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**Research Article / Araştırma Makalesi**

# The effect of dry cupping application on aerobic and anaerobic capacity in athletes

## *Sporcularda kuru kupa uygulamasının aerobik ve anaerobik kapasiteye etkisi*

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## ABSTRACT

**Objective:** Aerobic and anaerobic capacity are the most important performance parameters in athletes. In order to improve aerobic and anaerobic properties, various applications are also carried out apart from training. We aim to investigate the effect of dry cupping application on the aerobic and anaerobic capacity of football (soccer) players.

**Materials and Methods:** Thirty-one amateur football players aged between 18-20 were included in the study voluntarily. After the anthropometric measurements, the volunteers were divided into 2 groups: the cup application group (CAG, n:16) and the control group (CG, n:15). Dry cupping was applied to the anterior leg (on the quadriceps), posterior leg (on the hamstring), inner leg (on the adductors) and posterior calf (on the gastrocnemius) of the athletes in the CAG for 15 minutes. After dry cupping, Wingate test and Maximal Oxygen Consumption test ($VO_2$max) were performed. The same tests were performed on the athletes in the CG without the cup application. $VO_2$max, anaerobic threshold (AT), ratio of anaerobic threshold to $VO_2$max (%AT), peak power per kilogram, and average power per kilogram were taken. Since the data showed normal distribution, the student-t test was used to compare the groups. The statistical significance level was set as $p < 0.05$.

**Results:** There was no statistically significant difference between CAG and CG in terms of both aerobic properties ($VO_2$max, AT, %AT) and anaerobic properties (peak power per kilogram, average power per kilogram) ($p > 0.05$).

**Conclusions:** According to the results we obtained, it was concluded that the dry cup application did not increase the aerobic and anaerobic capacity of the football players.

**Keywords:** *Cupping therapy, $VO_2$max, anaerobic threshold, mean power, peak power*

## ÖZ

**Amaç:** Sporcularda aerobik ve anaerobik kapasite en önemli performans parametrelerini oluşturur. Aerobik ve anaerobik özellikleri geliştirmek için antrenmanlar dışında çeşitli uygulamalar da yapılmaktadır. Amacımız kupa uygulamasının futbolcularda aerobik ve anaerobik kapasite üzerine etkisini araştırmaktır.

**Gereç ve Yöntem:** Çalışmaya yaşları 18-20 arasında olan 31 amatör futbolcu gönüllü olarak katılmıştır. Antropometrik ölçümler yapıldıktan sonra gönüllüler, kupa uygulama grubu (CAG, n:16) ve kontrol grubu (CG, n:15) olmak üzere 2 gruba ayrıldı. CAG'da yer alan sporcuların bacak ön yüzüne (kuadriseps üzerine), bacak arka yüzüne (hamstring üzerine), bacak iç yüzüne (adduktorlar) ve baldır arka yüzüne (gastroknemius) 15 dakika süreyle kuru kupa uygulaması yapıldı. Kupa uygulaması sonrası Wingate testi ve Maximal Oksijen Tüketim testi ($VO_2$max) gerçekleştirildi. CG'de yer alan sporculara kupa uygulaması yapılmadan aynı testler uygulandı. $VO_2$max, anaerobik eşik (AT), anaerobik eşiğin $VO_2$max'a oranı (%AT), kilogram başına pik güç, kilogram başına ortalama güç değerleri alındı. Veriler normal dağılım gösterdiği için grupların karşılaştırılmasında student-t testi kullanıldı. İstatistiksel anlamlılık düzeyi $p < 0.05$ olarak alındı.

**Bulgular:** Gerek aerobik özellikler açısından ($VO_2$max, AT, %AT) gerekse anaerobik özellikler açısından (kilogram başına pik güç, kilogram başına ortalama güç) CAG ve CG arasında istatistiksel olarak anlamlı fark saptanmadı ($p > 0.05$).

**Sonuç:** Elde ettiğimiz sonuçlara göre kuru kupa uygulamasının futbolcularda aerobik ve anaerobik kapasitede artış yapmadığı sonucuna varıldı.

