

# Beyond the cold baths: contemporary applications of cold-water immersion in the treatment of clinical depression and anxiety

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## SUMMARY

Cold-water immersion (e.g. adapted cold showers, partial or whole-body immersion, cold swimming) are nowadays increasingly being used as an adjunctive procedure to enhance the effects of primary treatment of various clinical conditions, including depressive and anxiety disorders. This brief article reviews the evidence regarding the beneficial effects of cold-water immersion on clinical depression and anxiety and outlines potential therapeutic mechanisms underlying the intervention. Promising avenues for future research and best practice recommendations are also discussed to improve the clinical effectiveness of cold-water immersion.

## KEYWORDS

Cold-water immersion; depression; anxiety; fear-related disorders; cognitive-behavioural therapy.

Cold bathing is a popular practice in many territories across the world, and in ancient times Roman bathing moved through a sequence of heated rooms ('caldarium' and 'tepidarium'), finishing with a cold bath (the 'frigidarium') at the end to clean the sweat caused by going through the previous heated areas. In the history of psychiatry, particularly during the 18th century, cold baths were used to supposedly treat explosiveness and overexcitement, having earned a negative reputation largely because of their use as a means of coercive control. In the 18th and 19th centuries, madness was seen as the result of a disordered interplay between will and passions: a dysregulated will could fail to restrain the passions, which could in turn take control of the mind. Concurrently, the widespread medical belief in Europe was that inflamed blood vessels or nerves in the brain ('hot brain') were at the basis of the chaotic mind. Therefore, cold-water shock showers were thought to 'cool down' the brain by diminishing vascular

activation, ultimately helping the patient to control aggressive outbursts, downregulate obstinacy and overcome indolence or stupor (Cox 2019).

Nowadays, the 'frigidarium' is still a common practice in many thermal spas around the world, and different forms of cold-water immersion are used as an adjunctive procedure to enhance the effects of primary treatment of various clinical conditions, including depressive and anxiety disorders (Shevchuk 2008). Generally, aquatic exercise (winter swimming, leisure swimming, competitive swimming and aquatic aerobics) stands today as a promising complementary therapy for mental health management (Jackson 2022).

## The beneficial effects of cold-water immersion on depression and anxiety

Cold showering has been reported to have several positive effects on health, including enhancement of the immune and cardiovascular systems and improvement of depression, sleep disturbance, vitality, mood and relaxation; it appears that these effects persist for several hours and even longer, although the magnitude and stability of these improvements remain to be ascertained (Shevchuk 2008; Buijze 2016).

Nevertheless, there is increasing evidence suggesting that mood may be boosted following cold showers or baths: in a recent study, short-term whole-body cold-water immersion resulted in improved positive affect, and these changes in positive emotions were related to increased connectivity between brain areas involved in attention control and emotion regulation (Yankouskaya 2023). Interestingly, however, the existing evidence suggests that the benefits of cold-water immersion may be obtained by 'dipping' rather than swimming (Kelly 2022). Based on an evolutionary explanation of depression, the use of a brief daily cold shower (preceded by a 5-min gradual temperature reduction) to alleviate depressive symptoms was

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examined over a 2-year period, with tentative results indicating acute effects of increased analgesia, energisation, optimism and well-being, as well as long-term effects of increased work capacity, psychomotor performance and positive affect (Shevchuk 2008).

Bearing in mind that heightened CO<sub>2</sub> sensitivity is a common clinical feature in panic disorder, and that free divers with excellent breathing abilities present lower CO<sub>2</sub> sensitivity because of continuous training, one study investigated the short-term effects of cold facial immersion, breath-holding and related CO<sub>2</sub> challenges on panic disorder symptoms. As conjectured, the cold facial immersion task demonstrated greater anxiolytic effects in the clinical group than in healthy controls, by lowering heart rate considerably and reducing physiological and cognitive symptoms of panic and anxiety (Kyriakoulis 2021).

### Therapeutic mechanisms of cold-water immersion

#### *Activation of the diving reflex*

The evolutionary mechanism underlying the beneficial effects of cold-water immersion is assumed to be the mammalian diving reflex. According to Linehan (2015), 'cold water can work wonders [because] when you put your full face into cold water or put a zip-lock bag with cold water on your eyes and upper cheeks, and hold your breath, it tells your brain you are diving underwater' (p. 376). This reflex is a protective and multidimensional physiological reaction (i.e. involving apnoea, bradycardia and heightened peripheral vascular resistance) that mammals, including humans, display to safeguard oxygen storage during submersion in water. Specifically, cold-water facial immersion appears to be more effective in lowering heart rate than the immersion of other parts of the body (Kyriakoulis 2021).

