

Chronic disease risk management: Combining genetic testing with medical and nutrition therapy

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Abstract

Overwhelming evidence indicates that diet is a key environmental factor affecting the incidence of many chronic diseases treated by medical practitioners on a daily basis. Information available in public gene databases, combined with advanced molecular technologies and nutrition research, provides the opportunity for the development of a new set of treatment and prevention strategies based partly on nutritional genomics. Nutrigenetics has been used for decades to prevent rare monogenic disorders such as phenylketonuria. Gene-diet interaction can now also be targeted to prevent or reduce the risk of many chronic conditions long before clinical manifestation. This multi-disciplinary approach unites conventional medicine with genetics and lifestyle intervention for optimal health management.

(SA Fam Pract 2005;47(4): 40-42)

Practical application of nutritional genetics

Identification of genetic and lifestyle risk factors that may interact to increase the risk of chronic diseases and to intervene effectively is the key objective of nutritional genetics. Chronic disorders that may benefit from nutrigenetic applications include cardiovascular disease (CVD), diabetes, obesity, certain cancers, neurological disorders, osteoporosis, and a variety of inflammatory disorders.¹ Figure 1 illustrates the potential clinical outcomes associated with gene-environment interaction.

The first practical application of nutrigenetics in South Africa was based on the development of a multi-gene test for cardiovascular disease (CVD). Different test options related

to CVD are available, including screening for the monogenic disorder familial hypercholesterolaemia (FH) and a multi-gene strip-assay linked to nutrition and lifestyle assessment.^{2,3,4} Less than 10% of the estimated 120 000 persons with heterozygous FH in South Africa have been diagnosed with this condition,⁵ which is a prerequisite for optimal treatment of FH. The FH test is offered to adults with pre-treatment total cholesterol levels above 7.5 mol/l and a strong family history of premature coronary heart disease (CHD).

Individuals with normal or moderately raised serum cholesterol levels with or without other CVD risk factors (e.g. hypertension, diabetes, obesity, high homocysteine levels and/or a family history of CVD) may

choose to undergo genetic testing linked to dietary and lifestyle assessments. Genetic testing can distinguish high-risk individuals requiring life-long medication^{6,7} from those at increased risk of CVD as a consequence of less severe gene-environment interactions that can be treated successfully by dietary and lifestyle changes.

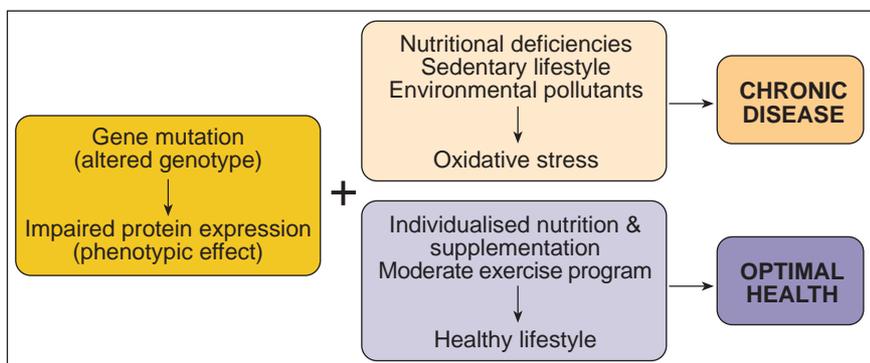
Which genes are included for multi-gene testing?

The selection of genes and mutations included in genetic tests linked to lifestyle and nutrition intervention are based on the phenotypic expression (clinical manifestation), prevalence in the general population, and availability of appropriate intervention or treatment options that may be required. Genotypes being tested for (1) affect the function of the gene products (proteins), (2) affect biological processes involved in disease development, and (3) have apparent metabolic/clinical implications, either alone or in combination with other genetic or environmental risk factors.

How can nutritional genomics help to achieve health goals?

The primary care physician plays a pivotal role in facilitating lifestyle changes that will be beneficial to the

Figure 1: Gene-environment interaction



health of their patients. They act as the contact person between the patient and other supporting services (e.g. genetic counselors, dieticians and pharmacologists), which can be accessed through a newly-established health network (www.genecare.co.za, HealthNet). By becoming actively involved in the health monitoring process outlined in the comprehensive reports provided for nutrigenetic tests, caregivers can help their patients to reach their health goals.

In our experience, the knowledge gained from genetic testing combined with lifestyle risk factors empowers patients to move from a passive to a participatory role in managing their health. Once the patient has contemplated the impact of the genetic and lifestyle assessment they are able to better evaluate their current health status and visualise their health goals. As patients begin to understand that their co-operation is the key to sustained health it becomes easier to make the decision to pro-actively follow the action plan outlined in the genetic test report. Progress needs to be monitored on a regular basis by the primary care physician or supporting dietician. Re-evaluation is recommended after a period of approximately three months, depending on the health status or severity of a chronic disorder. The realisation that the genetic and lifestyle information obtained can also be extrapolated to the children in the family may lead to a combined effort to make the recommended lifestyle changes.

Conclusions

All chronic disorders represent disturbances in cellular homeostasis. A person's genetic make-up may predict susceptibility to homeostatic dysfunction, but it is the environmental influences on the genetic factors that determine disease development. Nutritional genomics therefore has great potential for health management at both the clinical and population level. It provides a means to provide an explanation for disease development and target gene-environment interaction for risk reduction.

Internationally it is now accepted that because of the small number of registered genetic counsellors available, other health care

professionals will need to help educate the public about the genetic basis of chronic disorders, the biochemical consequences, and the genetic testing options and procedures available.¹ Given the potential for modifying the effects of deleterious gene mutations by optimising gene-environment interactions⁸, general practitioners are positioned to play a key role in meeting these needs and improve the health of their patients.

Acknowledgements

Emeritus Professor Peter H Beighton, University of Cape Town, and Dr Marjanne Senekal, University of Stellenbosch, are thanked for critical appraisal and comments on the manuscript.

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