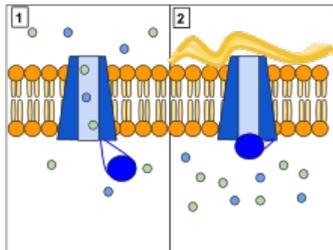


Most of the damage in CF is due to blockage of the narrow passages of affected organs with thickened secretions. These blockages lead to remodeling and infection in the lung, damage by accumulated digestive enzymes in the pancreas, blockage of the intestines by thick faeces, etc. There are several theories on how the defects in the protein and cellular function cause the clinical effects. The most current theory suggests that defective ion transport leads to dehydration in the airway epithelia, thickening mucus. In airway epithelial cells, the cilia exist in between the cell's apical surface and mucus in a layer known as Airway Surface Liquid (ASL). The flow of ions from the cell and into this layer is determined by ion channels like CFTR. CFTR not only allows Chloride ions to be drawn from the cell and into the ASL, but it also regulates another channel called ENaC. ENaC allows sodium ions to leave the ASL and enter the respiratory epithelium. CFTR normally inhibits this channel, but if the CFTR is defective, then sodium will flow freely from the ASL and into the cell. As water follows sodium, the depth of ASL will be depleted and the cilia will be left in the mucous layer.^[48] As cilia cannot effectively move in a thick viscous environment, there is deficient mucociliary clearance and a buildup of mucus, clogging small airways.^[49] The accumulation of more viscous, nutrient-rich mucus in the lungs allows bacteria to hide from the body's **immune system**, causing repeated respiratory infections. The presence of the same CFTR proteins in pancreatic duct and skin cells are what cause symptoms in these systems. <https://goo.gl/uPHmiP>



The CFTR protein is a channel protein that controls the flow of H₂O and Cl⁻ ions in and out of cells inside the lungs. When the CFTR protein is working correctly, as shown in Panel 1, ions freely flow in and out of the cells. However, when the CFTR protein is malfunctioning as in Panel 2, these ions cannot flow out of the cell due to a blocked channel. This causes cystic fibrosis, characterized by the buildup of thick mucus in the lungs.

<http://goo.gl/01DfB>

Neuro Endocrinol Lett. 2004 Feb-Apr;25(1-2):24-30.

The endocannabinoid-CB receptor system: Importance for development and in pediatric disease.

Endogenous cannabinoids (endocannabinoids) and their cannabinoid CB1 and CB2 receptors, are present from the early stages of gestation and play a number of vital roles for the developing organism. Although most of these data are collected from animal studies, a role for cannabinoid receptors in the developing human brain has been suggested, based on the detection of "atypically" distributed CB1 receptors in several neural pathways of the fetal brain. In addition, a role for the endocannabinoid system for the human infant is likely, since the endocannabinoid 2-arachidonoyl glycerol has been detected in human milk. Animal research indicates that the Endocannabinoid-CB1 Receptor ('ECBR') system fulfills a number of roles in the developing organism: 1. embryonal implantation (requires a temporary and localized reduction in anandamide); 2. in neural development (by the transient presence of CB1 receptors in white matter areas of the nervous system); 3. as a neuroprotectant (anandamide protects the developing brain from trauma-induced neuronal loss); 4. in the initiation of suckling in the newborn (where activation of the CB1 receptors in the neonatal brain is critical for survival). 5. In addition, subtle but definite deficiencies have been described in memory, motor and addictive behaviors and in higher cognitive ('executive') function in the human offspring as result of prenatal exposure to marijuana. Therefore, the endocannabinoid-CB1 receptor system may play a role in the development of structures which control these functions, including the nigrostriatal pathway and the prefrontal cortex. From the multitude of roles of the endocannabinoids and their receptors in the developing organism, there are two distinct stages of development, during which proper functioning of the endocannabinoid system seems to be critical for survival: embryonal implantation and neonatal milk sucking. We propose that a dysfunctional Endocannabinoid-CB1 Receptor system in infants with growth failure resulting from an inability to ingest food, may resolve the enigma of "non-organic failure-to-thrive" (NOFTT). Developmental observations suggest further that CB1 receptors develop only gradually during the postnatal period, which correlates with an insensitivity to the psychoactive effects of cannabinoid treatment in the young organism. Therefore, it is suggested that children may respond positively to medicinal applications of cannabinoids without undesirable central effects. Excellent clinical results have previously been reported in pediatric oncology and in case studies of children with severe neurological disease or brain trauma. We suggest cannabinoid treatment for children or young adults with cystic fibrosis in order to achieve an improvement of their health condition including improved food intake and reduced inflammatory exacerbations.

<http://goo.gl/duUkoZ>

J Basic Clin Physiol Pharmacol. 2011 Jun 17;22(1-2):29-32. doi: 10.1515/jbcpp.2011.004.

Treatment with tetrahydrocannabinol (THC) prevents infertility in male cystic fibrosis mice.

Bregman T1, Fride E.

BACKGROUND:

Cystic fibrosis (CF) is a hereditary disease caused by mutations of the gene encoding a channel protein CFTR, conducting Cl⁻ and HCO₃⁻

ions. The disease is characterized by disturbances in most physiological systems, and more than 95% of men are infertile. The mechanism underlying the etiology of CF is associated with an imbalance of fatty acids. It has been suggested that the function of the endocannabinoid system is also disturbed in CF, because endocannabinoids are derivatives of fatty acids. We assumed, therefore, that endocannabinoid activity, which plays an important role in fertility, is disrupted in CF and could be one of the causes of infertility. The aim of the present study was to test the hypothesis that stimulation of endocannabinoid receptors in infancy would normalize their function and prevent infertility in adulthood.

