

# The effect of cupping therapy combined with high-intensity interval exercise on selected blood parameters of football players

Ahmed Adel Mannaa<sup>1\*</sup>, Akram Abd Alaziz Sayed<sup>2</sup>, Amr Moustafa Yehia<sup>3</sup>, Heba Ali Abed Elghaffar<sup>2</sup>

<sup>1</sup> Al-Azhar University, Cairo, Egypt.

<sup>2</sup> Faculty of Physical Therapy, Cairo University, Giza, Egypt.

<sup>3</sup> Faculty of Physical Therapy, October 6 University, Giza, Egypt.

\* Correspondence: Ahmed Adel Mannaa; [Ahmed\\_Manna3@hotmail.com](mailto:Ahmed_Manna3@hotmail.com)

## ABSTRACT

Cupping therapy is a centuries-old and worldwide method that may be found in both the East and the West. The aim of this study was to find out how wet cupping therapy combined with high-intensity interval training affects blood markers and athletic performance in football players. A two-arms, pre- and post-test, parallel randomized controlled trial was carried out. Forty male football players were chosen from Wadi Degla Football Club and were divided into two equal groups (group A and group B) using computerized randomization. Twenty players were assigned to Group A (wet cupping group), which received cupping therapy once a month for three months and high-intensity interval training, including Fifa 11+ protocol six days a week for three months, while twenty other players were assigned to Group B (control group), which received only high-intensity interval training, including Fifa 11+ protocol six days a week for three months. At baseline and after the training program, hematological analysis, blood lactate, and the Yo-Yo level 2 test were performed. Compared with the MCHC (mean corpuscular hemoglobin), PLt (platelet count), and total distance values of the control group after treatment, the wet cupping therapy group showed statistically significant improvement in lactic acid ( $p = 0.005$ ), MCHC ( $p = 0.026$ ), PLt ( $p = 0.014$ ), lymphocytes ( $p = 0.047$ ), and distance (meter) ( $p = 0.007$ ). In football players, the mixed technique of using wet cupping with high-intensity interval training has resulted in clinically crystal-clear improvements in lactic acid, MCHC, PLt, and total distance covered.

## KEYWORDS

Cupping; Blood parameters; Athlete; Football

## **1. INTRODUCTION**

Cupping therapy, also known as Hijama in Arabic, is a centuries-old treatment method that is still used today in many parts of the world. From West to East, this treatment has been passed down via numerous cultures, including the ancient Greeks and Chinese (Al-Shamma & Abdil-Razzaq, 2009). Cupping therapy gained popularity during the 2016 Olympic Games in Rio de Janeiro, when numerous athletes were spotted wearing a red circle all over their bodies, indicating that they were receiving cupping therapy (Musumeci, 2016).

Cupping has been demonstrated to aid with symptoms such as chemotherapy, nausea, and vomiting, according to the National Institute of Health (NIH) in the United States (Ullah et al., 2007). Knee discomfort, sports injuries, muscle soreness, back pain, neck and shoulder pain, headaches, and migraines are some of the conditions for which it is recommended as a supplemental therapy (Lee et al., 2008).

By eliminating metabolic waste products, free radicals, and foreign debris from the interstitial spaces and fluids, cupping may assist to prevent disease (Refaat et al., 2014). The medical reason for cupping is the same as for glomerular filtration in the kidneys (Baghdadi et al., 2015).

Cupping can be classified into two types: retained cupping and bleeding cupping. In dry cupping, suction cups are put in certain regions of the body and negative pressure is administered. Cutting or scraping the skin and applying negative pressure to collect blood is known as wet cupping (Saad & Said, 2011). Wet cupping can be used as a treatment as well as a preventative strategy. In the literature, various methods of wet cupping have been proposed; however, the most common method involves creating light and minor cuts on the skin with a scalpel, followed by gentle suction for three minutes to remove a small amount of blood (Farhadi et al., 2009).

By precipitating stagnant blood and eliminating toxins from the body, this approach tries to restore normal blood flow (Guimberteau et al., 2010; Kim et al., 2011; El Sayed et al., 2013). Wet cupping, on the other hand, can help athletes increase their flexibility and range of motion by relieving muscle stiffness, discomfort, and tiredness (Kim et al., 2017). The mechanical effects of cupping therapy are aimed at promoting fascial movement by enhancing the lubrication of the superficial fascia between the skin and the deep fascia (Guimberteau et al., 2010; Lauche et al., 2011). This may assist to break down adhesions produced at the deep fascia, allowing muscle mobility to be more independent (Kim et al., 2017).

Even though it was confirmed to be safe after long-term clinical use, previous research on wet cupping has been sparse, and many of them have been skewed by cultural, social, and religious variables, which can lead to prejudice (Lüdtke et al., 2006; Ma et al., 2013).

