

## ORIGINAL ARTICLE

## Doping that is not a doping / effects of ozone therapy in sports

Mustafa Tansel Turan <sup>1</sup><sup>1</sup> Reborn Clinics Istanbul, Turkey OPEN ACCESS

## ABSTRACT

**Citation**

Tansel Turan M. Doping that is not a doping / effects of ozone therapy in sports. *J Ozone Ther.* 2021;5(6).

doi: 10.7203/jo3t.5.6.2021.21386

**Academic Editor**

Jose Baeza-Noci,  
School of Medicine, Valencia  
University, SPAIN

**Editor**

World Federation of Ozone Therapy,  
Brescia, ITALY

**Received**

Jul 25, 2021

**Accepted**

Sep 30, 2021

**Published**

Dec 17, 2021

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**Authors information**

drtanselturan@gmail.com

**Objectives**

The primary objective of this study was measuring the contribution of ozone therapy to athletic performance.

**Methods**

At the beginning, we conducted a performance measurement (Astrand Treadmill Test) of the 30 (thirty) Football Players actively playing in the Turkish National League (men U19 Players of Premier League and 1st Football League Teams). After the primary measurement, 15 players were selected randomly and treated with 20 µg/ml to 30 µg/ml Major Ozone Autohemotherapy, 2 times a week for 5 weeks. The other 15 players were designated as the control group. At the end of the process, Astrand Treadmill Test was repeated with the same players on the 8th week, and their measurements were taken and compared with the first results. Results for first day average VO<sub>2</sub> max was 51 mL/kg/min for each group. After 8 weeks, first group's VO<sub>2</sub> Max found averagely 61 mL/kg/min. Control group's average VO<sub>2</sub> Max was found 54 mL/kg/min. In the first measurement, max running time was average 25 min. for each group, and after 8 weeks it was measured as 32 min. average for the first group, and 28 min. average for the control group.

**Conclusion**

The difference in performance increase was found significant between football players who were treated and not treated with ozone therapy. All athletes performed the same training program for 8 weeks. VO<sub>2</sub>max was increased 28% in ozone therapy-treated athletes but it was increased 12% in the control group. Max running time was increased 20% at ozone therapy-treated athletes, and it was increased %6 in the control group. In terms of these results, we can say that ozone therapy will be very effective for increasing athletic performance before season or tournaments.

**Keywords**

Ozone; sports performance; professional sport; oxygen carrier; training; WADA list

## INTRODUCTION

L Ozone therapy is administered for various medical and not-medical purposes with an increasing interest specially in the last decades. It induces antioxidant, anti-inflammatory, antiviral and anti-infective effects. The modulation of the immune system, regulation of circulation, increase of tissue oxygenation are the most known and the major indications in medicine. (1) (2) (3)

In addition, it can be safely administered for different purposes in sports people. (4) (5) (6) (7)

It's said that ozone therapy is done to improve performance especially in Germany, Italy, Cuba and Russia for football players and athletes. Also in the USA, although it is not officially approved, it is mentioned as one of the most common performance enhancement methods for athletes.

We also observe that in Turkey, various European-born and trained athletes (football players, athletes, boxers) are personally taking Ozone Therapy for its benefits of anti-inflammatory effects. (8)(9)(10)

The question that arises is: what is the true effect of ozone in sports?

Can Ozone Therapy Really Increase Sports Performance?

Can we clearly answer to these questions?

Maybe not!

**“The unique purpose of this study is to find out the answer to this question.”**

## SUBJECTS AND METHODS

**Period:** 01.September.2018 - 01.November.2018

**Subjects:** Turkish National Premier League U19 Football Players. All players are divided objectively into two equal groups, containing 15 subjects each for the ozone therapy group and the control group (Table 1).