**Anahtar Sözcükler:** *Kupa tedavisi; $VO_{2max}$, anaerobik eşik, ortalama güç, pik güç*

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## INTRODUCTION

The football industry has emerged as it is one of the most popular sports branches with millions of players and spectators all around the world. It is important to be successful in order to get more shares in this industry. For this reason, besides scientifically accepted training methods, various supportive methods are also being researched to increase performance. Some of these are banned due to criteria based on the rules and regulations of the world anti-doping agency (WADA). Methods not included in the WADA list are popular among football players for both performance increase and recovery purposes. Some of these methods are traditional and complementary medicine (TCM) methods that have been applied since ancient times. One of the most commonly used TCM methods is the cup application. The fact that the champions in some sports branches have cupping applications brings to mind if there is a relationship with performance.

The history of the cup application dates back to 3300 years (1). Although there are many cupping application methods; wet cupping (hijama) and dry cupping are the most preferred methods in this field (2). In wet (hijama) cupping application, blood, and interstitial fluid are removed from the body by making epidermal incisions on the cupping application areas. In the dry cupping application, a vacuum is applied to different parts of the skin without applying a skin incision.

It is claimed that cupping application reduces muscle pain, accelerates regeneration, and as a result, increases athletic performance (1). It is also claimed that it accelerates the elimination of metabolic wastes and accelerates recovery by increasing local microcirculation (3). It is stated that there is a decrease in microcirculation, lactate accumulation, hypoxia, and metabolic acidosis, and an increase in vasodilation and microcirculation at the area of application (4,5).

There are multiple factors related to athletic success. Aerobic and anaerobic capacities are the most important of them. Aerobic capacity is an indicator of aerobic energy systems and is especially important in sports that require endurance. It indicates the sustainability of mild to moderate exercise. Although there are many indirect measurement methods, it can be measured directly with the maximal oxygen consumption test (VO2max) (6). Anaerobic capacity indicates the capacity of anaerobic energy systems such as ATP, CrP, and glycolysis. It is an important parameter in sports that require explosive or fast force. Although there are many measurement methods, no method fully reflects anaerobic capacity. However, one of the most commonly used methods is the Wingate test (6).

It is claimed that the wet cupping application has a positive effect on 10 m acceleration, leg muscle strength, vertical jump, and YOYO-1 test results (7). However, the general opinion is that cupping reduces inflammation and muscle joint pain, resulting in a positive effect on performance (8). In the literature review, no study was found on the effect of dry cupping application on aerobic and anaerobic capacity. We hypothesize that dry cupping will increase local microcirculation, aerobic and anaerobic capacities, decrease pain, and accelerate regeneration.

## MATERIAL and METHODS

Thirty-one male amateur football players between the ages of 18-20, who train regularly for 90 minutes 2 days a week, were voluntarily included in the study. Those who used drugs, had sports injuries, and could not comply with the tests were excluded. All volunteers were informed about the tests and their written consents were obtained. The Ethics committee certificate was obtained from Local Ethics Committee and approved by the Ministry of Health. Height and weight of all volunteers were measured with a digital height-weight meter (Densi, Turkey), and body fat percentages were measured by the bioimpedance method (Tanita, BC-418 MA Tokyo-Japan). They were randomly divided into two groups: Cup Application Group (CAG, n:16) and the Control Group (CG, n:15).

### Dry cup application

The areas to be cupped were wiped with alcoholic cotton. 2 pieces of 6 cm cups were placed on the front of the thighs (on the quadriceps), 2 pieces on the back of the thighs (on the hamstring), 2 pieces on the inside of the thighs (on the adductors) and 2 pieces on the back of the calves (gastrocnemius) and then vacuumed. Ultrasound gel was used to secure vacuuming. The cups were left for 15 minutes, the air was removed and the gel residues were cleaned (Figure 1). Applications were performed by a certified specialist physician.

**Figure 1.** Cupping application

Following the cup application, athletes warmed up on a stationary bike for 10 minutes and did stretching exercises. Athletes in CG were asked to perform warm up and stretching exercises as well.