Wet cupping therapy has been used to treat a variety of ailments and for a variety of objectives, including improving athletic performance. Many sportsmen, including 23-time Olympic gold medalist Michael Phelps, the greatest swimmer of all time, were seen with wet cupping impressions on their skin during the 2016 Olympic Games in Brazil (Musumeci, 2016). These athletes may have undergone wet cupping treatment for a variety of reasons, including improved performance.

However, we were unable to locate any research on the impact of wet cupping on sports performance. Thus, the aim of this study is to find out how wet cupping therapy combined with high-intensity interval training affects blood markers and athletic performance in football players.

## **2. METHODS**

### **2.1. Study design and Participants**

A two-arms, pre- and post-test, parallel randomized controlled trial was conducted. Forty male football players aged 18 to 33 were chosen from Wadi Degla Football Club. The study took place from July to August 2021 at Wadi Degla Football Club. Inclusion criteria included participants between the ages of 18 and 33, playing professional football, and be formally registered with the Egyptian football association to be considered. Participants with any sickness and/or long-term traumatic injuries and procedures were excluded. Participants were divided into two equal groups using computerized randomization: group A (wet cupping group) and group B (control group). Twenty players were assigned to Group A (wet cupping group), which got cupping therapy once a month for three months and high-intensity interval training, including Fifa 11+ protocol six days a week for three months, while Group B (control group) included also twenty players, who received just high-intensity interval training, including Fifa 11+ protocol six days a week for three months. During the trial, participants were told not to start any new exercises or use any supplements.

### **2.2. Randomization & Blinding**

Computerized randomization was used to divide the participants into two equal groups. An investigator with no direct contact with the individuals utilized opened serially numbered opaque envelopes. The outcome assessor was unaware of the participant assignment. All of the participants

read and signed the consent form before beginning the study. The study's procedures were authorized by the Faculty of Physical Therapy's Institutional Ethical Committee (No: P.T. REC/012/002618). This experiment was reported using the Consolidated Standards of Reporting Trials (CONSORT) statement (Schulz et al., 2010).

## **2.3. Interventions**

### **2.3.1. Wet Cupping Group**

In addition to high-intensity interval exercise and Fifa11+ protocol patients in this group got the wet cupping therapy. Plastic cups with valves and a suction mechanism were used to extract air from within the cup through the valve in the cupping set. The cups used are number five in size.

For three months, the players were given a single wet cupping intervention session per month. The players knelt in a prone position. Their backs were uncovered, and the skin was scrubbed clean with alcohol to prevent infection. The cupping therapy was administered for a few minutes to a relevant point till redness appeared. The doctor wore a face mask and sterilized gloves. The skin was superficially sliced using a single-use surgical blade (no. 11). Suction was then applied for another 4-5 minutes (typical blood clotting time), during which time the blood in the cup became stagnant. Finally, the blood-soaked cup was removed, and the skin was cleansed with 75% alcohol. The wounds were sterilized with 2% iodine, gauze was used, and adhesive plaster was applied for 24 hours. C7, the Rt inferior angle of the scapula, the Lt inferior angle of the scapula, and the middle of the sternum were all used as cupping points.

### **2.3.2. Control group**

During the pre-season, a three-month training program was implemented. The control group members received a high-intensity interval training as part of their sport-specific team training for three months in a row. A soccer training week included five 1.5-2 hour practice sessions and one soccer match. During the current study, the coach mostly concentrated on increasing aerobic and anaerobic fitness as well as technical-tactical skills, except for the particular training sessions.

To minimize undue fatigue, each training session began with a pre-training FIFA 11+ exercise, which consisted of 15 subcategories, and ended with post-training FIFA 11+ exercises, which consisted of 13 subcategories (Table 1). By their pre-season timeframe, the total training time of sessions was evenly allocated for both groups. The HIIT (High Intensity Interval Training) sessions, which were conducted without the use of a soccer ball, comprised of 15 seconds of

intermittent running at 90–95 percent of the players' velocity of intermittent fitness test (VIFT), followed by 15 seconds of passive rest.

