cance
ise Test	8.95	10.92	8.57		ely significant

TABLE NO 4: PRE AND POST COMPARISON OF MEAN SCORE OF HEEL RISE TEST OF GROUP B

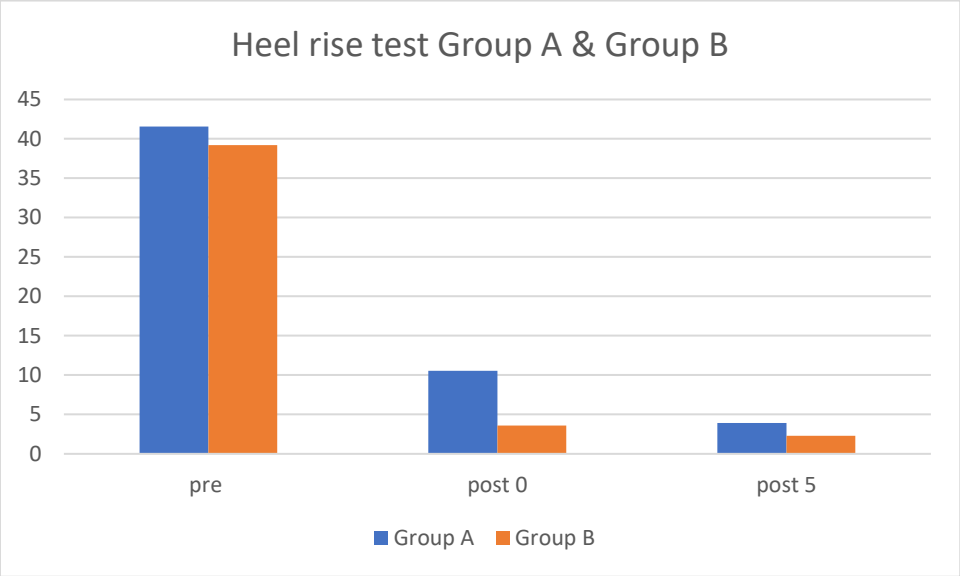
GROUP B HEEL RISE TEST					
ne Measure	±SD)	±SD)	(mean±SD)		cance
ise Test	.22	.59	8.18		nificant

Graph No 3 Graph showing comparison of heel rise test

Graph No 4 Graph showing comparison of Heel rise test for group B

TABLE NO 5: POST COMPARISON OF MEAN-SCORE OF HEEL RISE TEST OF GROUP A AND GROUP B

P A & GROUP B						
ne e	±SD)		±SD)			cance
se test	A	B	A	B	1	ıely significant
	2.96	24	.71	.37		



Graph No 5 Graph showing pre, post 0, post 5 Heel rise test comparison of Group A and Group B

RESULT

Total 50 people participated out of which 25 participants (Group A) were given kinesiotaping with 50% stretch on calf muscle and 25 participants (Group B) were given kinesiotaping with 0% stretch on calf muscle.

Among 50 participants heel rise test was the outcome measure. Age group taken was 18-25 years.

The statistics Mean and standard deviation for pre-test value of heel rise test for group A was 41.56±8.95 and post 0 value is 52.12±10.92 whereas post 5 value is 44.52±8.57. P value is 0.0006 which is extremely significant.

Mean and standard deviation for pre-test value of group B for heel rise test is 39.2±8.22 and post 0 value is 42.8±8.59 whereas post 5 value is 39.92±8.18. P value is 0.2770 which is not significant.

Mean and standard deviation for group A post 0 (10.56±2.96), post 5 (3.92±2.71) and group B post 0 (3.6±2.24) post 5 (2.28±1.37). P value is <0.0001 which is extremely significant.

DISCUSSION

This study was done to examine the effects of two different techniques of applying kinesio tape on calf in two different groups one with 50% stretch and another with 0% stretch. The taping was done with the view to improve functional performance in athletes and reducing the risk of fatigue in them. The 50 collegiate athletes were chosen as per the inclusion criteria and randomly divided into Group A kinesio taping with 50% tension and Group B kinesiotaping with 0% tension.

In this study ANOVA was used to show the statistical difference in both group A and group B. The test showcases that there was extremely significant improvement in heel rise group A on post 0 (52.12±10.92, p value- <0.0001, t value- 17.843) and post 5 (44.52±8.57, p value- 0.0003, t value- 3.927). Group B showcases extremely significant improvement in heel rise on post 0 (42.8±8.59, p value- <0.0001, t value- 8.050) and post 5 shows not significant difference (39.92±8.18, p value- 0.0848, t value- 1.416).

