Original Article

Comparison of the Effectiveness of Kinesio Tape and Sham Taping on Lower Extremity Performance in Elite University Volleyball Athletes

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Abstract

Introduction: *Kinesio taping is widely used in sports rehabilitation to enhance muscular performance and prevent injuries, yet evidence of its superiority over sham taping in healthy athletes remains limited. This study aimed to compare the effectiveness of kinesio taping and sham taping on lower-limb performance parameters among volleyball athletes, focusing on functional outcomes relevant to sports performance enhancement.*
Methods: *A single blind randomized clinical trial was conducted involving 38 male volleyball athletes aged 17–23 years. Participants were randomly assigned to kinesio taping or sham taping groups. Performance parameters including reaction time, explosive power, muscle strength, flexibility, and agility were measured at baseline, 20 minutes, and 72 hours post application using validated functional performance test protocols with standard measurement devices.*
Result: *The kinesio-taping group showed significantly greater improvements in reaction time, vertical-jump height, leg muscle strength, flexibility, and agility compared with the sham-taping group ($p < 0.05$). These findings indicate enhanced neuromuscular facilitation, proprioceptive feedback, and functional muscle performance following kinesio taping.*
Conclusion: *Kinesio taping effectively enhances short-term and sustained lower-limb performance among volleyball athletes. It may serve as an adjunctive therapeutic and preventive approach in sports rehabilitation and performance optimization programs.*

Keywords: *Agility, Explosive power, Kinesio taping, Muscle strength, Volleyball performance*

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Perbandingan Efektivitas Kinesio Tape dan Sham Taping Terhadap Performa Ekstremitas Bawah Pada Atlet Voli

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Abstrak

Pendahuluan: *Kinesio taping banyak digunakan dalam rehabilitasi olahraga untuk meningkatkan kinerja otot dan mencegah cedera, namun bukti keunggulannya dibandingkan sham taping pada atlet sehat masih terbatas. Penelitian ini bertujuan untuk membandingkan efektivitas kinesio taping dan sham taping pada parameter performa ekstremitas bawah di kalangan atlet bola voli, dengan fokus pada hasil fungsional yang relevan dengan peningkatan performa olahraga.*
Metode: *Uji klinis acak tersamar tunggal dilakukan dengan melibatkan 38 atlet bola voli pria berusia 17-23 tahun. Peserta secara acak dikelompokkan ke kelompok kinesio taping atau sham taping. Parameter kinerja termasuk waktu reaksi, daya ledak, kekuatan otot, fleksibilitas, dan kelincahan diukur pada awal, 20 menit, dan 72 jam pasca aplikasi menggunakan protokol uji fungsional lapangan yang telah tervalidasi, dengan perangkat pengukuran standar.*
Hasil: *Kelompok yang memakai kinesio-taping menunjukkan peningkatan yang jauh lebih besar dalam waktu reaksi, tinggi lompat vertikal, kekuatan otot tungkai, fleksibilitas, dan kelincahan dibandingkan dengan kelompok yang melakukan sham-taping ($p < 0,05$). Temuan tersebut menunjukkan peningkatan fasilitasi neuromuskular, umpan balik proprioseptif, dan kinerja otot fungsional setelah kinesio taping.*
Kesimpulan: *Kinesio taping secara efektif meningkatkan kinerja ekstremitas bawah jangka pendek dan berkelanjutan di kalangan atlet bola voli. Hal tersebut dapat berfungsi sebagai pendekatan terapi dan pencegahan tambahan dalam program rehabilitasi olahraga dan optimalisasi kinerja.*

Kata kunci: *Kelincahan, Daya ledak, Kinesio taping, Kekuatan otot, Performa bola voli*

Introduction

Volleyball is one of the most popular sports worldwide, with an injury rate ranging from 1.7 to 4.2 per 1,000 playing hours, making it the fourth most common source of sports injuries.[1] The success of volleyball depends not only on teamwork but also on the individual performance of each player.[2] Individual performance is largely determined by physical fitness, which includes both health-related and skill-related components such as power, speed, agility, reaction time, flexibility, coordination, and balance. Among these components, agility and flexibility are essential for supporting speed and efficient joint movement.[2] Moreover, several fundamental volleyball techniques rely on muscular strength and explosive power to generate maximal force during play.[3]

The lower extremities contain large and powerful muscle groups that play a key role in volleyball movements. Explosive power of these muscles significantly influences jumping and striking performance. Factors influencing muscle strength include age, sex, muscle cross-sectional area, muscle length, contraction tension, blood supply, contraction velocity, and motivation. Differences between male and female athletes are often attribut-

ed to physiological variations such as oxygen-carrying capacity and body-fat percentage. Consequently, this study focuses solely on male volleyball athletes to minimize biological variability in muscle performance.

