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# Acute Effect of Kinesiology Taping Applied to Adductor Muscle Group on Endurance, Strenght and Agility in Volleyball Players

# Voleybolcularda Addüktör Kas Grubuna Uygulanan Kinezyolojik Bantlamanın Endurans, Güç ve Çeviklik Üzerine Akut Etkisi

[1]Nadir Tayfun ÖZCAN, [2]Feyza ALTINDAL, [3]Nihal BÜKER, [1]Zeliha BAŞKURT

[1]Department of Physical Therapy and Rehabilitation, Faculty of Health Sciences, Süleyman Demirel University, Isparta, Türkiye
[2]Department of Physical Therapy and Rehabilitation, Ömer Halisdemir University, Niğde, Türkiye
[3]Faculty of Physiotherapy and Rehabilitation, Pamukkale University, Denizli, Türkiye

Nadir Tayfun Özcan: https://orcid.org/0000-0003-2239-2562
Feyza Altındal: https://orcid.org/0000-0001-7181-0906
Nihal Büker: https://orcid.org/0000-0001-7259-7983
Zeliha Başkurt: https://orcid.org/0000-0001-7488-9242

**ABSTRACT**

**Objective:** This study was conducted to investigate the acute effect of kinesiology taping (KT) to the hip adductor muscle group (AMG) on endurance, strength and agility in female volleyball players (VP).

**Materials and Methods:** Thirty female VP, with an average age of 17.53±2.55 years, who played licensed volleyball for at least two years were included in our study. KT was applied longitudinally to the athletes between the pubis and lower border of the tuberositas tibia, including the AMG using the facilitation technique (25% stretching). Evaluations were repeated before taping and 20 minutes after taping. The athletes' Adductor muscle endurance was evaluated using the Copenhagen adduction exercise, vertical jump test for lower extremity strength, and Edgren side step test for agility.

**Results:** When the results of the study were evaluated, it was found that there was a statistically significant increase in the endurance ($p<0.001$), strength ($p<0.001$) and agility ($p<0.001$) values of the athletes after KT application.

**Conclusions:** KT applied to the adductor area can be used by physiotherapists during competitions or training due to its positive effects on the performance of VP.

**Keywords:** Adductor muscles, agility, endurance, kinesiology tape, strength

**ÖZ**

**Amaç:** Bu çalışma kadın voleybolcularda, kalça addüktör kas grubuna uygulanan kinezyolojik bant (KB) uygulamasının endurans, güç ve çeviklik üzerine olan akut etkisini araştırmak amacıyla yapılmıştır.

**Materyal ve Metot:** Çalışmamıza en az iki yıl süre ile lisanslı voleybol oynayan, ortalama yaşı 17,3±2,55 yıl olan, 30 amatör kadın voleybolcu dahil edilmiştir. Sporculara KB, addüktör kas grubunu içine alacak şekilde pubis ile tuberositas tibia alt sınırı arasına, fasilitasyon tekniği (%25 gerilimle) kullanılarak uygulanmıştır. Değerlendirmeler bantlama öncesi ve bantlamadan 20 dakika sonra olmak üzere tekrarlanmıştır. Sporcuların addüktör kas enduransı Kopenhag addüksiyon egzersizi, alt ekstremite gücü dikey sıçrama testi, çevikliği ise Edgren yana adımlama testi kullanılarak değerlendirilmiştir.

**Bulgular:** KB uygulaması sonrası sporcuların endurans ($p<0,001$), güç ($p<0,001$) ve çeviklik ($p<0,001$) değerlerinde istatistiksel olarak anlamlı artış olduğu saptanmıştır.

**Sonuç:** Voleybolcularda addüktör bölgeye uygulanacak KB sporcuların performanslarındaki olumlu etkilerinden dolayı müsabaka veya antrenmanlar sırasında kullanılabilir.