**Table 1.** FIFA 11+ injury prevention programs

<b>FIFA 11+ pre-training exercises 20 min</b>		<b>FIFA 11+ post-training exercises 10 min</b>	
Part 1: Running exercises (8 min)	Sets	Part 1: Jogging exercises (4 min)	Sets
Running, straight ahead	2	Jogging, straight ahead	1
Running, hip out	2	Jogging, hip out	1
Running, hip in	2	Jogging, hip in	1
Running, circling partner	2	Jogging, circling partner	1
Running, jumping with shoulder contact	2	Jogging, jumping with shoulder contact	1
Running, quick forwards and back	2	Jogging, forwards and back backward	1
Part 2: Strength, plyometric and balance exercises (10 min)		Part 2: Strength, plyometric and balance exercises (5 min)	
The bench, static	3	The bench, static	1
The bench, alternate legs	3	The bench, alternate legs	1
The bench, one leg lift, and hold	3	The bench, one leg lift, and hold	1
Sideways bench, static	3	Sideways bench, static	1
Sideways bench, raise and lower hip	3	Sideways bench, raise and lower hip	1
Sideways bench, with leg lift	3	Sideways bench, with leg lift	1
Nordic hamstring, beginner	1	Nordic hamstring, beginner	1
Nordic hamstring, intermediate	1	Nordic hamstring, intermediate	1
Nordic hamstring, advanced	1	Nordic hamstring, advanced	1
Single-leg stance, hold the ball	2	Single-leg stance, hold the ball	1
Single-leg stance, throwing the ball	2	Single-leg stance, throwing the ball	1
Single-leg stance, test your partner	2	Single-leg stance, test your partner	1
Squats, with toe raise	2	Squats, with toe rise	1
Squats, walking lunges	2	Squats, walking lunges	1
Squats, one-leg squats	2	Squats, one-leg squats	1
Jumping, vertical jumps	2	Jumping, vertical jumps	1
Jumping, lateral jumps	2	Jumping, lateral jumps	1
Jumping, box jumps	2	Jumping, box jumps	1
Part 3: Running exercises (2 min)		Part 3: Jogging exercises (1 min)	
Running, across the pitch	2	Jogging, across the pitch	1
Running, bounding	2		
Running, plant and cut	2		

## 2.4. Outcome Measures

### 2.4.1. Blood Sampling and Hematological Analysis

Each individual was positioned in a comfortable posture with their arm resting on a table at heart level when they arrived, and blood samples were taken from the antecubital vein via venipuncture. The entire procedure took between one and two minutes. Before and after therapy, blood samples were taken to determine the total blood count using a Sandwich ELISA kit (SEA546mu, USA).

Hematocrit (%), hemoglobin (g dL<sup>-1</sup>), red cell count ( $\times 10^{12}$  L<sup>-1</sup>), mean cell volume (fL), mean cell hemoglobin (pg), platelet count ( $\times 10^9$  L<sup>-1</sup>), white cell count ( $\times 10^9$  L<sup>-1</sup>), neutrophil count ( $\times 10^9$  L<sup>-1</sup>), neutrophils (%), lymphocyte count ( $\times 10^9$  L<sup>-1</sup>), lymphocytes (%) were analysed in these samples.

### 2.4.2. Blood Lactate Measurement

To precisely quantify the amount of lactate in the blood, a blood lactate measuring meter (Lactate Plus, Nova Biomedical, USA) was employed. It employs an electrochemical lactate oxidase biosensor to measure lactate in whole blood. A 0.7 IL blood sample is required, with an analysis duration of 13 seconds. Calibration codes or particular calibration strips are not required for test strips used with the L. Before testing, the L comes with two levels of a quality control solution (level 1: 1.0–1.6 mM; level 2: 4.0–5.4 mM) that are used to guarantee the analyzer's accurate operation.

### 2.4.3. Yo-Yo intermittent endurance level 2 (Yo-Yo IE2) test

The Yo-Yo IE2 test was performed by all study participants before and after the completion of the treatment program (3 months). The test was conducted outdoor to keep the effects of weather and ground surfaces. The test lasted between 5 and 25 minutes. All participants were given a full explanation of the exam before becoming familiar with the procedures. The test began with a warm-up phase comprised of three running bouts of the Yo-Yo IE2 test, followed by lower-extremity stretching activities.

Following the warm-up, each participant ran a series of 20-meter shuttle runs at progressively faster speeds, as determined by an audible beep. The players had a 5-second jog around a marker 2.5 meters behind the finish line between shuttles. On two occasions, failure to finish the shuttle run in time resulted in the test being terminated, and the distance achieved in the last complete successful shuttle was recorded (Bradley et al., 2014).

## 2.5. Statistical Analysis

The statistical analysis was carried out using the SPSS Package application for Windows version 25 (SPSS, Inc., Chicago, IL). For demographic data variables, an independent test was employed to compare the wet cupping group and the control group (age, weight, and height). The tested key variables of interest were compared using multivariate analysis of variance (MANOVA) at different tested groups and measuring periods. The first independent variable (between-subject factors) was the tested group with two levels examined using a mixed design 2 x 2 MANOVA-test (cupping group vs. normal group). The Bonferroni correction test (Post hoc-tests) was performed to evaluate pairwise within and between groups of the tested variables. A p-value of  $< 0.05$  was considered statistically significant.

