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## **Abstract** “Micronutrients and the Brain”

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A number of micro nutrients, including vitamins and minerals, are only available directly from the diet. Not only are these essential nutrients required for the general healthy functioning of the body, but they are also essential for the optimal performance of a host of physiological processes that have both a direct and indirect effect on brain function.

Evidence from epidemiological studies shows that endogenous levels of a range of vitamins are positively related to better cognitive performance and negatively related to the incidence of dementia and mood disorders. The majority of these studies have concentrated on levels of B vitamins, and, in many cases, their inverse relationship with the neurotoxic amino acid homocysteine. However, evidence also suggests that levels of Vitamin D, and the anti-oxidant vitamins C and E, are also related to aspects of brain function.

These observations are particularly important because survey and blood analyte data collected from large cohorts (e.g. The 'National Diet and Nutrition Survey' in the UK) suggest that a significant proportion of the general population is deficient in one or more of these essential nutrients and may therefore be susceptible to decrements in cognitive function or mood. A number of previous studies have assessed the effects of B vitamin supplements in elderly participants with vitamin deficiencies and/or high levels of homocysteine, but have shown somewhat mixed results. However this is probably due to the disparate methodologies employed in the research. Very little research has addressed the possibility that members of the general population across ages might benefit from dietary supplementation with vitamins/minerals.

Recently, a series of investigations from our own laboratory has assessed the cognitive and mood effects of vitamins and minerals in healthy samples of humans. In the most recent of these we built on a previous study investigating the efficacy of vitamins/minerals in healthy children with two studies that assessed the effects of vitamins/minerals on aspects of mood and cognitive function in unselected (in terms of nutrient status) adult samples. In the first of these randomized, controlled trials a cohort of 210 males in full time work received multi-vitamins/minerals or placebo for 5 weeks and underwent assessments of cognitive function and mood before and after treatment. The vitamin/mineral group reported reduced 'mental tiredness' and subjective stress (Perceived Stress Scale) and increased vigour (as assessed by the Profile of Mood States). In the second study, those of 220 subjectively fatigued females in full time employment or childcare who received vitamins/minerals for 9 weeks showed improved cognitive performance and reported a reduction in the negative mood engendered by extended performance of a computerized multi-tasking battery. A concomitant investigation in a subsection (N = 102) of the sample demonstrated significantly reduced blood levels of homocysteine.

Overall, these findings challenge the assumption that the general population has adequate essential nutrient status and suggest that it may be possible to improve cognitive performance, mood and fatigue/energy by increasing micro-nutrient levels, including by direct dietary supplementation.