

MITOCHONDRIAL DISEASE – MEDICAL MARIJUANA RESEARCH OVERVIEW

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Mitochondrial disease results in the failure of mitochondria within the body's cells and primarily affects children. Studies on marijuana's direct effect on mitochondrial disease remains limited, but research does show it's effective at helping patients manage the symptoms associated with the disease.

OVERVIEW OF MITOCHONDRIAL DISEASE

Mitochondrial disease is when mitochondria, which are specialized compartments in the blood stream that are responsible for processing oxygen and converting substances from the food we eat into energy, fail. When they do fail, the body is limited on the amount of energy it can generate within a cell and the cell becomes injured or dies. If this process continues, whole systems throughout the body can fail and can threaten one's life. The disease is most commonly present in children, but it can develop in adults.

Most susceptible to damage caused by mitochondrial disease, according to the United Mitochondrial Disease Foundation, are the brain, heart, liver, skeletal muscles, kidney,

and the endocrine and respiratory systems. Cells are not able to make RNA or DNA in order to grow and function without functioning mitochondria.

The development of mitochondrial disease is caused by either inherited or spontaneous mutations in genes, which lead to altered functions of the proteins or RNA molecules that normally reside in mitochondria.

Common symptoms associated with mitochondrial disease are loss of motor control, muscle weakness, muscle pain, gastro-intestinal disorders, cardiac disease, liver disease, diabetes, developmental delays and poor growth, respiratory complications, seizures, visual and hearing problems and infection susceptibility.

There is no cure for mitochondria disease, so treatment focus is on reducing symptoms and delaying or preventing the disease's progression with vitamins, supplements, diet therapy and anti-oxidant treatments.

FINDINGS: EFFECTS OF CANNABIS ON MITOCHONDRIAL DISEASE

Most of the research on cannabis' effect on mitochondrial disease focuses on the symptomatic relief it offers by improving seizure control and reducing pain. Scientific reviews analyzing previously-published research on cannabis' effect on epilepsy conclude that a major cannabinoid found in cannabis, cannabidiol (CBD) is a well-tolerated and promising therapeutic treatment that has demonstrated the ability to reduce or even eliminate seizures (Blair, Deshpande & DeLorenzo, 2015). Cannabis has also demonstrated the ability to significantly lower pain that has proven refractory to other treatments (Boychuck, Goddard, Mauro & Orellana, 2015).

Research does suggest, however, that the function of mitochondria is modulated by the endocannabinoid system—a system that regulates a variety of cellular and physiological processes through the activation of receptors (Lipina, Irving & Hundal, 2014). The cannabinoid receptors (CB1 and CB2) are activated by the major cannabinoids found in

cannabis. The activation of cannabinoid receptors has shown to have a number of positive effects on the integrity of mitochondria, including oxidative phosphorylation and energy production (Lipina, Irving, & Hundal, 2014).

In support of the endocannabinoid system's role in mitochondrial health is one particular study, which found that cannabis improved the mitochondrial function in rodents. The researcher suggested that cannabis triggers the release of antioxidants, which serve as a cleaning mechanism to remove damaged cells and ultimately improve the efficiency of mitochondria (Bilkei-Gorzo, 2012). Cannabis has also been shown to have the capability to restore all mitochondrial parameters to normal after they had been deliberately aberrated, and to improve mitochondrial membrane potential (Lu & Anderson, 2015). Cannabis treatments have also been shown effective at increasing mitochondrial activity (Silvestri, et al., 2015).

STATES THAT HAVE APPROVED MEDICAL MARIJUANA FOR MITOCHONDRIAL DISEASE

Currently, only the state of [Georgia](#) has approved medical marijuana specifically for the treatment of mitochondrial disease.

Other states, however, allow medical marijuana to be prescribed to treat symptoms that are commonly associated with mitochondrial disease, like seizures and pain. Several states have approved medical marijuana to treat **seizures**. These states include: [Alaska](#), [Arizona](#), [Arkansas](#), [California](#), [Colorado](#), [Delaware](#), [Hawaii](#), [Louisiana](#), [Maryland](#), [Michigan](#), [Minnesota](#), [Montana](#), [Nevada](#), [New Hampshire](#), [North Dakota](#), [Ohio](#), [Oregon](#), [Pennsylvania](#) (intractable seizures), [Rhode Island](#), [Tennessee](#) (intractable seizures), [Vermont](#), [Washington](#), and West Virginia. Additionally, many states have approved medical marijuana specifically to treat **chronic pain**. These states include: [Alaska](#), [Arizona](#), [California](#), [Colorado](#), [Delaware](#), [Hawaii](#), [Maine](#), [Maryland](#), [Michigan](#), [Montana](#), [New Mexico](#), [Ohio](#), [Oregon](#), [Pennsylvania](#), [Rhode Island](#), [Vermont](#),

and [West Virginia](#). The states of [Nevada](#), [New Hampshire](#), [North Dakota](#), [Montana](#), [Ohio](#) and [Vermont](#) allow medical marijuana to treat **severe pain**. The states of [Arkansas](#), [Minnesota](#), [Ohio](#), [Pennsylvania](#), [Washington](#), and [West Virginia](#) have approved cannabis for the treatment of **intractable pain**.

A number of other states will consider allowing medical marijuana to be used for the treatment of mitochondrial disease with recommendation by a physician. These states include: [California](#) (any debilitating illness where the medical use of marijuana has been recommended by a physician), [Connecticut](#) (other medical conditions may be approved by the Department of Consumer Protection), [Massachusetts](#) (other conditions as determined in writing by a qualifying patient's physician), [Nevada](#) (other conditions subject to approval), [Oregon](#) (other conditions subject to approval), [Rhode Island](#) (other conditions subject to approval), and [Washington](#) (any "terminal or debilitating condition").

In [Washington D.C.](#), any condition can be approved for medical marijuana as long as a DC-licensed physician recommends the treatment.