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Nutrigenetics and blood pressure optimization – focus on fat intake and fatty acid desaturase function

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Precision nutrition based on targeted approaches such as nutrigenetics, has become an essential tool in lifestyle interventional strategies for managing cardiometabolic risk factors. Hypertension management remains instrumental in preventing cardiovascular disease, however, there is a huge gap between standard pharmacological approaches for optimizing blood pressure and lifestyle strategies for preventing its rise. Dietary actions based on salt intake reduction and prudent fat consumption are pivotal in sustaining optimal blood pressure levels, regardless of demographics or other health contexts. Customizing adequate fat intake gains increasing interest in light of genetic variability associated with fat and fatty acid metabolism and subsequent health implications.

Fatty acid desaturase gene cluster (including FADS-1 and -2 genes) resides on human chromosome 11 and encodes for the desaturase enzymes which catalyze endogenous conversion of essential fatty acids from foods towards highly unsaturated omega-6 and omega-3 plasma and tissue products. The omega-3 commonly refer to eicosapentaenoic acid (EPA, C20:5 n-3) and docosahexaenoic acid (DHA, C22:6 n-3), considered for their inflammation-resolving, endothelium-stabilizing and anti-thrombotic effects. Early research endeavors demonstrated the association between the FADS genes variability and levels of long-chain polyunsaturated fatty acids (PUFA) in plasma¹, then dyslipidemia factors such as high-density lipoprotein cholesterol and triglycerides². A recent study indicated that the single nucleotide polymorphism in FADS-2 gene might be linked with diastolic blood pressure in men only and depending on the adherence to a Dietary Approach to Stop Hypertension pattern³.

Several studies indicate a connection between long-chain PUFA profiles in plasma, and vascular function. Specifically in black Africans undergoing nutritional transition, plasma omega-6 PUFA were beneficially linked with blood pressure⁴, while the inverse link was observed for DHA in Chinese, community dwelling subjects⁵.

Importantly, certain populations, such as black Africans, have pronounced levels of long-chain PUFA in plasma⁴, which could at least partly be explained by the ethnic-specific and race-specific distribution of FADS haplotype reflected in different metabolic conversion⁶. There is thus a sound rationalization to presume that a variability in FADS human genetic region might also be linked with endothelial stability and vascular function, and future studies are urged to assess the link between the variable FADS region, fat intake, FADS-dietary interactions, and vascular implications, specifically systolic and diastolic blood pressure. Accounting for the population-specific fat metabolism features in customizing public health and personalized guidelines and recommendations, might support combating disproportionate disease burden in vulnerable groups, ultimately alleviating cardiovascular disease across world-wide populations.

Previous reports proposed nutrigenetic protocols for implementing FADS genotyping in precision nutrition assessments for personalized dietary and nutritional plans, as a standard of care⁷. Should the FADS genetic information be interpreted as a predisposition towards various amounts of advantageous omega-3 PUFA but also omega-6 PUFA in plasma, this might complement the information about the level of individual cardiometabolic risk associated with excessive fat intake. This way the FADS individual genetic signature stands out as a valuable print in customizing personalized plans and appropriate fat intake, for overall wellness and fitness, possibly leveraging blood pressure levels. What's more, previous report encouraged the pharmaco-nutrigenetic approach in balancing blood pressure in subjects already taking anti-hypertensive medication and based on customizing their daily salt intake according to the genetically driven salt-sensitivity phenotype, with a few predictive genetic biomarkers already replicated in several studies⁸. The FADS nutrigenetic evaluation in routine precision nutrition practice remains envisioned strategy for successful blood pressure optimization in pharmaco-nutrigenetic setting, in addition to emerging

as a promising tool for preventing blood pressure raise across world-wide populations.

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