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*Original research papers*

# EFFECT OF KINESIO TAPING ON SPRINT AND JUMP PERFORMANCE IN ACTIVE CHILDREN: A RANDOMIZED CROSSOVER TRIAL

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**Abstract**
***Introduction.*** The study investigated the effects of Kinesio taping on 30 m sprint and counter movement jump (CMJ) performance in active children. ***Material and Methods.*** Using a randomized crossover design, 28 healthy active children (12 girls, 16 boys) from a triathlon school participated in the study voluntarily. The two sessions were performed with an interval of three days to avoid accumulation of the Kinesio taping effects. ***Results.*** The ANOVA results for the counter movement jump test averages indicated statistically significant differences in favor of Kinesio taping condition ($F(1, 19) = 12.383$, $p = 0.002$; $\eta2 = 0.395$; $p = 0.916$). However, the ANOVA results for the sprint test averages revealed no statistically significant differences in 0-15 m, 15-30 m, and 0-30 m. ***Conclusions.*** Kinesio taping on the triceps surae does not seem to affect the sprint performance in apparently healthy active children, but it does affect the counter movement jump test.

**Key words:** I-technique, calf muscles, triceps surae, 30 m running sprint test, counter movement jump

## Introduction

Currently, one of the most popular treatments used by athletes to improve the quality of their motion and to aid in injury prevention is kinesio taping (KT) [1]. It is increasingly used by physical therapists and trainers to improve athletic performance and prevent injuries [2]. It is applied over muscles to prevent muscle over-contraction during the competition [3]. Elastic tape applied on the triceps surae has been commonly used by athletes to improve the performance of lower extremities [4, 5]. Sprinting and sports performance require great acceleration which depends heavily on muscular strength and power [6]. Leg extensor strength revealed a significant relationship with vertical jumping performance [7].

Although there are several suggested benefits of KT on athletic performance, research regarding the effect of KT on some aspects of performance is contradictory [8]. Cai et al. [9] found no significant differences in the maximum grip strength between facilitatory KT, inhibitory KT, and tapeless conditions application on wrist extensor muscles. Annino et al. [10] found no differences in jumping with KT applied over quadriceps and no tape condition in healthy soccer players. Dae-Young & Byoung-Do [11] found that taping of the quadriceps femoris muscles of healthy college students affected anaerobic muscle power. It suggests that KT influences athletic performance capacity. Fukui, Otake & Kondo [12] found greater muscle strength of the gluteus maximus with facilitatory KT application compared with inhibitory, sham and no tape condition. Karmin & Çimen [13] concluded that the KT application onto the peroneal muscles in 8-12 age-group tennis players had a statistically significant effect on agility and vertical jump performance.

Research concerning the effect of KT attached on triceps surae muscle on sport performance is scarce and inconclusive [14]. Huang et al. [4] investigated the effect of KT on the triceps surae during a maximal vertical jump. KT and placebo tape were applied to healthy inactive adults, respectively. The results showed that the vertical ground reaction force (VGRF) increased in the KT group even when the height of jump remained constant. A study showed that KT did not facilitate muscle performance by generating higher jumping power [15]. Another one found that taping calf muscles improved muscle power in young healthy women [16]. Hyoung-Won [17] did not find differences between KT, placebo taping, and no taping condition in vertical jumping performance in young women. Also, KT applied over triceps surae did not enhance horizontal jumping compared with placebo-control in handball players [18].

To our knowledge, there is not one study (randomized controlled crossover experiment design) examining the effect of KT on sprint performance and CMJ in active children. The objective of the present study was to identify the influence of KT on 30 m sprint and CMJ performance in active children.

## Material and methods

A randomized controlled crossover experiment design was used to examine the effect of KT application on triceps surae in children from a triathlon school. All participants performed the tests, 30 m sprint and CMJ, under both conditions with the order assigned randomly. The two sessions were performed with an interval of three days to avoid accumulation of the KT effects. The trial was reported according to the Consort 2010 statement: extension to randomized crossover trials [19].

### *Participants*

The first and the second author are trainers at Rincon de la Victoria triathlon school (Malaga, Spain), so they informed the children and legal guardians about the study and asked for volunteers. Of the 28 healthy active children (12 girls and 16 boys) enrolled in the triathlon school, all of them voluntarily agreed to participate in the study. And finally, 20 children (age 10.15 ± 2.01 years; body height 144.45 ± 14.78 cm; body mass 41.09 ± 13.92 kg; body mass index 19.06 ± 2.74 kg/m$^2$) finished the study. The participants were boys (n = 13) and girls (n = 7) involved in recreational triathlon training (3-4 sessions per week: 75-90 minutes per session). None of the participants reported any form of musculoskeletal disorder at the time of the testing. Children and their legal guardians were fully informed about all the features of the study and were required to sign an informed consent document. The protocol conforms to the Declaration of Helsinki statements (64th WMA, Brazil, October 2013) and the study was approved by the Ethics and Research Committee of the University of Malaga (No CEUMA 89-2022-H).