SERIES	TEAM NUMBER	AGE	POSITION	GROUP
1	1	18	Goal Keeper	ozone
2	21	18	Goal Keeper	control
3	12	19	Goal Keeper	ozone
4	5	19	Stopper	control
5	16	18	Stopper	ozone
6	20	18	Stopper	control
7	4	19	Left Fullback	control
8	3	18	Left Fullback	ozone
9	2	18	Right Fullback	control
10	13	18	Right Fullback	ozone
11	17	19	Center Midfield	control
12	14	19	Center Midfield	ozone
13	6	19	Central Defender	control
14	7	19	Number Ten	ozone
15	10	18	Number Ten	ozone
16	8	18	Number Ten	control
17	11	18	Right Wing	ozone
18	19	19	Right Wing	ozone
19	15	18	Right Wing	control
20	9	19	Centre Forward	ozone
21	18	19	Centre Forward	control
22	A	19	Goal Keeper	control
23	B	19	Stoper	ozone
24	C	19	Central Defender	ozone
25	D	19	Number ten	control
26	E	18	Right Wing	control
27	F	18	Centre Forward	ozone
28	G	18	Centre Forward	control
29	H	18	Center Midfield	control
30	I	18	Center Midfield	ozone

**Table 1. Classification of Athletes**

Astrand Treadmill Test was applied to all athletes for performance measurement at the beginning, and 8 weeks later. The objective of the Astrand Treadmill Test (Astrand 1952) is to monitor the development of the athlete's general endurance (VO<sub>2</sub> max). (11)(12)(13)

To do this test you need only

- A treadmill
- A stopwatch
- An assistant

**How to do the test?**

This test requires the athlete to run as long as possible on a treadmill whose slope increments at timed intervals

- The athlete warms up for 10 minutes
- The assistant sets up the treadmill with a speed of 8.05 km/hr (5 mph) and an incline of 0%
- The assistant gives the command “GO”, starts the stopwatch and the athlete starts to run
- After every 3 minutes, the assistant, changes the incline to 2.5% and then every 2 minutes thereafter increases the incline by 2.5%
- The test ends when the athlete is unable to continue so stopwatch is stopped.

**Assessment**

By the help of total running time, an estimation of the athlete’s VO<sub>2</sub> max can be calculated as follows:

$$VO_2 \text{ max} = (\text{Time} \times 1.444) + 14.99$$

(where “Time” is the recorded test time expressed in minutes and fractions of a minute )

AGE	VERY POOR	POOR	FAIR	GOOD	EXCELLENT	SUPERIOR
13-19	< 35.0	35.0 - 38.3	38.4 - 45.1	45.2 - 50.9	51.0 - 55.9	> 55.9
20 - 29	< 33.0	33.0 - 36.4	36.5 - 42.4	42.5 - 46.4	46.5 - 52.4	> 52.4
30 - 39	< 31.5	31.5 - 35.4	35.5 - 40.9	41.0 - 44.9	45.0 - 49.4	> 49.4
40 - 49	< 30.2	30.2 - 33.5	33.6 - 38.9	39.0 - 43.7	43.8 - 48.0	> 48.0
50 - 59	< 26.1	26.1 - 30.9	31.0 - 35.7	35.8 - 40.9	41.0 - 45.3	> 45.3
60 +	< 20.5	20.5 - 26.0	26.1 - 32.2	32.3 - 36.4	36.5 - 44.2	> 44.2

**Table 2. Astrand, P. (1952) Experimental studies of physical working capacity in relation to sex and age. Munksgaard, Copenhagen. (14)**

SPORT	AGE	MALE	FEMALE
Basketball	18 -32	48 -56	52 -57
Cycling	18 -30	40 -60	43 -60
Gymnastics	18 -22	52 -58	35 -50
Rowing	20 -35	60 - 72	58-65
Skiing Alpine	18 -30	57 -68	50 -55
Skiing Nordic	20 -28	65 -94	60 -75
Soccer	22 -28	54 -64	50 -60
Swimming	10 -25	50 -70	40 -60
Running	18 -39	60 -85	50 -75
Running	40 -75	40 -60	35 -60
Volleyball	18 -22		40 -56
Weight Lifting	20 -30	38 -52	
Wrestling	20 -30	52 - 65	
Canoeing	22 -28	55 -67	48 -52
Football ( USA )	20 -36	42 -60	

Table 3. Average VO<sub>2</sub>Max results. (15)

VO <sub>2</sub> Max	Athlete	Gender	Event
96.0	Espen Harald Bjerke	male	Skiing
96.0	Bjorn Daehlie	male	Skiing
92.5	Greg LeMond	male	Cycling
92.0	Matt Carpenter	male	Marathon R.
92.0	Tore Ruud Hofstad	male	Skiing
91.0	Harri Kirvensniemi	male	Skiing
88.0	Miguel Indurain	male	Cycling
87.4	Marius Bakken	male	5K Runner
85.0	Dave Bedford	male	10K Runner
85.0	John Ngugi	male	Ultra Trail R
73.5	Greta Waitz	female	marathon r.
71.2	Ingrid Kristiansen	female	marathon r.
67.2	Rosa Mota	female	marathon r.