METHODS:

Knockout male mice (*cfr-/-*) were treated with tetrahydrocannabinol (THC), endocannabinoid receptors agonist, in infancy from days 7 until 28, daily.

RESULTS:

CF males treated with THC were fully fertile, producing offspring comparable by the number of litters and the number of pups with wild-type mice. CF males that were not treated with THC were completely infertile.

CONCLUSIONS:

The present study shows that (i) endocannabinoid function is impaired in CF mice, as evidenced by the regenerating effect of its stimulation on the fertility of otherwise infertile males, (ii) endocannabinoid system dysfunction is apparently the determining factor causing infertility in CF, and (iii) mild stimulation of the endocannabinoid system in infancy and adolescence appears to normalize many reproductive processes and thereby prevent infertility in CF males.

<http://goo.gl/GZ1NmO>

[J Basic Clin Physiol Pharmacol](#). 2011 Jun 17;22(1-2):33-6. doi: 10.1515/jbcpp.2011.005.

Behavioral alterations in cystic fibrosis mice are prevented by cannabinoid treatment in infancy.

[Bregman T1, Fride E.](#)

Substantial data have been accumulated regarding the molecular basis of cystic fibrosis (CF) pathogenesis, whereas the influence of biochemical impairments on brain processes has been the focus of much less attention. We have studied some behavioral parameters, such as motor activity and anxiety level, in a mice model of CF. We have assumed that functioning of the endocannabinoid system could be impaired in CF (endocannabinoids are fatty acid derivatives, and fatty acid deficiency is considered a major factor in CF etiology). We have suggested that chronic treatment with cannabinoid receptors agonist during infancy would balance cannabinoid levels and prevent CF-related behavioral alterations. Motor activity and anxiety level were studied in naïve adult CF mice (*cfr*-deficient mice) and compared with wild-type mice and to CF mice treated chronically with Δ^9 -tetrahydrocannabinol (Δ^9 -THC; endocannabinoid receptor agonist) during infancy (from days 7 to 28). Motor activity was tested in the tetrad, and level of anxiety in the plus maze, a month after cessation of treatment. Motor activity decrease and elevated anxiety level were found in adult naïve CF mice compared with wild-type mice. CF mice treated with THC in infancy showed normal motor activity and anxiety levels in adulthood. Motor function alteration and elevated anxiety levels in CF can result from lack of CFTR-channel in neurons and disturbed activity of various brain areas, as well as being secondary and mediated by fatty acids deficiency, altered levels of endocannabinoids and their receptors. It can be suggested that chronic treatment during infancy restores endocannabinoid function and thus prevents behavioral alterations.

<http://goo.gl/hrbt1w>

[Eur J Pharmacol](#). 2004 Oct 1;500(1-3):289-97.

The endocannabinoid-CB(1) receptor system in pre- and postnatal life.

[Frída E1.](#)

Recent research suggests that the endogenous cannabinoids ("endocannabinoids") and their cannabinoid receptors have a major influence during pre- and postnatal development. First, high levels of the endocannabinoid anandamide and cannabinoid receptors are present in the preimplantation embryo and in the uterus, while a temporary reduction of anandamide levels is essential for embryonal implantation. In women accordingly, an inverse association has been reported between fatty acid amide hydrolase (the anandamide degrading enzyme) in human lymphocytes and miscarriage. Second, CB(1) receptors display a transient presence in white matter areas of the pre- and postnatal nervous system, suggesting a role for CB(1) receptors in brain development. Third, endocannabinoids have been detected in maternal milk and activation of CB(1) receptors appears to be critical for milk sucking by newborn mice, apparently activating oral-motor musculature. Fourth, anandamide has neuroprotectant properties in the developing postnatal brain. Finally, prenatal exposure to the active constituent of marijuana (Δ^9 -tetrahydrocannabinol) or to anandamide affects prefrontal cortical functions, memory and motor and addictive behaviors, suggesting a role for the endocannabinoid CB(1) receptor system in the brain structures which control these functions. Further observations suggest that children may be less prone to psychoactive side effects of Δ^9 -tetrahydrocannabinol or endocannabinoids than adults. The medical implications of these novel developments are far reaching and suggest a promising future for cannabinoids in pediatric medicine for

conditions including "non-organic failure-to-thrive" and cystic fibrosis.

Counteracting Diarrhea

Diarrhea can appear in those with CF as a result of inadequate digestion. The consumption of cannabinoids can counteract diarrhea and prevent the loss of nutrients.

Cannabis and Inflammation

Cannabinoids are known to be anti-inflammatory. Since cannabinoid receptors are in the lungs, THC can further benefit patients by reducing respiratory inflammation.

Appetite and Nausea

Sometimes, people with CF cough so much they vomit, which can lead to malnutrition. Cannabis can increase appetite and decrease nausea, which helps this problem.

Endocannabinoids and Coughing

Endocannabinoids, which work by activating receptors the same receptors in the brain that THC does, can help reduce coughing and irritation.

Managing Pain

CF patients often suffer from severe aches and pains. Marijuana can help as cannabinoids are effective painkillers which act in the brain and spinal cord to suppress both acute and chronic pain.

Improve breathing: "my lungs would open up more, allowing better oxygen intake, and was able to decrease the amount of sputum congestion my lungs."

i believe it is very beneficial in many ways- mucus clearance, antibacterial, antifungal. I have used in edible form to treat my TMJ, and just started giving a cbd chew (non-psychoactive) to my son (18 yrs old) about a month ago. He reports much thinner mucus and much less chest pain.