### Aerobic and anaerobic tests

*Wingate Anaerobic Test (WANT):* It was performed on a modified computerized bicycle ergometer (Monark 894-E Sweden). Before the test, the seat height of the bike was adjusted for the athlete. The resistance load to be applied was automatically calculated by Monark ergometer according to the athlete's body weight. The athletes were asked to cycle the bike at the highest pedal speed. When the pedal speed reached 60 revolutions per minute, the weight of the basket was automatically loaded into the system. The athletes were asked to pedal for 30 seconds at maximum rotation speed and were verbally motivated. Peak power, average power and power drop values were calculated per kilogram by the computer.

*Maximal Oxygen Consumption (VO2max) Test:* Before the test, athletes warmed up on the treadmill for 10 minutes and stretching exercises were performed. He was advised to give a signal with his hand or stop the test by pressing the stop button if he could not run, felt chest pain, dizziness, or nausea, and if he lagged behind. Following the informations, the ergospirometer mask was put on the athlete's face and checked to secure complete adjustment not to air intake from the outside. A wireless receiver for heart rate was worn on the chest (Polar, Finland). The test was started by pressing the start button on the monitor. The incline and speed were increased every 3 min according to the Bruce protocol. When the athlete was unable to run, the test was terminated and the mask was removed. The maximum amount of oxygen consumed per kilogram per minute (VO2-max), maximum expiratory volume per minute (VE), maximum expiratory volume/carbon dioxide volume (VE/VCO2), anaerobic threshold (AT), the ratio of anaerobic threshold to VO2max (AT%) were taken as output from the measurement device (Cosmed, Italy).

**Statistical Analysis:** The SPSS statistical program was used for the analysis of the data. The data showed normal distribution. Mean, standard deviation, minimum, and maximum values were taken for descriptive statistics. Student t-test was used to compare the groups. The significance level was set as $p<0.05$.

## RESULTS

There was no statistically significant difference between CAG and CG in terms of physical properties (Table 1).

There was no statistically significant difference between CAG and CG in terms of aerobic properties (Table 2).

There was no statistically significant difference between CAP and CG in terms of anaerobic properties (Table 3).

**Table 1.** Physical characteristics of participants

| | CAG (n:16) | CG (n:15) | p |
|---|---|---|---|
| **Age (year)** | 18.31 ± 0.75 (18-20) | 18.06 ± 0.25 (18-19) | *0.368* |
| **Height (cm)** | 173.76 ± 6.67 (164-185) | 173.52 ± 6.63 (161-184) | *0.999* |
| **Weight (kg)** | 67.15 ± 9.83 (56-89) | 68.03 ± 5.43 (54-76) | *0,627* |
| **Fat%** | 12.21 ± 4.37 (7-21) | 12.25 ± 4.28 (5-19) | *0.594* |

*CAG: Cupping application group, CG: Control group, Fat%; body fat percentage, mean ± sd (min-max)*

**Table 2.** Aerobic characteristics of participants

| | CAG (n:16) | CG (n:15) | p |
|---|---|---|---|
| **$VO_2$ max (ml/min/Kg)** | 59.62 ± 6.47 (50.18-73.12) | 60.33 ± 4.80 (50.71-71.48) | *0.739* |
| **AT (ml/min/Kg)** | 53.53 ± 5.75 (45.12-61.34) | 53.73 ± 3.50 (46.43-60.48) | *0.937* |
| **AT% (ml/min/Kg)** | 90.03 ± 3.65 (84.12-95.76) | 89.39 ± 3.72 (81.78-95.34) | *0.643* |
| **VE (l/min)** | 123.03 ± 4.18 (105-164.90) | 125.83 ± 5.95 (83.4-157.10) | *0,317* |
| **$VE/VCO_2$** | 43.07 ± 4.22 (29.0-87.60) | 43.77 ± 4.38 (32.90-88.60) | *0,689* |