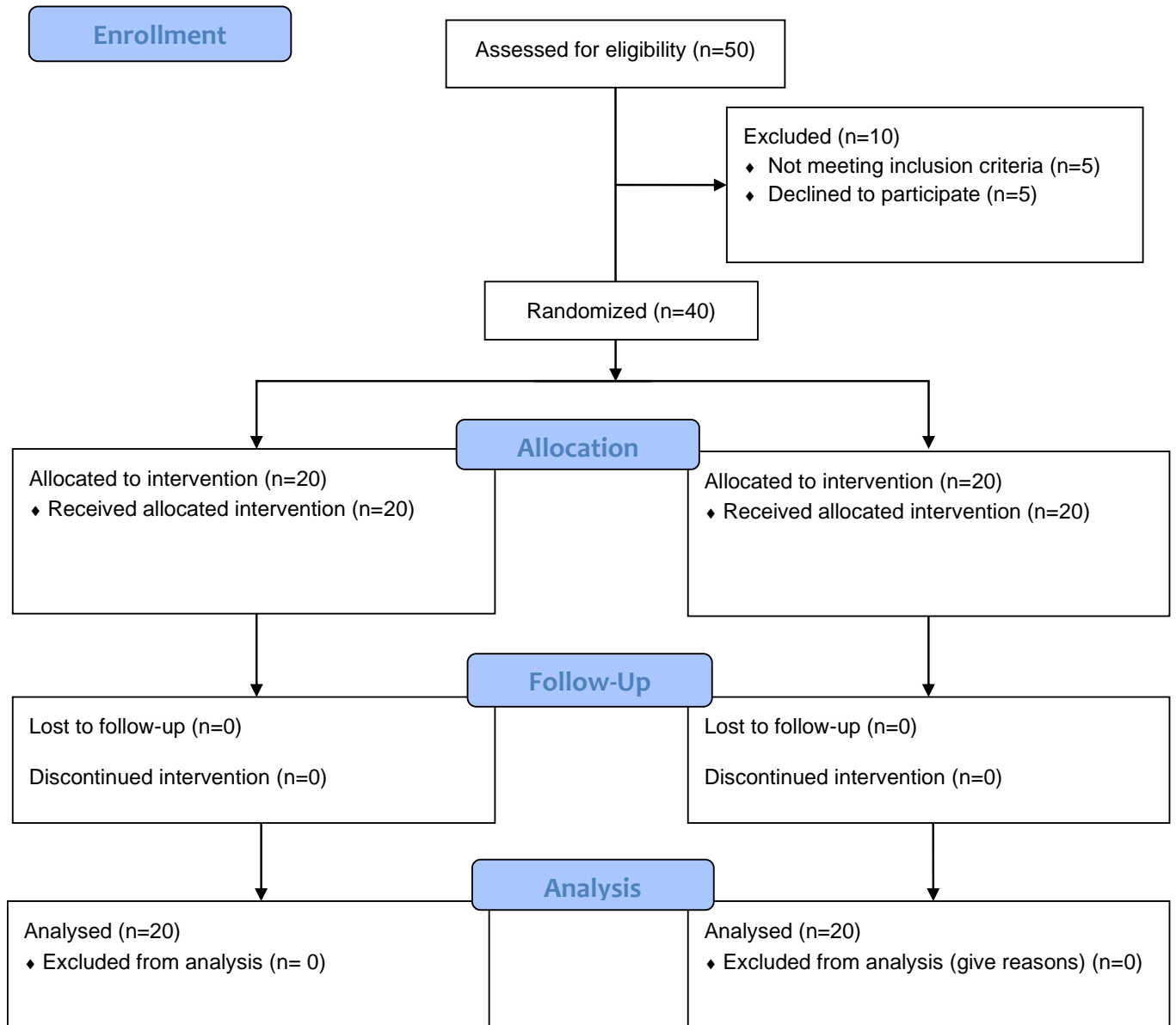
## 3. RESULTS

Ten Wadi Degla Football Club players were rejected from the study. Two of them were in phase one of ACL (Anterior Cruciate Ligament) reconstruction rehabilitation, one had a meniscal injury, one had a bankart lesion, one had a recent hamstring strain, and five declined to participate (Figure 2).

Between July and September 2021, forty individuals met the study's eligibility criteria and were enrolled in the study. Both groups had identical baseline characteristics and clinical assessments, as shown in Table 2.

After the intervention, participants in the experimental cupping plus high-intensity intermittent exercise group exhibited a 5.42 percent increase in Hgb levels and a 73.27 percent increase in the yo-yo test. Lactic acid was also reduced by 26.46 % in these subjects. The Hgb, RBCs, and hematocrit levels of participants in the control group improved by 8.62 percent, 6.67 %, and 5.51 %, respectively. In addition, participants in the control group improved their yo-yo test performance by 47.27 % (Table 3).

