



Advanced

Search

User Guide

Save | Email | Send to | Display options

Randomized Controlled Trial > J Clin Psychiatry. 2024 Nov 10;85(4):24m15464.

doi: 10.4088/JCP.24m15464.

# Hyperbaric Oxygen Therapy for Veterans With Combat-Associated Posttraumatic Stress Disorder: A Randomized, Sham-Controlled Clinical Trial

Keren Doenyas-Barak <sup>1 2 3</sup>, Ilan Kutz <sup>1</sup>, Erez Lang <sup>1 2</sup>, Amir Assouline <sup>1</sup>, Amir Hadanny <sup>1 2</sup>, Kristoffer C Aberg <sup>4</sup>, Gabriela Levi <sup>1</sup>, Ilia Beberashvili <sup>2 5 4</sup>, Avi Mayo <sup>6</sup>, Shai Efrati <sup>1 2 7</sup>

Affiliations + expand

PMID: 39566051 DOI: [10.4088/JCP.24m15464](https://doi.org/10.4088/JCP.24m15464)

[Free article](#)

## Abstract

**Objective:** Cumulative data indicate that new protocols of hyperbaric oxygen therapy (HBOT) may induce neuroplasticity and improve clinical symptoms of patients suffering from posttraumatic stress disorder (PTSD). The aim of the current study was to evaluate the effects of HBOT on veterans with combat-associated PTSD (CA-PTSD) in a randomized, sham-controlled trial.

**Methods:** Male veterans aged 25-60 years with CA-PTSD, with a Clinician-Administered PTSD Scale for *DSM-5* (CAPS-5) score above 20, were included. Exclusion criteria included a history of traumatic brain injury, other psychiatric diseases, or contraindication to HBOT. Participants were randomly assigned to HBOT or sham intervention. Both interventions involved 60 daily sessions, with 90 minutes of either 100% oxygen at 2 atmospheres absolute (ATA) (HBOT) or 21% oxygen at 1.02 ATA (sham) with 5-minute air breaks every 20 minutes. CAPS-5 score, Beck Depression Inventory-II (BDI-II), the Depression, Anxiety and Stress Scale 21 Items (DASS-21), and resting-state functional magnetic resonance imaging (rsfMRI) were assessed at baseline and posttreatment, with the primary end point defined as a 30% reduction in CAPS-5 score from baseline.

**Results:** The study was conducted between February 2020 and July 2023. Of 63 veterans who underwent randomization, 56 completed the study protocol (28 in each group). The HBOT group showed a significant decrease in mean CAPS-5 total score, from 42.57 ±9.29 at baseline to 25.8±9.5 following HBOT ( $P < .001$ ) and 25.08± 13.08 at follow-up ( $P < .001$ ). The sham group demonstrated a significant increase in CAPS-5 total score from baseline to follow-up, from 45.11 ±8.99 to 47.75± 11.27 following HBOT ( $P = .069$ ) and 49.22± 10.26 at follow-up ( $P = .011$ ). Significant improvements in the depression domain of the DASS-21 questionnaire and BDI-II were demonstrated ( $F = 4.55$ ,  $P = .03$  and  $F = 4.2$ ,  $P = .04$ , respectively). The stress and anxiety domains of DASS-21 did not reach statistically significant levels. Analysis of rsfMRI demonstrated improved connectivity within the 3 main networks (default-mode network, central-executive network, salience network) in HBOT vs sham groups.

**Conclusions:** Dedicated HBOT protocol can improve PTSD symptoms of veterans with CA-PTSD. The clinical improvement was accompanied by enhanced functional connectivity demonstrated by rsMRI.

**Trial Registration:** ClinicalTrials.gov identifier: [NCT04518007](https://clinicaltrials.gov/ct2/show/study/NCT04518007).

© Copyright 2024 Physicians Postgraduate Press, Inc.