**Anahtar Kelimeler:** Addüktör kaslar, çeviklik, endurans, güç, kinezyolojik bant

**Sorumlu Yazar / Corresponding Author:**
Nadir Tayfun Özcan
Department of Physical Therapy and Rehabilitation, Faculty of Health Sciences, Süleyman Demirel University, Isparta, Türkiye
Tel: +90 507 427 66 12
E-mail: nadirozcan@sdu.edu.tr

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## INTRODUCTION

The hip joint is unique in its wide range of motion and high stability through its strong and balanced musculature. The hip muscles, which are approximately two dozen in number and allow the joint to move in three planes, have important functions in producing and transferring forces during activities involving the upper extremity, except athletic activities, including the lower extremities, such as running and jumping.[1]

The adductor muscle group (AMG), responsible for controlling the movements of the femur and pelvis, contributes to the hip joint flexion, extension and internal rotation, and adduction of the hip joint. The torque generated by the AMG on the hip joint in three planes contributes to the performance of repetitive activities such as running or squatting.[1] In addition, the AMG also plays a role in transferring the forces to the ground during sudden changes in direction and speed.[2]

The fundamental skills affecting success in the volleyball branch are jumping performance, the ability to move quickly in the field, and hitting the ball at the required tempo of the volleyball player (VP). These fundamental skills, which are related to various physical fitness components such as strength, endurance, agility, and speed, also require the harmony and synchronisation of the upper and lower extremities.[3]

Kinesiology taping (KT), developed by Dr. Kenzo Kase in 1979, has been an effective method in physiotherapy and rehabilitation in recent years. KT, which positively affects joint range of motion, muscle strength, function and healing processes, is used in athletes to prevent injuries and as a part of the physical therapy and rehabilitation program applied after injury. Apart from all these, the KT is also preferred to improve the performance of athletes from various sports branches.[4]

Our study aimed to investigate the acute effect of KT on endurance, strength, and agility in VP.

## MATERIALS AND METHODS

***Ethics Committee Approval:*** To conduct the study, official permission and approval were obtained from the Pamukkale University Non-Invasive Clinical Research Ethics Committee (Date: 12/09/2019, decision no: 60116787-020/62662). During the study, the Helsinki Declaration criteria were complied with to protect the athletes' data, and written consent was obtained from all the athletes participating in the study.

***Study Design and Participants:*** This study was designed as an experimental study. Thirty female VP, aged between 15-23, were included in our study. Inclusion criteria: being a female between the ages of 16 and 25, being a licensed volleyball player for at least 2 years, training at least 3 days a week, and cooperating with the parameters to be applied in the study. Exclusion criteria: having undergone any surgery in the last 6 months, no musculoskeletal injury in the previous 3 months, active inflammation in the participant, open wound on the skin in the KT area.

***Data Collection:*** Before evaluation, the descriptive information of the athletes was recorded. The tests used to evaluate the athletes were performed twice, before and 20 minutes after KT. Before the tests, athletes were asked to warm up for 10 minutes.

***Muscular Endurance Evaluation:*** The athletes' endurance was evaluated using the Copenhagen exercise protocol.[5] The athletes were positioned in the side-lying position with the head, trunk and lower extremities in the same alignment and the forearm at 90° flexion as the support point. The athlete, whose upper lower extremity was supported at the ankle and knee joints by the researcher, was asked to adduct the lower extremity (dominant extremity) and touch the upper foot. The number of adduction exercises was noted regardless of time.

***Muscular Strength Evaluation:*** The vertical jump test was used to evaluate the strength of the athletes. The data from the vertical jump test were recorded using the "My Jump 2" iPhone 7® smartphone application, whose validity and reliability studies were conducted.[6] Athletes were asked to squat and then jump vertically. Athletes were warned not to bend their knees and to keep their hands on the waist during jumping. This process was repeated 3 times. The best jump height was recorded in centimeters (cm).