There were no statistically significant differences between groups at baseline ( $p > 0.05$ ). We found statistically significant difference ( $p < 0.05$ ), for MCHC levels with a mean disparity of 0.7 (95% CI 0.08 to 1.31), but levels with a mean difference of 42.45 (95% CI 8.79 to 76.10), and yo-yo test with a mean-variance of 567 (95% CI 163.26 to 970.73) between the experimental and control group at post-treatment. All the remaining between-group differences were not statistically crystal-clear (Table 3).



**Figure 1.** Flow of participants through the trial



**Table 2.** Demographic and clinical characteristics of the participants at baseline (n = 40)

<b>Variables</b>	<b>Cupping group (n=20)</b>	<b>Control group (n=20)</b>
Age	20.50 ±1.27	21.20 ±2.76
Weight	76.50 ±5.04	74.30 ±4.45
Height	179.95 ±5.14	177.10 ±4.61
Hgb	14.75 ±1.33	14.50 ±0.76
RBCs	5.30 ±0.47	5.25 ±0.44
HCT	45.40 ±2.76	45.40 ±2.76
MCV	86.35 ±4.71	85.35 ±2.97
MCH	28.50 ±1.93	28.05 ±1.05
MCHC	32.70 ±1.12	32.50 ±0.76
PLt	234.65 ±61.28	222.45 ±44.36
WBCs	7.15 ±2.81	6.15 ±1.87
Neutrophils	47.10 ±13.30	54.65 ±9.97
Lymphocytes	45.85 ±12.65	38.45 ±9.57
Lactic acid	9.65 ±3.93	9.45 ±3.01
Distance (meter)	1762.00 ±500.69	1688.00 ±378.32

*NOTE: Hgb: Hemoglobin; RBCs: Red blood cell count; HCT: Hematocrit; MCV: mean corpuscular volume; MCH: mean corpuscular hemoglobin; MCHC: mean corpuscular hemoglobin concentration; PLt: Platelet count; WBCs: White blood cells count*

**Table 3.** Means (SD) for outcomes at baseline and mean (95% CI) for within- and between-groups difference.

Outcomes	Groups				Difference within groups		Difference between groups
	Baseline		Posttreatment		Posttreatment – Baseline		Posttreatment – Baseline
	Experimental	Control	Experimental	Control	Experimental	Control	Experimental - Control
	(n=20)	(n=20)	(n=20)	(n=20)	(n=20)	(n=20)	(n = 40)
Hgb	14.75±1.33	14.50±0.76	15.55±0.99	15.75±0.71	0.80 (0.18 – 1.42)	1.25 (0.63 – 1.86)	0.20 (-0.41 – 0.81)
RBCs	5.30±0.47	5.25±0.44	5.55±0.51	5.60±0.50	0.25 (0.05 – 0.55)	0.35 (0.04 – 0.65)	0.05 (-0.25 – 0.35)
HCT	45.40±2.76	45.40±2.76	46.50±2.28	46.95±2.41	1.10 (-0.45 – 2.65)	2.45 (0.89 – 4.00)	0.45 (-1.10 – 2.00)
MCV	86.35±4.71	85.35±2.97	86.90±3.30	86.20±2.14	0.55 (-1.60 – 2.70)	0.85 (-1.30 – 3.00)	0.70 (-1.45 – 2.85)
MCH	28.50±1.93	28.05±1.05	28.90±1.25	28.25±0.91	0.40 (-0.45 – 1.24)	0.20 (0.65 – 1.05)	0.65 (-0.20 – 1.49)
MCHC	32.70±1.12	32.50±0.76	33.30±1.03	32.60±0.94	0.60 (-0.01 – 1.21)	0.10 (0.51 – 0.71)	0.70 (0.08 – 1.31)
PLt	234.65±61.28	222.45±44.36	258.10±60.76	215.65±44.81	23.45 (-10.20 - 57.10)	6.8 (-26.85 – 40.45)	42.45 (8.79 – 76.10)
WBCs	7.15±2.81	6.15±1.87	6.70 ±1.83	6.35 ±1.66	0.45 (-0.87 – 1.77)	0.20 (-1.12 – 1.52)	0.35 (-0.97 – 1.67)
Neutrophils	47.10±13.30	54.65±9.97	44.75 ±12.45	52.05 ±11.18	2.35 (-5.08 – 9.78)	2.60 (4.83 – 10.03)	7.3 (-0.13 – 14.73)
Lymphocytes	45.85±12.65	38.45±9.57	47.50 ±13.29	40.55 ±11.35	1.65 (-5.78 – 9.08)	2.10 (-5.33 – 9.53)	6.95 (-0.48 – 14.38)
Lactic acid	9.65±3.93	9.45±3.01	7.00 ±2.75	8.10 ±2.46	2.65 (0.70 – 4.59)	1.35 (-0.59 – 3.29)	1.10 (-0.84 – 3.04)
Distance (meter)	1762.00±500.69	1688.00±378.32	3053.00±982.80	2486.00±532.84	1291 (877.26 - 1694.73)	798 (394.26 – 1201.73)	567 (163.26 – 970.73)