[PubMed Disclaimer](#)

## Similar articles

[Hyperbaric Oxygen Therapy for Veterans With Treatment-resistant PTSD: A Longitudinal Follow-up Study.](#)

Doenyas-Barak K, Kutz I, Levi G, Lang E, Beberashvili I, Efrati S.  
Mil Med. 2023 Jul 22;188(7-8):e2227-e2233. doi: 10.1093/milmed/usac360.  
PMID: 36433746

[Loving-Kindness Meditation vs Cognitive Processing Therapy for Posttraumatic Stress Disorder Among Veterans: A Randomized Clinical Trial.](#)

Kearney DJ, Malte CA, Storms M, Simpson TL.  
JAMA Netw Open. 2021 Apr 1;4(4):e216604. doi: 10.1001/jamanetworkopen.2021.6604.  
PMID: 33861329 [Free PMC article.](#) Clinical Trial.

[Evidence brief: hyperbaric oxygen therapy \(HBOT\) for traumatic brain injury and/or post-traumatic stress disorder.](#)

Bennett MH.  
Diving Hyperb Med. 2018 Jun 30;48(2):115. doi: 10.28920/dhm48.2.115.  
PMID: 29888387 [Free PMC article.](#)

[Systematic review and dosage analysis: hyperbaric oxygen therapy efficacy in the treatment of posttraumatic stress disorder.](#)

Andrews SR, Harch PG.  
Front Neurol. 2024 May 31;15:1360311. doi: 10.3389/fneur.2024.1360311. eCollection 2024.  
PMID: 38882688 [Free PMC article.](#)

[Hyperbaric oxygen therapy for the adjunctive treatment of traumatic brain injury.](#)

Bennett MH, Trytko B, Jonker B.  
Cochrane Database Syst Rev. 2012 Dec 12;12(12):CD004609. doi: 10.1002/14651858.CD004609.pub3.  
PMID: 23235612 [Free PMC article.](#)

[See all similar articles](#)

## Cited by

[Hyperbaric Oxygen Therapy for PTSD: Threshold Effect for Sustained Symptom Improvement in a Biologically Based Treatment.](#)

Danan D, Grosskopf Y, Mayo A, Efrati S, Kutz I, Lang E, Alon U, Doenyas-Barak K.  
Brain Behav. 2025 Aug;15(8):e70757. doi: 10.1002/brb3.70757.  
PMID: 40847457 [Free PMC article.](#) Clinical Trial.

[Mechanism and application of hyperbaric oxygen therapy in neurosurgery.](#)

Wang X.  
Med Gas Res. 2026 Jun 1;16(2):156-160. doi: 10.4103/mgr.MEDGASRES-D-24-00164. Epub 2025 Aug 18.  
PMID: 40826939 [Free PMC article.](#) Review.

## Publication types

> [Randomized Controlled Trial](#)

## MeSH terms

- > Adult
- > Combat Disorders / therapy
- > Humans
- > Hyperbaric Oxygenation\* / methods
- > Magnetic Resonance Imaging
- > Male
- > Middle Aged
- > Stress Disorders, Post-Traumatic\* / therapy
- > Treatment Outcome
- > Veterans\* / psychology

## Associated data

> [ClinicalTrials.gov/NCT04518007](https://clinicaltrials.gov/NCT04518007)

## Related information

[GEO Profiles](#)

[MedGen](#)

## LinkOut - more resources

**Full Text Sources**  
[Physicians Postgraduate Press, Inc.](#)

**Medical**  
[ClinicalTrials.gov](#)  
[MedlinePlus Health Information](#)

**Research Materials**  
[NCI CPTC Antibody Characterization Program](#)

**Miscellaneous**  
[NCI CPTAC Assay Portal](#)

## FULL TEXT LINKS



## ACTIONS

- [Cite](#)
- [Collections](#)
- [Permalink](#)

## PAGE NAVIGATION

- < [Title & authors](#)
- [Abstract](#)
- [Similar articles](#)
- [Cited by](#)
- [Publication types](#)
- [MeSH terms](#)
- [Associated data](#)
- [Related information](#)
- [LinkOut - more resources](#)

## FOLLOW NCBI



Connect with NLM



National Library of Medicine  
8600 Rockville Pike  
Bethesda, MD 20894

Web Policies  
FOIA  
HHS Vulnerability Disclosure

Help  
Accessibility  
Careers