Exposure to cold water is also presumed to trigger the sympathetic division of the autonomic nervous system, thus increasing the levels of beta-endorphins and noradrenaline in the blood. In addition, given the high concentration of cold-sensitive thermoreceptors in the skin, a cold shower, for instance, is likely to send a huge number of electrical impulses from nerve endings in the skin (sensory receptors) to the brain, which could ultimately provide an antidepressant effect (Shevchuk 2008).

#### *Activation of the drive and soothing systems*

Cold-water immersion also prompts a hormonal reaction that improves metabolism and the amounts of cortisone, noradrenaline, adrenaline, adrenocorticotropic hormone and endorphins in the blood, while

increasing levels of testosterone in men. Moreover, it has been hypothesised that positive effects of cold-water immersion in the treatment of pain and emotional disorders are due to the stimulation of the opioid-based soothing system, which is known to have a vital role in emotion regulation, motivational processes, stress responses, attachment dynamics and control of food intake (Rymaszewska 2008).

### *Bringing putative psychobiological mechanisms together*

Based on a transdiagnostic conceptualisation and mechanistic definition of emotional disorder within process-based cognitive-behavioural therapy (Bullis 2019), Fig. 1 graphically depicts the hypothesised psychobiological mechanisms (putative mediators) linking cold-water immersion and depressive/anxiety symptom reduction.

### Directions for future research

Voluntary exposure to cold-water immersion seems to have prophylactic health effects; however, the low methodological quality of the studies conducted so far (e.g. small, non-clinical samples; inconsistent water immersion protocols) precludes the extraction of clear conclusions (An 2019; Esperland 2022). Although the study of its clinical applications and efficacy is still in its infancy, the available evidence for cold-water immersion is encouraging and calls for additional research on its feasibility, therapeutic mechanisms, treatment moderators and contraindications or potential side-effects to ensure its optimal administration.

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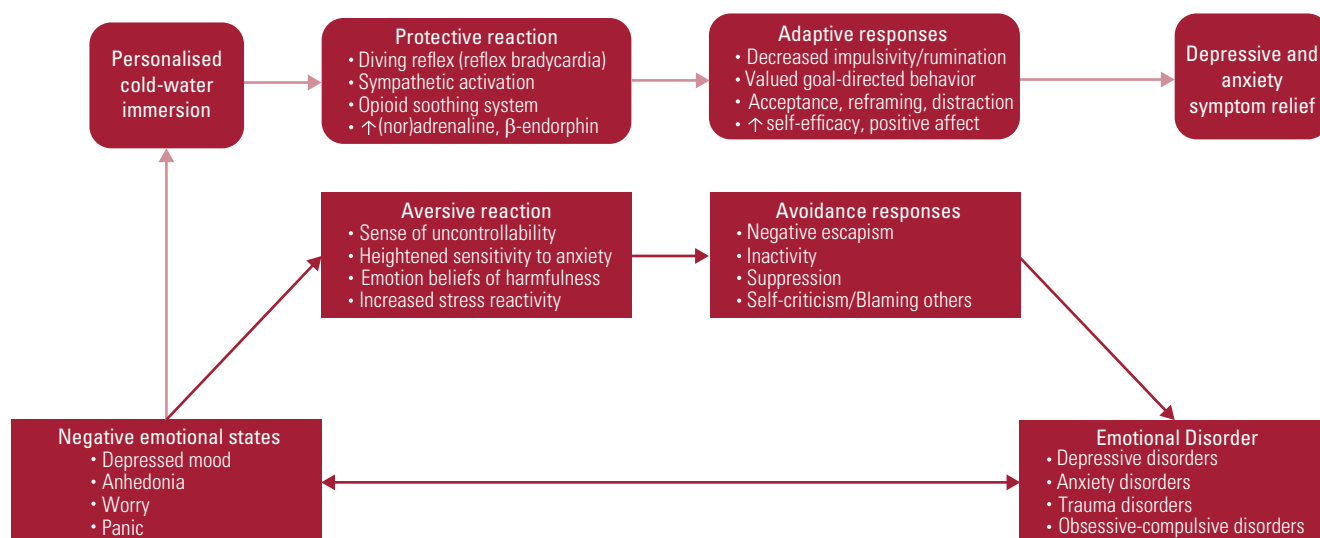
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### Author contributions

C.C.: conceptualisation, writing (original draft), writing (review and editing). S.M.: validation, writing (review and editing).

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**FIG 1** Possible psychobiological mechanisms linking personalised cold-water immersion and depressive/anxiety symptom reduction in emotional disorders. Dark red arrows indicate hypothesised pathways to psychological distress; light red arrows suggest theorised pathways to symptom relief.

Intervention (UIDB/PSI/00730/2020) at the University of Coimbra.

### Declaration of interest

C.C. is a member of the *BJPsych Advances* editorial board but did not take part in the review or decision-making process of this article.

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