An a priori sample size calculation was performed with the function F-test ANOVA repeated measures by the G*Power Version 3.1.9.4 for Windows. Parameters were set as follows: effect size, f = 0.15 [20], significance level, $\alpha = 0.05$, statistical power $(1 - \alpha) = 0.80$, and correlation between repeated measures, r = 0.9. A dropout up to 20% was estimated. A final sample size of at least 20 children (minimum initial sample size equal to 25) was estimated.

***Procedures***

The present study followed a randomized, controlled crossover trial design. The participants were tested across two different sessions, randomly receiving experimental KT condition and no tape condition. Trials were standardized according to the time of the day, shoes, and clothing. A week before the measurement started, the participants were familiarized with the test procedure and allowed to practice them to reduce practice effects. All the trials took place on the same public sports track in Rincon de la Victoria (Malaga, Spain).

The procedure started with a 10-minute warm-up:

- 3 minutes running at light to moderate pace,
- 1 minute rotation of ankles,
- 1 minute flexion-extension of knees,
- 1 minute flexion-extension of hips,
- 1 minute flexion-extension of shoulders,
- 1 minute wrist rotations in both directions,
- 2 repetitions of 20 m accelerations.

The participants were taped 15 to 20 minutes before starting the warm-up [21].

To generate the random assignment sequence, the data collection sheets were randomly marked with a small letter a or b alternatively. Only the KT practitioner knew that these letters corresponded to one of the two groups. All participants received KT from the first author, a certified KT practitioner with more than 12 years of experience (Fig. 1).

***Sprint measurements***

30 m sprint time was measured using a system of photocells placed at the starting line, in the middle and at the finish line. The photocells were placed near the knee height of the participants (Smart speed, Australia). Participants were instructed to run as fast as possible. They began by standing upright at the starting line, a 50 cm strip of brown tape placed perpendicular to the run direction. They started to run when they were ready. One of the researchers gave encouragement to motivate participants throughout the test. Two test trials were performed with a 10-minute rest. The average 15 m and 30 m sprint times were calculated and used for comparisons. 30 m sprint with the photocell placed near the knee height and the participant standing upright at the starting line is a reliable and validated test [22].

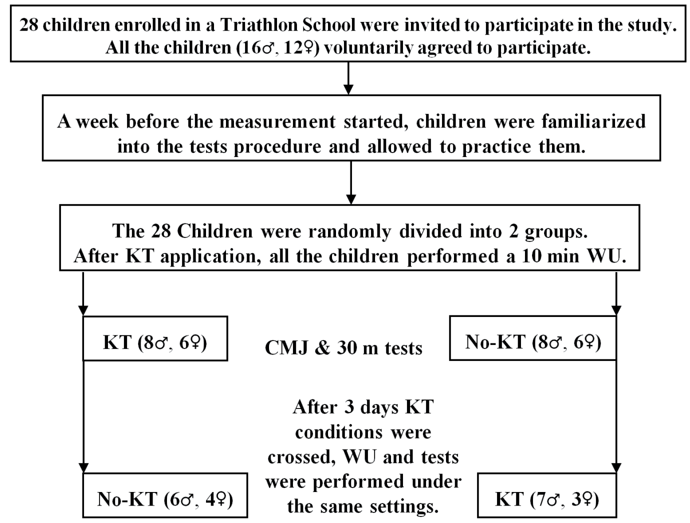


**Figure 1.** Flow chart of the procedure

***Counter movement jump***

Each participant performed one practice and two experimental trials of consecutive maximum CMJ performed with hands placed at the waist. The higher jump was used for further analysis. In line with previous studies, one minute of rest was allowed between consecutive trials to minimize the effects of fatigue [7]. Jump performance was quantified by the maximum jump height, measured by a validated tool Smartjump™ (Fusion Sport, Queensland, Australia) according to the previously documented method [23]. Several studies have confirmed the reliability and validity of the Smartjump™ system for measuring CMJ performance [23, 24].