Table 4. Max VO<sub>2</sub> values of some Olympic Athletes. (15)

All athletes are divided into two groups which were fully equal with their ages and positions.

First 15 athletes were designated as the Control Group, and the others are called the Ozonotherapy Group.

Athletes in both groups were assigned the same training and nutrition program between September 1, 2018 and November 1, 2018, and all athletes are at the level of National Team Candidate and Candidate level.

The only variable fact was that we started Major Ozone Autohemotherapy to one of the groups. We started from 20 µg/ml and finished at 30 µg/ml, and administered two days a week for 5 weeks.

Ozone Therapy was performed for 5 weeks, and control tests were recorded on the 8th week.

## RESULTS

Anti-inflammatory, anti-infective, circulation regulatory, antioxidant, detoxification, immune modulating effects of ozone therapy are well known. All these are also necessary for athletes. Beside these effects, we observe that ozone therapy can increase sportive performance significantly.

At the beginning of the study, VO<sub>2</sub> max was average 51 mls/kg/min for both groups. At the end of the study, VO<sub>2</sub> max was calculated average 54 mls/kg/min for the control group (Table 5) and average 61 mL/kg/min for the ozone therapy group (Table 6).

At the beginning max. running time is average 25 min. for both groups. At the last evaluation, it is average 28 min for the control group (Table 5) and average 32 min. for the ozone therapy group (Table 6)

After 10 sessions of autohemotherapy, VO<sub>2</sub>Max increased %12 when compared to the control group, and %20 from the starting performance (Table 7).

It is very important for athletes of the same level to make a difference at the level of the dignity,

In near future; reproducing this study in other sport branches, which require strength, durability and condition, will show the importance of ozone therapy in physiologically supporting the performance of athletes.

Age	Position	Running time 1	Running time 2	Difference	Vo2max 1	Vo2max 2	Difference %
		min	min	min	mls/kg/min	mls/kg/min	
18	GoalKeeper	22	25	3	46.76	51.09	4%
19	Stopper	24	27	3	49.65	53.98	4%
18	Stopper	23	27	4	48.20	53.98	6%
19	Left Fullback	26	28	2	52.53	55.42	3%
18	Right Fullback	25	28	3	51.09	55.42	4%
19	Center Midfield	24	27	3	49.65	53.98	4%
19	Central Defender	25	29	4	51.09	56.87	6%
18	Number Ten	27	29	2	53.98	56.87	3%
18	Right Wing	28	30	2	55.42	58.31	3%
19	Centre Forward	26	29	3	52.53	56.87	4%
19	Goal Keeper	24	27	3	49.65	53.98	4%
19	Number Ten	28	31	3	55.42	59.75	4%
18	Right Wing	25	29	4	51.09	56.87	6%
18	Centre Forward	24	27	3	49.65	53.98	4%
18	Center Midfield	24	27	3	49.65	53.98	4%

**Table 5. Astrand Results of Control Group.**

Age	Position	Running time 1	Running time 2	Difference	Vo2max 1	Vo2max 2	Difference %
		min	min	min	mls/kg/min	mls/kg/min	
18	Goal Keeper	24	32	8	49.65	61.20	12%
19	Goal Keeper	24	30	6	49.65	58.31	9%
18	Stopper	25	34	9	51.09	64.09	13%
18	Left Fullback	25	32	7	51.09	61.20	10%
18	Right Fullback	24	31	7	49.65	59.75	10%
19	Center Midfield	25	32	7	51.09	61.20	10%
19	Number Ten	24	33	9	49.65	62.64	13%
18	Number Ten	25	30	5	51.09	58.31	7%
18	Right Wing	27	35	8	53.98	65.53	12%
19	Right Wing	27	33	6	53.98	62.64	7%
19	Center Forward	25	31	6	51.09	59.75	7%
19	Stoper	27	33	6	53.98	62.64	7%
19	Central Defender	24	32	8	49.65	61.20	12%
18	Central Defender	25	31	6	51.09	59.75	7%
18	Center Midfield	24	31	7	49.65	59.75	10%