Comparative analysis was done between Group A and Group B to find out the effectiveness on calf muscle fatigue.

The results of the present study indicate that the mechanism associated with muscle fatigue is influenced by the specific application of KT. One of the possible explanations could be that KT may improve intramuscular blood flow. When

muscles contract isometrically beyond 20% of maximum voluntary contraction, blood flow inside intramuscular capillaries is reported to decrease to 30 to 40 mm Hg[12].Thus oxygen supply is reduced and algogenic substances such as bradykinin and lactate are not drained[13]. It is hypothesized that lymphatic drainage and blood flow improve after applying KT to muscles[8][14].

KT is assumed to improve blood circulation because it stimulates the autonomic nervous system, causing vasodilation in the area where KT is applied. Therefore, this improved lymphatic drainage and blood flow may increase oxygen supply and help to remove an increased amount of lactate and bradykinins, thus increasing muscle resistance to fatigue. Another mechanism proposed to support the role of KT in decreasing pain after fatigue is the facilitation of pain-gate control theory.

In addition to the mechanisms mentioned above, some placebo factors could contribute to muscle resistance to fatigue. Applying KT can psychologically affect individuals, causing changes in their expectations and behavior that may lead to more positive performance[15].

One potential mechanism of KT is that motor neuron threshold reductions can be induced by skin irritation, resulting in easier recruitment of motor units and improved functional performance. In addition, KT is effective in pain control management by inhibiting muscle activities[16].

Some contradictory findings were seen Lee et al reported that KT does not have significant positive effects on self-perceived fatigue level, muscle endurance, strength, and power[17]. Some studies did not report an immediate increase in strength, functional performance after application of taping[18][19][20][21]. It could be possible because of participants pain-free state and strong functional performance[22].

As a result of fewer Ia afferents, tactile input from KT can inhibit muscle weakness and decrease muscle activities. However, in people who are not injured, tactile stimulation from KT is insufficient to increase muscle strength. Konishi's study found that functional performance was more closely linked to muscle strength[22].

Our findings are consistent with the findings of a prior study that found that when applied with 0% tactile input from KT, muscle power, which affects VJH after 5 days, was not sufficiently improved[21].

When KT was applied to the calf muscle, it increased the resistance of the muscle to fatigue, therefore, KT can be applied to the calf muscle when athletes want to delay fatigue in this muscle. The results of the present study also have clinical implications, as the results indicate that KT when applied under tension, can significantly reduce the fatigability of the calf muscle therefore, it can be used in clinical settings and sports activities to enhance muscle function and thus improve the overall performance of individuals[22].

According to Dr. kenzo kase taping has mechanical effect which says when tape is applied over skin the recoil of kinesio tape creates a lifting motion over compressed pain receptors, blood vessels, lymphatic fluid. This creates space between the top layer of the skin and underlying tissues. This reduces pressure on pain receptors within skin, and reduces resistance to lymphatic drainage[8]. Thus when kinesio taping was applied with 50% tension the deep fascia is lifted up and effects were seen in experimental group both post 0 and post 5. The kinesio taping with 0% tension did not showed significant result because the tension created was not enough to generate effects for post 5 days.

CONCLUSION

The present study concludes that the Kinesio taping application with 50% tension has immediate as well as long term effects in reducing fatigability in calf muscle when compared to no tension Kinesio taping. Also, we conclude that effect is more immediately after 30 minutes of application. Although we found that there is long term effect of Kinesio taping with 50% tension, it was less compared to immediate effect. Hence, we recommend use of Kinesio taping with 50% tension for calf muscle fatigue in athletes.

CLINICAL IMPLICATIONS

Kinesio taping with 50% tension is useful in reducing fatigue of calf muscles. It can be used in clinical set ups for patients with calf injury. Further it should be used in the athletes during their training and active sports injuries to reduce fatigue. Preventive Kinesio taping may help to reduce incidence of calf injuries due to overloading fatigued muscle.

LIMITATIONS AND STRENGTH

Small percentage of student athletes were tested with limited sample size. The gender was not considered during the statistical analysis. The variable used for outcome measure was only one.

Despite these limitations, this study has several strengths it investigated immediate and long-term effects of kinesiotaping and our study had both male and female participants.

RECOMMENDATION & FUTURE SCOPE

Further studies should include more outcome measures. Similarly, comparison between response of males and females can be further evaluated. Future studies can be focus on use of Kinesio tape on fatigue in the field injuries of athletes.

We also recommend that Kinesio tape for calf muscles with minimum 50% of tension can be used in athletes to reduce muscle fatigue while training as well as active sports.

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