NOTE: Hgb: Hemoglobin; RBCs: Red blood cell count; HCT: Hematocrit ; MCV: mean corpuscular volume; MCH: mean corpuscular hemoglobin; MCHC: mean corpuscular hemoglobin concentration; PLt: Platelet count; WBCs: White blood cells count

#### 4. DISCUSSION

Cupping is a medicinal practice that has been used since ancient times and is still utilized in many nations today. Wet cupping has been shown to improve athletes' ability to heal by increasing blood flow to tissues and eliminating toxins from the body (El Sayed et al., 2013; Yoo & Tausk, 2004; Tham et al., 2006). Furthermore, wet cupping has improved athletic performance by reducing muscle soreness in athletes (Farhadi et al., 2009; Hanan & Eman, 2013; Musumeci, 2016), also was reported to improve the immune system (Alshareef et al., 2021).

According to our study results, both the wet cupping therapy and control groups improved significantly in Hgb, RBCs, and total distance covered. Compared with the MCHC, PLt, and total distance values of the control group after treatment, the wet cupping therapy group showed statistically significant improvement in lactic acid ( $p = 0.005$ ), MCHC ( $p = 0.026$ ), PLt ( $p = 0.014$ ), lymphocytes ( $p = 0.047$ ), and DIST ( $p = 0.007$ ), and total distance covered.

For lactic acid, there was a significant decrease ( $p < 0.05$ ) in the experimental group after treatment compared with pre-treatment. In the control group, there was no significant difference ( $p > 0.05$ ) in lactic acid between pre- and post-treatment, while there was no significant difference between groups ( $p > 0.05$ ).

Our results come in agreement with a study by Almainan (2018) who summarized the results of eight original research articles. The overall net results of wet cupping did not significantly affect C-reactive protein, Hsp-27, sister chromatid exchanges, and cell replication index. In contrast, wet cupping was found to produce higher oxygen saturation, eliminate lactate from subcutaneous tissues, remove blood containing higher levels of malondialdehyde and nitric oxide, and produce higher activity of myeloperoxidase.

The current study's findings align with previous research that found a substantial difference in MCHC levels when evaluated before and after wet cupping (Hekmatpou et al., 2013; Soleimani et al., 2019). Sindi et al. (2019) showed some agreement with our findings. They looked at the impact of wet cupping on hematological parameters and the risk of anemia resulting from wet cupping. The information was gathered from 17 people who took part in the survey. Hematological parameters were analyzed by comparing samples from each participant before, one week after, and two weeks after wet cupping. The MCHC mean level before wet cupping was  $31.27 (\pm 1.34)$  g/dl, in the first week after wet cupping it showed an increase in the mean value  $32.59 (\pm 1.18)$  g/dl, and then it also increased after two weeks of wet cupping  $33.17 (\pm 2.17)$  g/dl with statistically significant difference ( $p < 0.001$ ) and this came in agreement with the findings of the current study.

In the current study, PLt levels showed noticeable improvement in post-treatment scores with a mean difference of 42.45 (95% CI 8.79 to 76.10). However, Sindi et al. (2019) showed that mean PLt before wet cupping was 210.8 ( $\pm$  59.4) X 10<sup>9</sup>/L, it decreased after one week of wet cupping 208.1 ( $\pm$  56.1) X 10<sup>9</sup>/L and increased after two weeks of wet cupping 209.8 ( $\pm$  51.06) X 10<sup>9</sup>/L with no statistically apparent variance which came in disagreement with the current study. Sucking pressure applied by cupping seems to cause more platelets to be reduced at a lower density. This platelet excretion increases blood clotting time, thus facilitating blood flow and oxygen delivery to the organs.

The present study results also partially agreed with the results of Karavelioğlu et al. (2019) who investigated the effectiveness of wet cupping on performance and specific blood parameters of athletes. Yoyo test and blood parameters such as WBC, RBC, Hgb, PLt, and HCT levels were measured. The yoyo test revealed statistical indication in the experimental group, which is compatible with the current study, but no improvement in blood parameters was found, consistent with our findings. The disparity could be explained by differences in application sites, as both investigations used wet cupping on the calf and hamstring muscles. The YoYo test showed a high level of consistency and sensitivity, allowing for a thorough examination of athletes' physical abilities in intermittent sports. The Yo-Yo intermittent recovery test, in particular, was found to be a reliable indicator of soccer fitness (Krustrup et al., 2003).

