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### Effects of Creatine Supplementation in Creatine Deficiency Syndrome associated Neurodegenerative and Cancerous Diseases

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#### Abstract

Reductions in cerebral and cytotoxic T cell (CD8 T cell) phosphocreatine (PcR) stores manifest in a plethora of neurodegenerative and cancerous diseases. Optimal PCr concentrations are vital for the energy reaction of every cell in the human body and optimized T- cell mediated immunity. CD8 T cells rely heavily on PCr reservoirs to buffer ATP levels in the tumor microenvironment in which there is high competition against cancer cells for bioenergetic fuel sources.

Disrupted cerebral bioenergetics and T-cell mediated immunity are manifested in impaired creatine uptake and translocation via creatine transporter (CrT) into target neuronal and immune cells. Defective creatine transporter deficiencies (CTD), glycine amidinotransferase (AGAT), and guanidinoacetate methyltransferase (GAMT) are a group of creatine synthesis and transport deficiencies known as creatine deficiency syndromes (CDS).

Mutations in the human CrT gene (SLC6A8 gene mapped to Xq28) give genesis to CTD and ultimately non-detectable PCr reservoirs in the brain and CD8 T cells. Individuals with X-linked CTD have detrimental neurodegenerative diseases such as hypotonia, developmental speech delay, autism, brain atrophy, seizures, and Alzheimer's disease. AGAT and GAMT CDS are autosomal recessive disorders that impair the biosynthesis of creatine due to deficiencies of arginine enzymes AGAT and GAMT. AGAT and GAMT deficiencies are high in males with speech delay and mental retardation. CTD significantly reduces the anti-tumor ability of tumor antigen specific CD8 cytotoxic T cells. CD8 T cells with CTD exemplified nonexistent CrT uptake and ultimately increased tumor growth via angiogenesis.

Therefore, the aim of this review is to investigate the effects of creatine monohydrate supplementation on combating the neurodegenerative disease states, optimizing CrT activity, and the ability to enhance T cell mediated immunity against cancer growth and proliferation.

**Keywords:** Creatine transport (CrT), Creatine Deficiency Syndrome (CDS), glycine amidinotransferase (AGAT), guanidinoacetate methyltransferase (GAMT), Cytotoxic CD8 T cell (CD8 T cell), Phosphocreatine (PCr), Creatine Transport deficiency (CTD), Adenosine triphosphate (ATP).

#### Biography

Navin H. Khan is the sports nutritionist, exercise physiologist, Director of Product Development and Research for Rocktomic Labs LLC, and Chief Scientific Officer for Immune Whey LLC. He has conducted over 1000 VO2 max and resting metabolic assessments. He is known for Determining client-specific nutrient and energy requirements, with consideration to specific lifestyles, physiology and medical concerns of all his clients. His research areas focus on the effect of dietary supplements on brain health and exercise performance. His passion is researching, innovating, and pushing the boundaries of human performance, sports nutrition, and exercise physiology. His career is dedicated to educating and motivating others to be optimal in their approach to naturopathic nutrition, training, and supplementation.