***Agility Evaluation:*** Edgren side step test was used to evaluate. Five cones were placed in parallel at 1 metre intervals. The athlete was asked to side-step from the rightmost cone to the leftmost cone at the highest speed. One point was given for every 1 metre completed in 10 seconds. A point was not given if the athlete rotated her trunk or crossed her legs during side-stepping.[7]

***Kinesiology Tape Application:*** KT was applied to the AMG of the lower extremity 10 minutes after the first evaluation. Before KT, the area to be taped was cleaned with alcohol. Athletes were positioned in the supine position with hip joint in flexion + abduction. The hip AMG was covered with the I-shaped band using the facilitation technique, with 25% tension applied in the direction of the origo-insertion. The athletes were evaluated for a second time after waiting 20 minutes to adapt and for the effects of the KT to be revealed.[8]

***Statistical Analysis:*** The sample size was calculated using G*Power software (Version 3.1.9.5. Institut der Universit€at Bonn, Bonn, Germany). Type-1

error rate was accepted at 0.05 and power rate at 95%. The effect size was calculated as 0.72 using the data of the reference study.[9] According to the power analysis results, the number of athletes to be included in the study was 27**.** Thirty athletes were included in the study. Statistical analyses were performed using the SPSS 23. The statistical significance level was set at $p<0.05$. All data were presented as mean±standard deviation. The dependent samples t-test was used to analyse data before and after KT.

## RESULTS

Thirty athletes participated in the study. The mean age of the athletes was 17.53±2.55 years, their body weight was 57.23±5.35 kg, their height was 169.36±6.89 cm, and their body mass index was 19.93±1.29 kg/m² (Table 1).

When the athletes' endurance before and after KT were examined, the difference was statistically significant ($p<0.001$). It was determined that there was a statistically significant increase in the muscular strength measured with the "My Jump 2" after KT ($p<0.001$). Similarly, the increase in the agility of the athletes evaluated with the Edgren side step test after KT was found to be statistically significant ($p<0.001$) (Table 2).

**Table 1.** Demographic characteristics of athletes.

| Variables | X±SD (n=30) |
|---|---|
| Age (year) | 17.53±2.55 |
| Body Weight (kg) | 57.23±5.38 |
| Height (cm) | 169.36±6.89 |
| Body Mass Index (kg/m$^2$) | 19.93±1.29 |

X: mean; SD: Standard deviation.

**Table 2.** Comparison of athletes' endurance, strength and agility pre and post-kinesiology taping application.

| Variables | Pre-KT application (X±SD) | Post-KT application (X±SD) | Variation (%) | p |
|---|---|---|---|---|
| Endurance (Repetation number) | 19.00±5.25 | 22.66±5.92 | 20.21 | 0.000* |
| Strength (Jump height) | 26.75±4.39 | 27.89±5.00 | 4.1 | 0.000* |
| Agility (Number of cones passed) | 20.03±1.58 | 21.86±1.45 | 9.4 | 0.000* |

*p<0.05; X: mean; SD: Standard deviation; KT: Kinesiology taping.

## DISCUSSION AND CONCLUSION

In our study, in which we examined the acute effect of KT applied to the AMG in VP on the endurance, strength, and agility of the athletes, the acute improvement caused by the KT in the endurance, power and agility of the athletes were found.

In volleyball, an interval sport with both aerobic and anaerobic components, muscular endurance is extremely important to squat, jump and move in different directions.[10,11] In the literature, we found no study showing the effect of KT applied to the adductor region in VP on adductor muscle endurance; it is also seen that there is no consensus on the results of the studies conducted with different muscle groups. Studies evaluating the acute effect of KT on endurance in different muscles such as finger flexors,[12] quadriceps,[13] and gastrocnemius[14] have shown that KT does not increase endurance. In these studies, KT was applied from origin to insertion to facilitate different muscle groups. Contrary to the common view, studies in the literature suggest that KT should be applied from insertion to origin to provide muscle facilitation.[9,15] Therefore, studies investigating KT's effects on muscle endurance with different techniques should be conducted.

