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ORIGINAL ARTICLE

Coenzyme Q10 and pro-inflammatory markers in children with Down syndrome: clinical and biochemical aspects[☆]

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KEYWORDS

CoQ10;
Down syndrome
children;
IL-6;
Oxidative stress;
TNF α

Abstract

Objective: Evidence of oxidative stress was reported in individuals with Down syndrome. There is a growing interest in the contribution of the immune system in Down syndrome. The aim of this study is to evaluate the coenzyme Q10 (CoQ10) and selected pro-inflammatory markers such as interleukin 6 (IL-6) and tumor necrosis factor α (TNF α) in children with Down syndrome. **Methods:** Eighty-six children (5–8 years of age) were enrolled in this case-control study from two public institutions. At the time of sampling, the patients and controls suffered from no acute or chronic illnesses and received no therapies or supplements. The levels of IL-6, TNF α , CoQ10, fasting blood glucose, and intelligence quotient were measured.

Results: Forty-three young Down syndrome children and forty-three controls were included over a period of eight months (January–August 2014). Compared with the control group, the Down syndrome patients showed significant increase in IL-6 and TNF α ($p=0.002$), while CoQ10 was significantly decreased ($p=0.002$). Also, body mass index and fasting blood glucose were significantly increased in patients. There was a significantly positive correlation between CoQ10 and intelligence quotient levels, as well as between IL-6 and TNF α .

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58**PALAVRAS-CHAVE**CoQ10;
Crianças com
síndrome de Down;
IL-6;
Estresse oxidativo;
TNF α

Conclusion: IL-6 and TNF α levels in young children with Down syndrome may be used as biomarkers reflecting the neurodegenerative process in them. Coenzyme Q10 might have a role as a good supplement in young children with Down syndrome to ameliorate the neurological symptoms. © 2016 Sociedade Brasileira de Pediatria. Published by Elsevier Editora Ltda. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Coenzima Q10 e marcadores pró-inflamatórios em crianças com síndrome de Down: aspectos clínicos e bioquímicos**Resumo**

Objetivo: Foram relatadas evidências de estresse oxidativo em indivíduos com a síndrome de Down. Há um interesse cada vez maior na contribuição do sistema imunológico na síndrome de Down. O objetivo deste estudo é avaliar a Coenzima Q10 (CoQ10) e marcadores pró-inflamatórios selecionados, como interleucina 6 (IL-6) e fator de necrose tumoral α (TNF α), em crianças com a síndrome de Down.

Métodos: 86 crianças (5-8 anos de idade) de duas instituições públicas foram inscritas neste estudo de caso-controle. No momento da amostragem, os pacientes e os controles não sofriam de nenhuma doença aguda ou crônica e não recebiam nenhuma terapia ou suplementos. Foram medidos os níveis de IL-6, TNF α , CoQ10, glicemia de jejum e quociente de inteligência.

Resultados: 43 crianças com síndrome de Down e 43 controles foram incluídos em um período de 8 meses (janeiro-agosto 2014). Em comparação ao grupo de controle, os pacientes com síndrome de Down mostraram aumento significativo na IL-6 e no TNF α ($p=0,002$), ao passo que a CoQ10 apresentou significativa redução ($p=0,002$). Além disso, o índice de massa corporal e a glicemia de jejum eram significativamente maiores nos pacientes. Houve uma correlação significativamente positiva entre os níveis de CoQ10 e do quociente de inteligência, bem como entre a IL-6 e o TNF α .

Conclusão: Os níveis de IL-6 e TNF α em crianças mais novas com síndrome de Down podem ser utilizados como biomarcadores, refletindo o processo neurodegenerativo neles. A Coenzima Q10 pode ter um papel como bom suplemento em crianças com síndrome de Down para melhorar os sintomas neurológicos.

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Introduction

Trisomy 21 is the most frequent chromosomal abnormality, which characteristically has significant cognitive disability and neurologic deficiencies. It affects 1/700 to 1/1000 live births.¹ Excess inhibition in the brain of patients with an extra chromosome 21 could be responsible for cognitive deficits noticed throughout their lives.² Oxidative stress is known to have a substantial role in the pathology because of genetic and epigenetic factors, which suggests that oxidative imbalance contributes to the clinical manifestations in Down syndrome (DS).³ In Down syndrome the oxidative damage has a major role in the neurodegenerative processes.⁴ CoQ10 works as a reactive oxygen species (ROS) scavenger. Possibly, in addition, it stimulates oxidative damage repair enzymes and has a role in the regulation of gene expression. It also might work as a modulator of DNA repair mechanisms.^{5,6} The effect of CoQ10 has been studied in some neurological disorders where mitochondrial dysfunction was detected.⁷ This could explain the biochemical process by which exogenous CoQ10 improves the bioenergetic impairment in some mitochondrial myopathies

and in cardiomyopathy.^{8,9} Coenzyme Q10 has been administered in patients affected by DS, attempting to counteract the oxidative imbalance present due to its secondary deficiency, with promising results.^{10,11} Individuals having DS are more prone to infections and autoimmune disorders. Ineffective immune responses in DS lead to recurrent viral/bacterial infections and contribute to the development of various pathophysiological symptoms, including cognitive impairment.¹²

The dysfunction of the immune system in DS has been attributed to decreased number of B-lymphocytes, T-cell subset modifications, as well as changes in the levels of anti- and pro-inflammatory cytokines. Tumor necrosis factor α (TNF α) and interleukin 6 (IL-6) have been implicated as key components of immune and also inflammatory processes.¹³ An improved and better understanding of the relationship between these different elements may help in the discovery of new approaches to ameliorate the progression of dementia in trisomy 21 patients.

The aim of the study was to evaluate the level of some pro-inflammatory markers (IL-6 and TNF α) and CoQ10 in 5–8 year-old children with DS.

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