*CAG: Cupping application group, CG: Control group, mean ± sd (min-max)*

**Table 3.** Anaerobic characteristics of participants

| | CAG (n:16) | CG (n:15) | p |
|---|---|---|---|
| **Peak power (W)** | 798.41 ± 56.45 (578.83-952.85) | 826.56 ± 49.32 (641.52-976.91) | *0.682* |
| **Peak power (W/kg)** | 11.89 ± 1.41 (8.62-14.19) | 12.15 ± 1.48 (9.43-14.36) | *0.616* |
| **Average power (W)** | 546.60 ± 34.12 (448.22-608.37) | 553.08 ± 28.14 (441.51-620.43) | *0.941* |
| **Average power (W/kg)** | 8.14 ± 0.56 (6.68-9.06) | 8.13 ± 0.65 (6.49-9.12) | *0.959* |
| **Power drop (W)** | 149.57 ± 14.30 (139.38-169.60 | 160.43 ± 12.41 (141.38-196.57 | *0.85* |
| **Power drop (W/kg)** | 4.53 ± 0.12 (3.48-6.45) | 4.18 ± 1.14 (4.01-5.96) | *0.82* |
| **Power drop %** | 56.88 ± 3.41 (48.18-66.34) | 59.40 ± 2.86 (55.41-68.62) | *0.91* |

*CAG: Cupping application group, CG: Control group, mean ± sd (min-max)*

## DISCUSSION

The mechanism of action for cupping is still not fully known. Dry cupping application initially leads to a decrease in microcirculation, lactate accumulation, hypoxia, and metabolic acidosis develop in the application area. It is suggested that there is an increase in vasodilation and microcirculation afterwards (4). The mechanism of action in the wet cup application is best explained by the Taibah theory (9).

In this study, we focused on the most frequently used muscle groups in football and running movement. We aimed to increase microcirculation, reduce pain, accelerate regeneration, and ultimately increase performance by applying cups to the quadriceps, hamstrings, adductors, and gastrocnemius muscles. However, we could not obtain a statistically significant difference between the groups with and without cupping in both aerobic and anaerobic capacity.

Most of the studies related to cupping were conducted on chronic and unknown pain. Various studies have shown that cupping reduces chronic pain of unknown origin (4,10-16).

It was observed that the dry cup application to myofascial trigger points once a week for 3 weeks significantly reduced trigger point sensitivity and increased the pain threshold compared to the control group of 70 football players with low back pain (17). It was observed that the cupping application once a week for four times reduced low back pain and increased waist flexibility in 20 amateur football players with non-specific low back pain (18).

It was determined that the dry cup applied to football players increased the knee and hip flexion, but did not increase the knee and hip strength (19).

The recovery phase in athletic activities is very important. In a study, investigating the effect of moxibustine (a stimulant substance used in the Far East) and cup application on gymnastics athletes after a vigorous exercise activity, it was observed that CK levels were lower in moxibustine and cup application groups and this group was found to be less affected by fatigue. In addition, personal symptom screening test (SCL-90) indicated that cup-applied group was better than the control group (20). In a study conducted on 22 male handball players it was observed that cupping and exercise increased CK and LDH values, which are markers of muscle damage (21).

There are also very limited studies on the effect of cupping on anaerobic capacity. It has been claimed that wet cup application increases leg muscle strength, vertical jump, 10 m acceleration, and YOYO-1 test results positively (7).

In addition, it was suggested that a single-dose, mobile cup application increased hip and knee range of motion but did not increase isokinetic knee flexion strength in 21 athletes (22).

In conclusion, we found that dry cup application on main muscle groups at lower extremities has no effect on aerobic and anaerobic capacity of football players.

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***Ethics Committee Approval / Etik Komite Onayı***

The Ethics Committee of Erciyes University approved all procedures and the experimental design (date: 22/09/2020 and number: 77979112). The study protocol is in accordance with the latest version of the Declaration of Helsinki.

***Conflict of Interest / Çıkar Çatışması***

The authors declared no conflicts of interest with respect to authorship and/or publication of the article.

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***Author Contributions / Yazar Katkıları***

Concept: SA, SS, BP ; Design: SA, SS, BP, OO, FI; Supervision: OO, BP, SS, MK; Materials: OO, BP, Serar Sucan, MK, FI, SA; Data collection and/or processing:OO, BP, Serar Sucan, MK; Analysis and Interpretation:FI, BP, SS; Literature review:BP, SS; Writing manuscript:SS, BP, OO, MK, FI, SA; Critical reviews:SA, SS, BP. All authors contributed to the final version of the manuscript and discussed the results and contributed to the final manuscript.

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