One intervention frequently used to enhance muscle activation and prevent injury is kinesio taping, a rehabilitative technique developed by Dr. Kenzo Kase.[4] Kinesio tape has several corrective functions including mechanical, fascial, space, ligament, tendon, and lymphatic correction.[5,6] It is widely used by professional athletes because it is non-invasive and easy to apply. However, most available studies have focused on individuals with musculoskeletal disorders rather than on healthy athletes, and findings regarding its effect on muscle performance remain inconsistent.

Kinesio tape is applied from the muscle origin to its insertion with a stretch of 25–75 percent to facilitate muscular contraction. Tani and colleagues[7] found that beneficial effects are observed approximately three days after application with 75 percent stretch on the quadriceps. In volleyball, vertical and long jumps are fundamental techniques for attacking and blocking, relying on the coordinated contraction of the gluteus maximus, biceps femoris, triceps surae, and quadriceps femoris muscles to generate the necessary momentum for high jumps and powerful spikes. Therefore, taping these muscles may improve strength, explosive power, agility, reaction time, and flexibility, which are critical components of volleyball performance.

Although kinesio taping is increasingly adopted in competitive sports, empirical evidence supporting its effectiveness in healthy male volleyball athletes remains limited. Most prior investigations have centered on rehabilitation contexts or clinical populations, and findings in athletic populations remain inconclusive due to methodological heterogeneity. There is therefore a need for well-controlled experimental research evaluating the short-term effects of standardized kinesio taping application on multiple dimensions of lower-extremity performance.

Given the high physical demands of volleyball and the critical role of lower-limb neuromuscular function, kinesio taping may offer a practical strategy to enhance proprioceptive input and muscular activation. However, robust evidence is required to clarify its true impact on athletic performance. Therefore, this study aims to compare the effectiveness of kinesio taping and sham taping on lower-extremity performance in male volleyball athletes. Specifically, it seeks to examine differences in muscle strength of the quadriceps femoris, triceps surae, biceps femoris, and gluteus maximus; lower-limb explosive power; agility; reaction time; and flexibility.

Methods

A single-blind randomized clinical trial design was employed. Participants were randomly assigned by computer-generated allocation into two groups: a kinesio-taping group and a sham-taping (control) group. Both groups underwent identical assessment procedures, while participants were blinded to their group assignment to minimize bias. This research was conducted at the Biomechanics Laboratory and Sports Hall of Universitas Negeri Jakarta. The study followed a structured timeline: preparation (January–July 2022), implementation (August–December 2022), data analysis (January–March 2023), and reporting (April–June 2023).

The study recruited male volleyball athletes aged 17–23 years who were actively enrolled in the Faculty of Sports Science, Universitas Negeri Jakarta. All participants were required to have at least one year of continuous training experience and a normal nutritional status (BMI 18.5–24.9 kg/m^2). Recruitment was conducted using a consecutive sampling method until the calculated sample size was achieved. Inclusion criterias was male volleyball athletes aged 17–23 years, normal BMI, active training status, and willingness to complete the study by signing informed consent. Exclusion criteria included history of musculoskeletal disorders affecting the spine, pelvis, knees, or ankles; neurological or movement disorders of the lower limbs; prior surgery or injury to the lower extremities; open wounds or skin infections; uncontrolled diabetes mellitus or peripheral neuropathy; psychiatric disorders or substance use; and known allergy to kinesio tape adhesive. Drop-out criteria was participants who did not complete intervention sessions, failed to attend the post-test evaluation, or developed allergic reactions to the tape adhesive during the study.

Sampling followed the inclusion and exclusion criteria using a consecutive enrollment approach until the minimum number of participants was reached. Based on parameters derived from Flood,[4] et al and subsequent power calculations across the five performance outcomes (strength, explosive power, agility, reaction time, and flexibility), the largest required sample size was 32 participants. Considering a potential dropout rate of 20%,

the final minimum total sample included 38 participants (19 in each group).

