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Hair Potassium and Sodium in Cystic Fibrosis

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Cystic fibrosis (CF) or (Mucoviscidosis) is a common inherited autosomal recessive disease characterized by the failure of the sodium and chloride cellular trans membrane transport [1 *Merck]. That trans membrane transport CF gene is located on 7 th chromosome and it has some 900 mutations [2]. Increased skin sweat loss of chlorine is the "golden standard" for the CF diagnosis, a demanding test available at only few places in the world [2].

Since chlorine is essential part of our table salt, and since sodium is biologically entangled to potassium in their respective cell influx (K) and efflux (Na), we aimed to study to what extent they are both affected in CF. To reach this objective we analyzed hair sodium and potassium nutritional status of two girrls.

For a long time use of hair bio element (bioinorganic elements) analysis in clinical practice was considered controversial, because the analyses of the replicate hair samples in different laboratories were discrepant [3]. Today, we know that there is no identical hair sample replicate, even if they came from the same head, since the collected hair sample is a mixture of hair piles in their distinct follicular growth cycle phase [4].

Hair multi bio element profile was analyzed in the hair of two supposedly autistic young girls suspected of having an environment metal over exposure.

The six years old girl (Pu.CF) has a life long history of lung bronchial respiratory problems, whereas the four years old girl (GI PF) has problems with food digestion, painful and foul smell stools since she was born.

However, their hair bio element profile excluded the existence of metal over exposure. But both girls , had low hair sodium as expected, but different hair potassium response (Table 1). Indeed,

Table 1: Hair potassium (K), sodium (Na), and potassium to sodium (K/Na) ratio of two girls having Cystic Fibrosis (CF). One is having the lung (Lu_CF), and the other pancreatic (Pa CF) cystic fibrosis clinical pictures.

Cystic fibrosis	Yr.	Height 0 (cm)	Weight (Kg)	Hair (µg·g-1)		
				K	Na	K/Na
Lung (Lu_CF)	6	113	19	158	69.2	2.28
Pancreas (CF)	4	113	27	36.4	45.9	0.79
Normal [6]				8.9	14.25	0.64

Cystic fibrosis manifests itself as either respiratory bronchial and lung disease (Res·CF) or pancreatic gastrointestinal disease (GasI·CF) form, respectively.

.ry form of Cystic fibrosis, but only about three times in a younger girl suffering from the gastro-intestinal form of CF. This two cases revealed the metabolic polymorphism in CF, i.e., that there is a metabolic difference between sodium an potassium hair concentrations between the pulmonary and gastro-intestinal clinical forms of CF. Indeed, hair K/Na ratio was three times higher in the Pu·CF but almost normal in GI·CF. Thus, pulmonary CF affects K/Na ratio differently than the gastro-intestinal CF. Apparently, in the pulmonary CF sodium deficit is accompanied with excessive increase in hair potassium, whereas in its gastrointestinal form the drop of sodium is accompanied with a drop in hair potassium. We inferred how in pulmonary CF only the sodium ionic channel was affected, whereas in its gastrointestinal form both sodium and potassium ionic channel malfunction was involved. Apparently, the pulmonary form of CF is associated with a greater metabolic stress than it's gastro intestinal form. It should be noted that the

younger Pa.CF girl experienced excessive skin sweating at the summer high ambient temperatures.

In conclusion, The observed data suggests that the control of the cell membrane potassium and sodium transport in CF is regulated by the two different mutations of the CF gene. Apparently, in the pulmonary form of CF, the gene mutation involves sodium ionic channel, whereas in the pancreatic variant of CF, both potassium and sodium ionic channels of the cell membrane transport are involved. This is the first report to show metabolic difference in two distinct polymorphic forms of CF with a complementary pair of the physiologicaly entangled pair of sodium and potassium. The multi bio element hair analysis provides the clinicians with the early, rapid and accurate noninvasive screening and diagnosis of CF.

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