Furthermore, the results of this current study contradict the results of a study conducted by Mustafa & Sheiko (2020) which evaluated the effectiveness of wet cupping versus blood donation on hematological parameters. A total of 60 healthy young adults were assigned non-randomly either in cupping (n=30) or blood donation (n=30) groups. Blood samples were collected from all subjects to measure hematological parameters before and one week after interventions. The findings of that study showed that wet cupping is an effective intervention in reducing hematological parameters but not MCHC (MD: +0.19, P=0.123) or Platelet (MD: +7.20, P=0.081).

The discrepancy could be due to the unequal way of application, as it was utilized only once in the previous study versus three times in three months in the current one. Obohat et al. (2020) disagreed with the current study's findings, claiming that Hgb, HCT, PLt, and ESR do not change with wet cupping application. This could be due to the current study's methodological differences, as it used normal people who were not athletes, and the measurements were taken over a seven-day interval, rather than the current study's three-month period.

## 5. LIMITATIONS

This study has significant limitations, including using only one performance measure, the yo-yo test, which represents only one component of performance, and the lack of a quality-of-life questionnaire that evaluates contentment with an image of his performance. These drawbacks could be addressed in future research.

## 6. CONCLUSIONS

In football players, the mixed technique of using wet cupping with high-intensity interval training has resulted in clinically crystal-clear improvements in lactic acid, MCHC, PLt, and total distance covered.

## 7. REFERENCES

1. Almaiman, A. A. (2018). Proteomic effects of wet cupping (Al-hijamah). *Saudi Medical Journal*, 39(1), 10-16.
2. Al-Shamma, Y. M., & Razzaq, A. A. (2009). *Al-Hijamah cupping therapy*. Kufa Medical Journal, 12(1), 49-56.
3. Alshareef, A., Alsaedi, A. K., Alnakhli, A. A., Albeladi, A. A., AlHejili, R. S., & Younis, M. S. (2021). Wet cupping (Hijama) positively and significantly impacted multiple hematological parameters. *Majmaah Journal of Health Sciences*, 9(2), 98-112.
4. Baghdadi, H., Abdel-Aziz, N., Ahmed, N. S., Mahmoud, H. S., Barghash, A., Nasrat, A., ... & El Sayed, S. M. (2015). Ameliorating role exerted by Al-Hijamah in autoimmune diseases: effect on serum autoantibodies and inflammatory mediators. *International Journal of Health Sciences*, 9(2), 207.
5. Bradley, P. S., Bendiksen, M., Dellal, A., Mohr, M., Wilkie, A., Datson, N., ... & Krstrup, P. (2014). The application of the Y o-Y o intermittent endurance level 2 test to elite female soccer populations. *Scandinavian Journal of Medicine & Science in Sports*, 24(1), 43-54.
6. El Sayed, S. M., Mahmoud, H. S., & Nabo, M. M. H. (2013). Methods of wet cupping therapy (Al-Hijamah): in light of modern medicine and prophetic medicine. *Alternative & Integrative Medicine*, 2(3), 1-16.
7. Farhadi, K., Schwebel, D. C., Saeb, M., Choubsaz, M., Mohammadi, R., & Ahmadi, A. (2009). The effectiveness of wet-cupping for nonspecific low back pain in Iran: a randomized controlled trial. *Complementary Therapies in Medicine*, 17(1), 9-15.