The study utilized a suite of standardized and validated biomechanical instruments to ensure precise and reproducible measurements. Lower-limb muscle strength, encompassing the quadriceps femoris, triceps surae, biceps femoris, and gluteus maximus, was assessed using a calibrated Leg Dynamometer. Agility was evaluated through the Modified T-Test Agility Protocol using a digital stopwatch, while explosive power was determined via vertical jump height measured with a wall marker and measuring tape. Reaction time was recorded using the Whole-Body Reaction Time Type II device, and flexibility was assessed using a Sit-and-Reach Box and Flexometer. Kinesio tape (5 cm × 5 m) was used for both kinesio-taping and sham-taping applications and was applied using a kinesiology taping–inspired facilitation pattern without joint restriction. All instruments were calibrated prior to data collection. Test–retest reliability of all performance measures was evaluated in a pilot session using intraclass correlation coefficients (ICC), demonstrating good to excellent reliability (ICC > 0.80).

Before intervention, all participants completed a standardized 20-minute warm-up session followed by baseline assessments of strength, explosive power, agility, reaction time, and flexibility. Participants were then randomized using computer-generated sequences into the Kinesio Tape group or the Sham Taping group, with allocation concealment and participant blinding maintained (single-blind design). In the intervention group, kinesio tape was applied to the quadriceps femoris, triceps surae, gluteus maximus, and hamstring using a facilitation technique with 75% tension from origin to insertion, following the protocol of the Kinesio Taping Association International and applied by a certified therapist. In the control group, identical Kinesio tape was placed horizontally across the same muscle regions without stretch. Participants were advised to maintain normal daily activities but abstain from additional physical training throughout the study. Measurements were taken at 20 minutes and 72 hours post-application. Any adverse skin reactions were managed with topical hydrocortisone cream, and affected subjects were withdrawn. All safety protocols were strictly followed, and evaluations were terminated immediately in the event of chest pain, fatigue, dyspnea, muscle cramps, syncope, or other abnormal physiological responses.

Data were analyzed using IBM SPSS Statistics for Windows. Normality was tested using the Shapiro–Wilk test or coefficient of variation (CoV). Descriptive statistics were reported as mean ± standard deviation for normally distributed data and as median (minimum–maximum) for non-normally distributed data. Between-group comparisons for parametric variables were performed using the independent t-test, while non-parametric variables were analyzed with the Mann–Whitney U test. Statistical significance was defined as a two-tailed p-value < 0.05 with a 95% confidence interval.

Ethical clearance was obtained from the Faculty of Medicine Ethics Committee, Universitas Indonesia (Reference No. KET-I125/UN2.F1/ETIK/PPM.00.02/2022). The study followed the ethical principles of beneficence, non-maleficence, autonomy, and justice. All participants were informed of the objectives, procedures, and potential risks before providing written informed consent. Confidentiality and the right to withdraw at any time were guaranteed.

Result

The study was conducted at the Biomechanics Laboratory, Faculty of Sport Science, Universitas Negeri Jakarta, from August to December 2022. Thirty-eight eligible male volleyball athletes aged 17–23 years were recruited based on inclusion and exclusion criteria. Participants were randomly assigned into two groups: the intervention group (n = 19) received kinesio taping with 75% tension applied to the triceps surae, quadriceps femoris, gluteus maximus, and hamstring muscles of both lower limbs, while the control group (n = 19) received sham taping without tension on the same muscle areas. No dropouts or adverse reactions occurred during the study period.

Baseline demographic and anthropometric characteristics of the participants are presented in Table 1. No statistically significant differences were observed between groups at baseline (p > 0.05). However, given the relatively small sample size, the absence of statistical significance should be interpreted with caution and does not necessarily indicate complete baseline equivalence. Overall, no clinically meaningful differences were observed between the kinesio-taping and sham-taping groups with respect to the measured baseline variables.

Table 1. Baseline Characteristics of Participants (n = 38)

Variable	Kinesio Taping (n=19, mean ± SD)	Sham Taping (n=19, mean ± SD)	p-value
Age (years, median)	19 (18–20)	19 (18–20)	0.08 **
Body weight (kg)	73.05 ± 2.46	73.89 ± 2.16	0.25 *
Height (cm)	179.79 ± 2.88	180.58 ± 2.52	0.37 *
BMI (kg/m²)	22.60 ± 0.85	22.67 ± 0.88	0.81 *
Athletic experience (years)	1.0 (1–2)	1.5 (1–2)	0.30 **
Physical activity level (PAL)	1.92 ± 0.07	1.90 ± 0.05	0.40 *

Reaction time was evaluated using the Whole-Body Reaction Time (WBRT) test at baseline, 20 minutes post-taping, and 72 hours post-taping. Data were normally distributed. The kinesio-taping group showed a significantly faster reaction time both at 20 minutes and 72 hours ($p < 0.001$) compared with the sham-taping group (Table 2).

