HELLENIC REPUBLIC
National and Kapodistrian University of Athens

MOVE
Mobilité Vieillissement et Exercice

Université de Poitiers

Hellenic Academy of Thermal Medicine · Healing in Greece ·

ΔΗΜΟΚΡΙΤΕΙΟ ΠΑΝΕΠΙΣΤΗΜΙΟ ΘΡΑΚΗΣ | DEMOCRITUS UNIVERSITY OF THRACE

Medical School (Department of Physiology), National & Kapodistrian University of Athens, Greece
Faculty of Sport Science (Laboratory MOVE – UR 20296), University of Poitiers, France
Medical School (Department of Dermatology), Democritus University of Thrace, Greece
Hellenic Academy of Thermal Medicine, Greece

EXPLORING THERMAL PERCEPTION PARADOX OF CARBONATED BATHS

Corresponding author: mantouma@med.uoa.gr

By MARIA NTOUMANI, BENOIT DUGUE, CONSTANTIN KOUSKOUKIS, & SOFIA TZOUVARA

INTRODUCTION

- The Greek historian Lycus of Rheghium recorded an extraordinary thermal paradox in the Sicilian ritual Palici lake, where bathers expressed a warm sensation after immersion in cold sulfurous – carbonated waters (Croon, 1952).
- It is well established that CO2 rich water bath has a strong physiological effect on cardiovascular and thermoregulatory systems (Hayashi, 2021).
- However, little attention has been given on how such waters modify thermal perception in the sense of well-being.

PUPROSE

The purpose of this study was to investigate the behavioral thermoregulatory responses during CO2 water immersion in a variety of water temperatures.

METHODS

- The base of this research was the scoping review method.
- A standard literary search was performed on PubMed, Google Scholar, and SCOPUS.
- The words "Water Immersion" "Thermosensing/physiology," were used either as solely searched terms and MeSH terms (Medical Subject Headings) or in combination with the text words "thermal perception," thermal sensation," and "subjective sensation".

- The inclusion criteria for clinical trials akin to behavioral thermoregulatory measurements were, at least, healthy individuals and carbonated water immersion.

RESULTS

- Six published articles fulfill the review inclusion/exclusion criteria (three measured partial immersion and three measured whole-body immersion).
- The literature findings showed that CO2 water modified thermal sensation after an acute whole-body immersion expressed by a "slightly warm" feeling at 35°C (Nishimura et al., 2002; Sato et al., 2009), and a "slightly cool" feeling at 30°C, while a cooler sensation was felt when exposed in tap water at the same temperature (Hayashi, 2021).
- However, thermal sensation did not differ during partial immersion (forearm or leg) with tap condition at 25°C contrary to colder water temperatures at 18-20°C, in which a warmer sensation was reported in CO2 water, also, in post-immersion phase (Karagülle et al., 2004; Tanaka et al., 2020; Yoshimura et al., 2020).

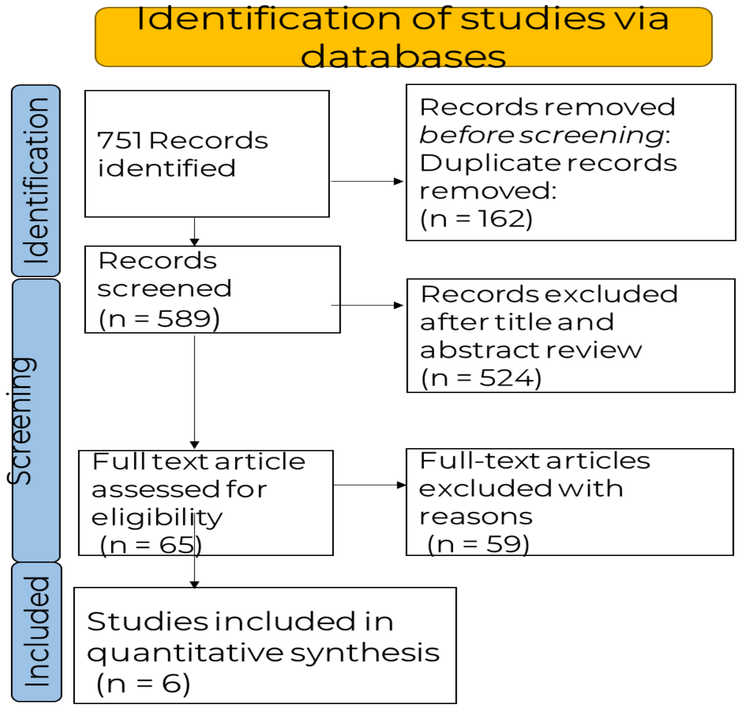

Figure 1. PRISMA flow diagram of search and study selection

DISCUSSION

Carbonated immersion (CO2) enables, probably, TRPA1 ion channel in a dose and time-dependent manner; causing local dilation in endothelial cells and meninges even after water immersion, as a result a prolonged elevation of cerebral blood flow (Eberhardt et al., 2014; Nazıroğlu et al., 2012; Wang et al., 2010; Kunkler et al., 2011). The warmer sensation observed may be explained by the different autonomic function in CO2 water immersion and the quality of heat signal from the periphery to central nervous system, produced by the synergistic function of TRPA1 with other TRP ion channels.

CONCLUSION

This scoping review suggests that CO2 water immersion induces an increase in cutaneous skin blood flow enabling a warmer and more comfortable thermal feeling. However, further investigations are needed due to limited experimental works.

MinWat 2020
3rd INTERNATIONAL MULTIDISCIPLINARY CONFERENCE ON MINERAL AND THERMAL WATERS