8. Guimberteau, J. C., Delage, J. P., McGrouther, D. A., & Wong, J. K. F. (2010). The microvacuolar system: how connective tissue sliding works. *Journal of Hand Surgery (European Volume)*, 35(8), 614-622.
9. Hanan, S., & Eman, S. (2013). Cupping therapy (al-hijama): It's impact on persistent non-specific lower back pain and client disability. *Life Science Journal*, 10(4), 631-642.
10. Hekmatpou, D., Moeini, L., & Haji-Nadali, S. (2013). The effectiveness of wet cupping vs. venesection on arterial O<sub>2</sub> saturation level of cigarette smokers: A randomized controlled clinical trial. *Pakistan Journal of Medical Sciences*, 29(6), 1349.
11. Karavelioğlu, M. B. , Altıkat, S. , Başkaya, G. & Gökçelik, E. (2019). Investigation of the effect of wet cupping application on certain performance and blood parameters of athletes. *Sportive Perspective: Journal of Sport and Educational Sciences*, 6(1), 74-84.
12. Kim, J. E., Do, K. S., & Kim, H. J. (2017). Effect of cupping therapy on range of motion, pain threshold, and muscle activity of the hamstring muscle compared to passive stretching. *Journal of The Korean Society of Physical Medicine*, 12(3), 23-32.
13. Kim, J. I., Kim, T. H., Lee, M. S., Kang, J. W., Kim, K. H., Choi, J. Y., ... & Choi, S. M. (2011). Evaluation of wet-cupping therapy for persistent non-specific low back pain: a randomised, waiting-list controlled, open-label, parallel-group pilot trial. *Trials*, 12(1), 1-7.
14. Krstrup, P., Mohr, M., Amstrup, T., Rysgaard, T., Johansen, J., Steensberg, A., ... & Bangsbo, J. (2003). The yo-yo intermittent recovery test: physiological response, reliability, and validity. *Medicine & Science in Sports & Exercise*, 35(4), 697-705.
15. Lauche, R., Cramer, H., Choi, K. E., Rampf, T., Saha, F. J., Dobos, G. J., & Musial, F. (2011). The influence of a series of five dry cupping treatments on pain and mechanical thresholds in patients with chronic non-specific neck pain-a randomised controlled pilot study. *BMC Complementary and Alternative Medicine*, 11(1), 1-11.
16. Lee, H. J., Park, N. H., Yun, H. J., Kim, S., & Jo, D. Y. (2008). Cupping therapy-induced iron deficiency anemia in a healthy man. *The American Journal of Medicine*, 121(8), 5-6.
17. Lüdtke, R., Albrecht, U., Stange, R., & Uehleke, B. (2006). Brachialgia paraesthetica nocturna can be relieved by “wet cupping”—results of a randomised pilot study. *Complementary Therapies in Medicine*, 14(4), 247-253.
18. Ma, Y., Cui, J., Huang, M., Meng, K., & Zhao, Y. (2013). Effects of Duhuoji Sheng Tang and combined therapies on prolapse of lumbar intervertebral disc: a systematic review of randomized control trails. *Journal of Traditional Chinese Medicine*, 33(2), 145-155.

19. Mustafa, Z. R., & Sheiko, S. K. (2020). Evaluation of effectiveness of wet cupping versus blood donation on Hematological parameters in Healthy young adults. *Erbil Journal of Nursing and Midwifery*, 3(1), 11-21.
20. Musumeci, G. (2016). Could cupping therapy be used to improve sports performance? *Journal of Functional Morphology and Kinesiology*, 1(4), 373-377.
21. Obohat, R., Kazemeini, S., Mansouri, R., Vakili, M. (2020). Determination and comparison of laboratory parameters of venous blood before and after cupping therapy. *Pakistan Journal of Medical and Health Sciences*, 14(4),1405-1409.
22. Refaat, B., El-Shemi, A. G., Ebid, A. A., Ashshi, A., & BaSalamah, M. A. (2014). Islamic wet cupping and risk factors of cardiovascular diseases: effects on blood pressure, metabolic profile and serum electrolytes in healthy young adult men. *Alternative and Integrative Medicine*, 3(1), 151.
23. Saad, B., & Said, O. (2011). *Greco-Arab and Islamic herbal medicine: traditional system, ethics, safety, efficacy, and regulatory issues*. John Wiley & Sons.
24. Schulz, K. F., Altman, D. G., & Moher, D. (2010). CONSORT 2010 statement: updated guidelines for reporting parallel group randomised trials. *Trials*, 11(1), 1-8.
25. Sindi, W. I., Alzhrani, A. A., Al Harbi, A. M., Rashad, F. S., Zainy, A. R. O. A., Alzahrani, S. M., ... & Saeed, S. (2019). Effect of wet cupping use among patients complaining of pain attended in the Hijama clinic Makkhat Saudi Arabia. *European Journal of Molecular & Clinical Medicine*, 6(01), 205-215.
26. Soleimani, R., Saghebi, S. A., Taghipour, A., Vakilzadeh, A. K., & Afshari, J. T. (2019). Evaluation of Changes in Health and Complete Blood Count after Wet Cupping. *Journal Of Biochemical Technology*, 10(s2), 162-170.
27. Tham, L. M., Lee, H. P., & Lu, C. (2006). Cupping: from a biomechanical perspective. *Journal of Biomechanics*, 39(12), 2183-2193.
28. Ullah, K., Younis, A., & Wali, M. (2007). An investigation into the effect of cupping therapy as a treatment for anterior knee pain and its potential role in health promotion. *The Internet Journal of Alternative Medicine*, 4(1), 1-9.
29. Yoo, S. S., & Tausk, F. (2004). Cupping: East meets West. *International Journal of Dermatology*, 43(9), 664-665.

### **AUTHOR CONTRIBUTIONS**

All authors listed have made a substantial, direct and intellectual contribution to the work, and approved it for publication.

### **CONFLICTS OF INTEREST**

The authors declare no conflict of interest.

### **FUNDING**

This research received no external funding.

### **COPYRIGHT**

© Copyright 2023: Publication Service of the University of Murcia, Murcia, Spain.