Table 2. Comparison of Whole-Body Reaction Time (seconds) between Groups

Parameter	Kinesio Taping (mean ± SD)	Sham Taping (mean ± SD)	p-value
Baseline	0.294 ± 0.002	0.294 ± 0.002	0.590
20 min post-taping	0.276 ± 0.002	0.283 ± 0.002	< 0.001
72 h post-taping	0.276 ± 0.002	0.283 ± 0.002	< 0.001

The kinesio-taping group demonstrated significantly higher vertical-jump height than the control group at both 20 minutes and 72 hours post-taping ($p < 0.05$; Table 3).

Table 3. Comparison of Vertical-Jump Height (cm) between Groups

Parameter	Kinesio Taping (cm)	Sham Taping (cm)	p-value
Baseline	54.95 ± 1.31	54.74 ± 1.63	0.663
20 min post-taping	56.95 ± 1.31	55.74 ± 1.63	0.016
72 h post-taping	58.95 ± 1.31	56.74 ± 1.63	< 0.001

Muscle strength was assessed using a leg dynamometer at baseline, 20 minutes post-taping, and 72 hours post-taping. At baseline, both groups demonstrated comparable mean strength values ($p = 0.680$). However, at 20 minutes post-taping, the kinesio-taping group exhibited a significantly greater increase in muscle strength compared with the sham-taping group ($p < 0.001$). This effect remained consistent at 72 hours post-intervention ($p < 0.001$), indicating sustained improvement in lower-limb muscular performance (Table 4).

Table 4. Comparison of Leg Muscle Strength (kg) between Groups

Parameter	Kinesio Taping (mean ± SD)	Sham Taping (mean ± SD)	p-value
Baseline	197.11 ± 1.66	197.32 ± 1.46	0.680
20 min post-taping	203.21 ± 1.36	199.74 ± 1.24	< 0.001
72 h post-taping	204.05 ± 1.35	200.21 ± 1.36	< 0.001

Flexibility was measured using the Sit-and-Reach Test across three time points. At baseline, both groups showed nearly identical flexibility levels ($p = 0.820$). Following

kinesio-taping, flexibility improved significantly after 20 minutes ($p < 0.001$), and this improvement was maintained at 72 hours post-application ($p < 0.001$). In contrast, the sham-taping group showed only minimal gains. These findings suggest that kinesio-taping enhances short- and medium-term muscle elasticity and range of motion (Table 5).

Table 5. Comparison of Flexibility (cm) between Groups

Parameter	Kinesio Taping (mean ± SD)	Sham Taping (mean ± SD)	p-value
Baseline	21.50 ± 0.18	21.48 ± 0.10	0.820
20 min post-taping	22.30 ± 0.16	21.96 ± 0.15	< 0.001
72 h post-taping	22.50 ± 0.16	22.16 ± 0.15	< 0.001

Agility performance was evaluated using the Modified Agility T-Test. Baseline agility times were equivalent between the kinesio-taping and sham-taping groups ($p = 0.926$). At 20 minutes post-application, the kinesio-taping group demonstrated a significantly faster mean agility time ($p < 0.001$). This performance advantage persisted at 72 hours ($p < 0.001$), suggesting that kinesio-taping contributes to improved neuromuscular coordination and rapid directional changes in volleyball athletes (Table 6).

Table 6. Comparison of Agility (seconds) between groups

Parameter	Kinesio Taping (mean ± SD)	Sham Taping (mean ± SD)	p-value
Baseline	5.994 ± 0.015	5.994 ± 0.019	0.926
20 min post-taping	5.938 ± 0.017	5.973 ± 0.019	< 0.001
72 h post-taping	5.919 ± 0.019	5.964 ± 0.020	< 0.001

Discussion

The present randomized clinical trial demonstrated that kinesio taping significantly improved lower-limb performance across all evaluated parameters, including reaction time, explosive power, muscle strength, flexibility, and agility, compared with sham taping. At baseline, no significant differences were observed between the intervention and control groups across all outcome measures ($p>0.05$), confirming group homogeneity prior to treatment. Significant improvements were already evident 20 minutes after tape application ($p<0.001$ in most variables), and beneficial effects were maintained up to 72 hours post-application, consistent with previous short-term intervention studies.[7,8] These findings are in line with previous evidence suggesting that kinesio taping facilitates proprioceptive feedback, enhances muscle activation, and promotes local circulation, thereby improving overall neuromuscular function.[9-11] The results confirm that kinesio taping can be an effective adjunct in athletic performance optimization, particularly for dynamic sports such as volleyball that demand coordinated lower-limb strength and responsiveness.