***Taping***

The tape was applied by a senior physiotherapist (first author), familiar with using KT and specifically trained to apply this tape using the prescribed technique. This method of tape application was chosen because it is believed to increase muscle strength [21]. A white 5 cm wide KT (Kinesiology tape®, Korea) was applied to the triceps surae, using the I-shaped taping technique, from origin to insertion to facilitate muscle function. The base of the tape was placed unstretched with the participant lying prone on a bench in a neutral body position. Then, a functional strip was applied on the stretched muscle belly, with a tape tension of 25%. Afterward, the anchorage was applied without stretching, just distal to the insertion of muscle in a neutral body position. Finally, the tape was rubbed to improve adherence to the skin [21]. The participants in the no tape condition went through the same procedure, including calf stretching, but KT was not applied. The participants did not need skin preparation before tape application because their skin was free of oils, lotions and clean. The KT application did not cause any discomfort or injury on the skin to the children during the study.

***Statistical analysis***

Descriptive statistics (means and standard deviations) of age, height, body mass, body mass index were used, and the height jump and sprint results were calculated. An analysis of variance (ANOVA) with taping conditions (kinesio tape, control) as a within-subject factor on the height jump and sprint results was performed. Effect size was estimated using the eta-squared (η2). Statistical power (P) for the n size was determined as well. The consistency internal reliability of the administrated tests was estimated using the intraclass correlation coefficient from two-way ANOVA (ICC) [22]. Furthermore, as suggested by Baumgartner and Chung (2001), 95% confidence interval (CI) was calculated. All statistical analyses were performed using the SPSS version 15.0 for Windows (SPSS® Inc., Chicago, IL). The statistical significance level was set at $p < 0.05$.

## Results

Mean values and standard deviations obtained in the counter movement jump and sprint tests, as well as the results of repeated measures ANOVA are presented in Table 1. The ANOVA results for the counter movement jump test averages indicated statistically significant differences in favor of KT condition ($F(1, 19) = 12.383$, $p = 0.002$; $\eta^2 = 0.395$; $p = 0.916$). However, the ANOVA results for the sprint test averages revealed no statistically significant differences in 0-15 m ($F(1, 19) = 0.625$, $p = 0.439$; $\eta^2 = 0.032$; $p = 0.117$), 15-30 m ($F(1, 19) = 1.486$, $p = 0.238$; $\eta^2 = 0.073$; $p = 0.212$), and 0-30 m ($F(1, 19) = 1.718$, $p = 0.206$; $\eta^2 = 0.083$; $p = 0.238$). The internal consistency for counter movement jump test was 0.93 (0.81-0.97), and for sprint test it was 0.97 (0.92-0.99) in 0-15 m, 0.98 (0.96-0.99) in 15-30 m, and 0.99 (0.96-0.99) in 0-30 m.

**Table 1.** Effects of Kinesio tape application on counter movement jump and sprint tests

| | Kinesio tape (M ± SD) | Control (M ± SD) | F | p | $\eta^2$ |
|---|---|---|---|---|---|
| **CMJ (cm)** | 24.28 ± 4.71 | 23.33 ± 4.25 | 12.383 | 0.002 | 0.395 |
| **0-15 m (s)** | 3.05 ± 0.22 | 3.06 ± 0.22 | 0.625 | 0.439 | 0.032 |
| **15-30 m (s)** | 2.50 ± 0.25 | 2.52 ± 0.29 | 1.486 | 0.238 | 0.073 |
| **0-30 m (s)** | 5.55 ± 0.46 | 5.59 ± 0.51 | 1.718 | 0.206 | 0.083 |

M = mean; SD = standard deviation; CMJ = counter movement jump test.

## Discussion

The results suggest that KT does not affect sprint performance, but it does affect CMJ when applied to the calf muscles in apparently healthy active children.

### *Jump*

Although the results of the present study showed an improvement in CMJ when KT was applied to the calf muscles of apparently healthy active children, research concerning the effect of KT on jump performance is contradictory.

