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Editorial

Water and Brain Health - An Overview

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Introduction

Accumulating evidence suggests that the food and drink consumed by us have an impact on our mental and physical function. Food and food components, which exert physiological and mental effects are termed as 'functional foods' or 'nutraceuticals'. Such foods are considered to offer sustained good health and protect against illness, disease and pathological ageing. Water constitutes 60-80% of the human body; however, it usually goes unnoticed as an important nutrient that can have an impact on mental performance in addition to physical performance. Water is known to be essential for human homeostasis and survival but recently we are beginning to understand its role in the maintenance of brain function [1].

Role of water in brain health

Water plays a role in metabolism, electrolyte balance, and several other functions. For humans, it is vital to maintain the balance of water input and output. Individuals get dehydrated when the water input is less than the output. Dehydration may cause certain adverse outcomes such as reduced muscle endurance and strength, or increased risk of kidney stones and urinary tract infections.[2] It is suggested that associations may exist between hydration status and cognitive performance and mood, as water accounts for 75% of brain mass [2,3].

Impact of hydration status on brain health

It has been shown that severe dehydration results in cognitive deficits e.g., short-term memory loss visual perceptual abilities, and mood disturbance. On the other hand, water consumption can help in improving cognitive performance, especially visual attention and mood [1].

Growing evidence suggests that acute states of dehydration may impair cognitive function. These effects can be responsible for accidents at work and are likely to affect vulnerable populations, including children and adolescents whose brains are still in the developmental phase, and elderly people, whose ability to self-regulate appropriate fluid levels is thought to be impaired [4].

Several studies have assessed the impact of hydration on cognitive performance and mood. Some outcomes support the hypothesis that cognitive performance and mood could be impaired by dehydration and improved by rehydration. Fadda *et al,* evaluated the effects of water supplementation on the cognitive performance and subjective mood states of school-going children in a hot climate, which revealed negative effects of dehydration on short-term memory and beneficial effects of water supplementation. Armstrong *et al,* observed that dehydration resulting from intermittent moderate exercise without hyperthermia resulted in increased perception of task difficulty and led to mood deterioration in 25 female subjects. In another study, Ganio *et al,* demonstrated that mild dehydration without hyperthermia lead to impaired vigilance and working memory and increased anxiety and fatigue in 26 male participants [3]. Certain studies have demonstrated that dehydration impaired cognitive performances in terms of short-term memory, vigilance attention, choice reaction, or working memory [2]. Few more studies conducted by Cian, Lieberman, and D'anci., *et al*, have also supported the view that hydration state has potential to influence cognitive performance [3].

However, some studies have reported inconsistent conclusions. Wittbrodt *et al,* reported that rehydration after water supplementation resulted in effective mitigation of physiological strain due to mild dehydration following exercise-heat stress, but mild dehydration was not associated with adverse effects on cognitive performance among 12 recreational athletes. A randomized trial by Trinies *et al*, conducted in primary school students in Zambia also revealed that provision of water or hydration level did not have an impact on cognitive performance [3]. Some studies revealed that mild dehydration had an impact on the visual vigilance and visual working memory response latency of men, but without substantial alteration in the chief aspects of cognitive performances of women. This indicated that differences exist between genders that need further study [2].

Several studies have examined the effects of hydration on brain volume and other changes of brain, which also revealed conflicting results. Duning *et al,* analyzed three-dimensional data sets at three time points as follows: (1) before (baseline) and (2) after water restriction for 16 hours, and (3) 20 to 30 min after drinking (rehydration). Investigators observed that after water restriction for 16 hour, the brain volume demonstrated a reduction of 0.55% in comparison with the baseline volume. Furthermore, after rehydration, the volume of brain was found to increase by 0.72% compared with the baseline. Kempton *et al,* utilized 90-min physical exercise to induce dehydration, and the findings suggested that acute dehydration could result in the ventricular expansion, but without change in the volume of the total brain, which was different than the findings from Duning's study.[2] Certain studies of dehydration have employed structural magnetic resonance imaging (sMRI) methods and have revealed that acute or prolonged dehydration resulting from physical exercise or restricted fluid intake leads to reversible brain changes. These changes comprise reduced brain volume and associated increases in ventricular volume [4].

Considering above aspects, it is important to draw attention towards the importance of water intake and hydration. In our previous report [5], we have mentioned that metabolic, environmental, behavioral and genetic factors that result in the restoration of neurological functions have yet to be monitored. In addition to the above factors, it is also important to evaluate further, the effects of water on the restoration of neurobiological functions of water. Furthermore, water-related health education should be provided effectively to advice drinking adequate amounts of water in order to maintain a state of optimal hydration [3].

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