Improvements in reaction time, explosive power, and muscle strength observed in this study reflect enhanced neuromuscular facilitation and muscle recruitment efficiency following kinesio application. Comparable to previous findings, the application of kinesio tape has been shown to shorten reaction times and increase both vertical jump height and leg dynamometer strength, the application of kinesio tape shortened reaction times and increased both vertical-jump height and leg dynamometer strength.[7,10,12] In the present study, whole-body reaction time was significantly shorter in the kinesio group compared with sham taping at 20 minutes post-application ($p<0.001$), with a sustained but slightly attenuated effect at 72 hours, in agreement with prior findings on visual and auditory reaction time improvements.[13,14] Vertical jump performance increased significantly at both 20 minutes ($p=0.016$) and 72 hours ($p=0.001$), supporting earlier investigations reporting acute and short-term enhancements in jump performance.[15] Lower-limb muscle strength measured using a leg dynamometer also demonstrated marked improvements at both time points ($p<0.001$), consistent with previous experimental and meta-analytic findings.[11,16]

The cutaneous stimulation produced by the tape may improve afferent sensory feedback, leading to faster motor output, while the elastic properties of the tape support mechanical recoil and optimized contraction force generation in large muscle groups such as the quadriceps and gastrocnemius.

Enhanced flexibility and agility outcomes further reinforce the functional benefits of kinesio taping. Similar improvements in range of motion and reductions in agility test times have been reported in earlier studies.[17,18] Flexibility assessed using the sit-and-reach test improved significantly in the kinesio group at both 20 minutes and 72 hours ($p<0.001$), corroborating previous reports demonstrating increased range of motion following kinesio application.[19] Agility measured by the modified agility T-test showed significantly shorter completion times compared with sham taping at both evaluation periods ($p<0.001$), aligning with earlier studies indicating enhanced speed and change-of-direction performance after kinesio taping.[17,20] These improvements are particularly relevant for volleyball athletes, where rapid directional changes, acceleration–deceleration control, and optimal joint range of motion are essential for spike, block, and defensive maneuvers.[21,22] These effects may result from increased myofascial glide, reduced mechanical restriction, and improved coordination between stabilizing and mobilizing muscle units. Although a slight reduction in flexibility gains was observed after 72 hours, possibly due to declining tape elasticity, the sustained improvement across multiple domains indicates that kinesio taping offers both immediate and short-term enhancement of lower-limb athletic performance.

Overall, this study reinforces evidence that kinesio taping is more effective than sham taping in enhancing lower extremity performance in volleyball athletes, particularly in the short term (20 minutes). Effects were also observed at 72 hours, although the magnitude varied by parameter. This study is novel as it is the first single-blind randomized clinical trial in Indonesia evaluating kinesio taping on five performance parameters in volleyball athletes. No adverse effects were reported, and participant adherence was excellent with no dropouts.

Nevertheless, the study has limitations, including its focus on male volleyball athletes aged 17–23 years with normal BMI and no injury history, limiting generalizability. The intervention duration was only three days, so long-term effects could not be evaluated. Future studies should include participants of varying gender, age, experience, and longer follow-up periods to determine the clinically significant impact of kinesio taping on athletic performance.

Conclusion

Provide This randomized clinical trial successfully demonstrated that kinesio taping is significantly more effective than sham taping in enhancing multiple aspects of lower-limb performance among volleyball athletes, including reaction time, explosive power, muscle strength, flexibility, and agility. The findings confirm the hypotheses stated in the introduction, showing that kinesio taping provides measurable biomechanical and neuromuscular advantages during both short-term (20 minutes) and extended (72 hours) application. These results support kinesio taping as a practical and evidence-based adjunct for athletic performance enhancement and injury prevention. Future development may focus on integrating kinesio taping into standardized rehabilitation and training programs, exploring longer-term use, and expanding its application across various sports populations.

Conflicts of Interest

The authors declare no potential conflicts of interest, whether financial, institutional, or personal, that could have influenced the conduct of this study, the interpretation of its results, or the preparation of this manuscript.

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