In our study, it was found that KT applied to the AMG caused an acute increase in endurance. There are also studies in the literature reporting similar results to the findings of our study and examining different populations and muscle groups. A study investigating KT's effect on abdominal muscle endurance reported that KT acutely increased trunk flexor and left lateral muscle endurance.[16] In another study investigating the acute effects of KT applied to the forearm in tennis players, significant positive effects of KT on wrist flexor muscle endurance were shown.[17] We can explain the positive effect of KT on endurance by the increase in cutaneous afferent inputs and, consequently, facilitation in motor neuron excitability.[18] In addition, we think that one of the potential reasons for a positive effect on endurance may be the placebo effect.[19]

Vertical jumping skills in VP are another important factor for their service, spike, block, and defence performances.[20] Athletes need to generate as much power as possible in the shortest possible time to

optimise their vertical jump performance, which is affected by both muscular and neural mechanisms.[21] A correlation is observed between jump height and lower extremity muscle strength in VP.[20] Different results have been reported concerning the effects of KT on muscle strength. In a study examining the effect of KT applied to quadriceps and gastrocnemius muscles in VP on jump height and strength, it was reported that KT did not cause a significant change in the jump performance of participants.[22] Similarly, another study involving football players found that KT did not cause an acutely significant increase in quadriceps strength.[23]

In our study, we observed that the jumping performance of VP increased acutely after KT. There are also studies in the literature that support our results. In a study involving basketball players, it was observed that the vertical jump performance of athletes increased significantly.[24] Aktaş and Baltacı also reported that the increase in isokinetic knee extension peak torque value and jump performance was significant after KT.[25] We think the different results in the literature may be due to factors such as the selected KT technique, the test method used and the population.

Biomotor skills such as agility, coordination, and reaction became prominent characteristics that athletes should have in sports branches played in narrow spaces, such as volleyball. Agility, which can be defined as a minimal loss of control and the ability to change direction at an average speed, has positive effects on the performance of athletes by contributing to the effective acceleration and deceleration of VP in a short time.[11,26,27] In our study, we found that the agility performance of athletes increased after KT was applied to the adductor region. We think that the positive effect of KT on agility performance is related to both the increase in proprioceptive sensation caused by stimulation of mechanoreceptors[28] and the application of KT to the AMG, which will contribute to stabilising hip and knee joints.[1] Although studies in the literature report that KT increases agility,[8,29] there are also studies reporting the opposite. It has been reported that KT in VP, by supporting the peroneus longus and peroneus brevis muscles and the tibiofibular ligaments of both legs, does not cause a significant change in the agility performance of athletes.[8] Similarly, after KT was applied to both quadriceps muscles in football players, no significant changes were found in the agility performances of the athletes.[30] In these studies, we think that the effect of KT on agility may have been insufficient due to the evaluation of agility with different methods, a small sample size, and low statistical power.

The limitations of our study are that the researchers could not be blinded, the sample size was small, only a female VP was included in the study, the relationship between the dominant and non-dominant extremities of the athletes was not investigated, there was no control group, and examination of only the acute effect of KT on endurance, strength, and agility.

In conclusion, our study will contribute to the literature because no analysis shows the effect of KT applied to the adductor region on performance in VP. We think that the KT can be used to improve performance and prevent injuries in VP. Studies can be conducted to investigate the long-term effects of KT with larger sample sizes, evaluating symptomatic VP and including athletes from different sports branches.

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***Conflict of Interest:*** No conflict of interest was declared by the authors.

***Author Contributions:*** Concept – FA, NTÖ; Supervision – NB, ZB; Materials – FA, NTÖ; Data Collection and/or Processing – FA, NTÖ, NB, ZB; Analysis and/or Interpretation – NTÖ, NB, ZB; Writing – FA, NTÖ, NB, ZB.

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