**Table 6. Astrand Results of Ozone Therapy Group.**

	CONTROL GROUP	OZONE THERAPY GROUP
Average Age	18.5	18,5
Running Time First Day ( A )	25 min	25 min
Running Time Last Day ( B )	28 min	32 min
Difference between A and B	3 min	7 min
VO <sub>2</sub> Max First Day ( C )	51 mls/kg/min	51 mls/kg/min
VO <sub>2</sub> Max Last Day ( D )	55 mls/kg/min	61 mls /kg/min
VO <sub>2</sub> Max Difference C - D	4 mls / kg/min ( % 8 )	10 mls/kg /min ( %20 )

**Table 7. Results Summary Table.**

## DISCUSSION AND CONCLUSIONS

According to the results of the study, the contribution of mild-dose major autohemotherapy in the 20 to 30  $\mu\text{g/ml}$  range was found to be significant for the performance of athletes.

Of course, the study should be supported by further research and in different sports branches.

But at this stage, we need to ask a question: if ozone therapy increases the performance of the athlete, then isn't it a way of doping?

The IOC?? defines doping as follows: "Doping is the intentional or unintentional use of prohibited substances and prohibited methods on the current doping list." Since 2004, WADA's definition as embedded in the World Anti-Doping Code has been accepted as the international standard.

If we discuss this according to the application method, autohemotherapy will be considered under the WADA's 2019 Prohibited List's Article M1 (Table 8). (16) But there is no definitive information about the question if "autohemotherapy, or any other protocol of ozone therapy, is prohibited". The reason for writing this article is a better definition of "blood doping", actually intended as an illicit method of improving athletic performance by artificially boosting the blood's ability to bring oxygen to muscles. In many cases, blood doping increases the amount of hemoglobin in the bloodstream. Hemoglobin is an oxygen-carrying protein in the blood. So, increasing hemoglobin allows higher amounts of oxygen to reach and energy consumption in the athlete's muscles. This can "pharmacologically" improves the performance, particularly in long-distance events, such as running and cycling. But ozone therapy is not a method like this, being instead a completely natural perturbation induced by small and brief oxidative stress like those produced by the training itself, so completely physiological. In spite of this, applications have been made to WADA from many countries and many institutions of the World in the past years but all these applications have been left unanswered.



ARTICLE M1.

MANIPULATION OF BLOOD AND BLOOD COMPONENTS

The following are prohibited:

1. The Administration or reintroduction of any quantity of autologous, allogenic (homologous) or heterologous blood, or red blood cell products of any origin into the circulatory system.
2. Artificially enhancing the uptake, transport or delivery of oxygen. Including, but not limited to: Perfluorochemicals; efaproxiral (RSR13) and modified haemoglobin products, e.g. haemoglobin-based blood substitutes and microencapsulated haemoglobin products, excluding supplemental oxygen by inhalation.
3. Any form of intravascular manipulation of the blood or blood components by physical or chemical means.

**Table 8. WADA's 2019 Prohibited List's Article M1. (16)**

For this purpose, American UFC (Ultimate Fighting Championship) athlete Ion Cutelaba case can be given as the most typical example.

On June 11, 2017, Ion Cutelaba knocked down his competitor Henrique da Silva in 22 seconds in a title competition. Because of Ion Cutelaba's regular ozone therapy treatment at training season, USADA (American Anti Doping Agency ) reviewed the competition, but after 6 months Ion Cutelaba was re-established in the competitions and his title was given back. (17)

However, the debate is still ongoing and some judgments would confirm that there are not enough evidences to consider ozone as a doping agent but only a natural method able to improve the physiological release of oxygen to the tissues without affecting its transport. (18,19)

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