Huang et al. [4] did not find better results when applying KT to the calf muscles compared to placebo tape in jump height, but the VGRF increased when KT was applied (Y shaped from I-O, no data about tension). However, the height of the jump decreased, and there was no difference in VGRF in placebo taping group. Vinken [14] compared the effect of no KT, rectus femoris KT, triceps surae KT and sham tape on vertical jump in healthy gymnasts and found no improvement in performance. KT was applied to rectus femoris (Y shaped) and triceps surae (Y shaped) from O-I with a 50-75% of its maximum length tension. Cheung, Yau, Wong, Lau, Chan, Kwok et al. [15] study showed that KT did not facilitate muscle performance by generating higher jumping power. KT was applied to quadriceps (I shaped) and gastrocnemius (Y shaped) from O-I with 75% of its maximum length tension. Hyoung-Won [17] did not find differences between KT, placebo taping, and no taping condition in vertical jumping performance in young women (Y shaped from I-O with a 75% tension). Hong, Lee, Eom, Yeom, Park, Jeong et al. [16] found that taping calf muscles improved muscle power in young healthy women (O-I technique with a 20-30% tension). MacDowall, Sanzo & Zerpa [26] applied KT to the dominant leg using a combined taping technique (mechanical corrective to the Achilles tendon, and two I shaped from O-I with a 25% tension to the gastrocnemius). The application of KT increased jumping performance in 20 college students during a static one-legged vertical jump versus the no tape condition. Arabaci, Kose & Okuyuku [18] found that KT applied over triceps surae (Y shaped from O-I with a 25-50% tension) did not enhance horizontal jumping compared with placebo-control in handball players.

According to Cheung, Yau, Wong, Lau, So, Chan et al. [15], previously reported muscle facilitatory effects or functional enhancement using KT may be attributed to placebo effects. These authors, who recruited athletes who were trained for vertical jump, stated that the application of KT does not enhance performance during familiar functional tasks.

Another explanation could be that according to Kase, Wallis & Kase [21], the proper tension application is one of the most critical factors in the KT success. In the present study, a tension of 25% was applied to KT. Hong, Lee, Eom, Yeom, Park, Jeong et al. [16] and MacDowall, Sanzo & Zerpa [26] did the same. These are the only three studies in which KT increased jumping performance. However, all the other studies that applied a much higher tension did not obtain a significant increase in jumping performance.

On the other hand, a small improvement in jump height would be important for an athlete, especially for a high jumper. Therefore, the application of KT could be interesting when this skill is required to enhance their performance [4].

### *Sprint*

Sprinting requires great acceleration which depends heavily on muscular strength and power [6]. A possible explanation of the negative results observed in the current study is that the magnitude of cutaneous afferent stimulation generated by KT may not have been strong enough to modulate the muscle strength [8, 27] during sprinting. Indeed, taping a single muscle may not have produced sufficient muscular stimulation to enhance sprint performance. Therefore, if KT had been applied to both the hip and knee extensor muscles, it might have improved sprint performance.

Several studies have also found no effect of KT on sprint performance. For example, Kirmizigil, Chauchat, Yalciner, Iyigun, Angin & Baltaci [28] did not find differences between KT and no taping conditions in sprint performance in 22 recreational college athletes. In their study, KT was applied to rectus femoris (Y-shaped) from O-I with 15-25% of its available tension. Similarly, Solomon, McLean & Smith [29] did not find differences in sprint performance between KT applied to quadriceps muscles, placebo taping, and no taping condition in female college athletes (no data were provided about KT application specifics).

An interesting study by Hanayoğlu & Can [30] reported contradictory results. On the one hand, when they applied KT to the quadriceps, no improvements in speed were observed. However, when KT was applied to the triceps (Y-shaped from O-I with a 25-50% tension), performance in the 30 m test increased. The difference in speed values before the application and at 30th minute, 24th hour, and 48th hour after KT application to the triceps muscle was statistically significant.

Another possible explanation is related to the tension applied during KT application. According to Kase, Wallis & Kase [21], proper tension application is one of the most critical factors in the effectiveness of KT. In the present study, a tension of 25% was applied to KT manually by the physiotherapist, without the use of an electronic device to measure the exact tension.

It is generally better to have insufficient tension than too much, as proper tension application is crucial for success. Kase, Wallis & Kase [21] suggest that for O-I application, the tension should be light to moderate (25-50% of available tension), whereas for I-O application, the tension should be very light or light (15-25% of available tension).

To our knowledge, this is the first study that examines the effect of KT on 30 m sprint and CMJ performance in active children. The novelty of this article is that there is not a single study that analyzed KT application in sports performance in active children. The use of a crossover research design also adds quality to this study. It allows us to make sure that those results are due to the KT application and not to other possible external factors.

However, some limitations should also be considered. First of all, due to human and time restrictions, a larger sample could not be examined. This fact could limit the generalizability of the outcomes obtained to the particular setting studied.

Further investigation should be designed to incorporate KT application on hip and knee extensors muscle groups to achieve greater muscle performance when jumping and especially when sprinting.

## Conclusions

1. KT on the triceps surae does not seem to affect the sprint performance in apparently healthy active children.
2. KT on the triceps surae improves the CMJ performance in apparently healthy active children.
3. The KT application did not cause any discomfort or injury to the children during the study.

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