2017

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Recommended Citation
Kamath, V. G. (2017). Is it time to start using mitochondrial DNA copy number as an indicator of health and diseases? Cancer Studies and Molecular Medicine Open Journal, 3(2), 21-22.

CANCER STUDIES AND MOLECULAR MEDICINE

Openventio PUBLISHERS

ISSN 2377-1518 Open Journal http://dx.doi.org/10.17140/CSMMOJ-3-118

Letter to the Editor

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Volume 3 : Issue 2
Article Ref. #: 1000CSMMOJ3118

Article History
Received: May 19th, 2017
Accepted: May 25th, 2017
Published: May 25th, 2017

Citation
Kamath VG. Is it time to start using mitochondrial DNA copy number as an indicator of health and diseases? *Cancer Stud Mol Med Open J.* 2017; 3(2): 21-22. doi: 10.17140/CSMMOJ-3-118

Is it Time to Start Using Mitochondrial DNA Copy Number as an Indicator of Health and Diseases?

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Clinical biochemistry and pathology have contributed too many assays for diagnosis and prognosis of human health and diseases. Bedside biochemistry has revolutionized modern medicine and the invention of new generation biosensors have educated the patients like never before. Although, there are many gadgets which are available for monitoring the blood glucose in the patients with metabolic syndromes, hardly any assays can accurately predict and aid in early detection of metabolic syndrome. By the time a person is diagnosed and treated for metabolic syndrome, molecular and pathological damages further push the patient towards the metabolic syndrome. Early detection and early treatments are necessary to further revolutionize the field of Medicine.

Metabolic syndrome is not a completely solved riddle, there are several factors which contribute towards the genesis and progression of the disease. Energy metabolism is in the center of metabolic syndrome, and mitochondria are one such organelle where majority of the energy metabolism takes place. Given that it is at the center of energy metabolism, most of the proteins required for this process are supplied by the nuclear gene products. Additionally, the mitochondria with its genome is responsible for 13 of the key electron transport complex proteins. Mutations in both nuclear and mitochondrial genes result in Mitochondrial Encephalomyopathy Lactic Acidosis and Stroke-like Episodes (MELAS), Myoclonic Epilepsy and Ragged-Red Fiber Disease (MERF), Mitochondrial Neurogastrointestinal Encephalopathy (MNGIE) and Leigh syndrome.

The mitochondrial genome is a simple closed circular molecule that contains 16,569 DNA base pairs compared to the complex nuclear genome. But on the other hand, the nuclear genome has specified amount i.e., two copies at the least of every gene and the quality of the genome is well maintained by "well-oiled" DNA repair machinery. In mitochondrial genome contains numerous copies of the genes. Apart from this the number of mitochondria in each tissue also varies. This imbalance in quantity of proteins generated from mitochondria and nucleus for electron transport complex is a testimony of their importance in energy metabolism. Mitochondrial DNA (mtDNA) quantity and the quality is an important aspect of the energy metabolism. The factors attributing towards determining the number of mitochondria and mitochondrial DNA copy number is yet unclear. Nonetheless, recent investigations suggest a negative correlation between mitochondrial DNA copy number and disease process and progression. A recent article Reznik et al[1] clearly demonstrated the correlation between mtDNA copy number to the expression of mitochondrially-localized metabolic pathways, suggesting that mtDNA copy number variation reflects gross changes in mitochondrial metabolic activity. As we discussed the significance of the mitochondrial DNA copy number, it is also important to note the quality of the DNA, it is observed that over a period of time the bad copies of the mitochondrial DNA accumulate within tissue mitochondria as the mitochondrial DNA repair mechanism is not as effective as the nuclear DNA repair mechanisms and the chances of mutation at the end of every replication cycle is higher. With this delicate balance of the quality and quantity of the mtDNA determining the efficacy of the energy metabolism, there is a high possibility that these changes can be used as indicators of the metabolic problems to occur in near future. It is up to

ISSN 2377-1518 http://dx.doi.org/10.17140/CSMMOJ-3-118

the scientific communities to decide whether it is time for us to seriously investigate the numerical relation of mitochondrial DNA copy number as a health indicator. Appropriate detection of mtDNA mutations and quantification of mtDNA can be a very important means in the resources of the modern day physicians.

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