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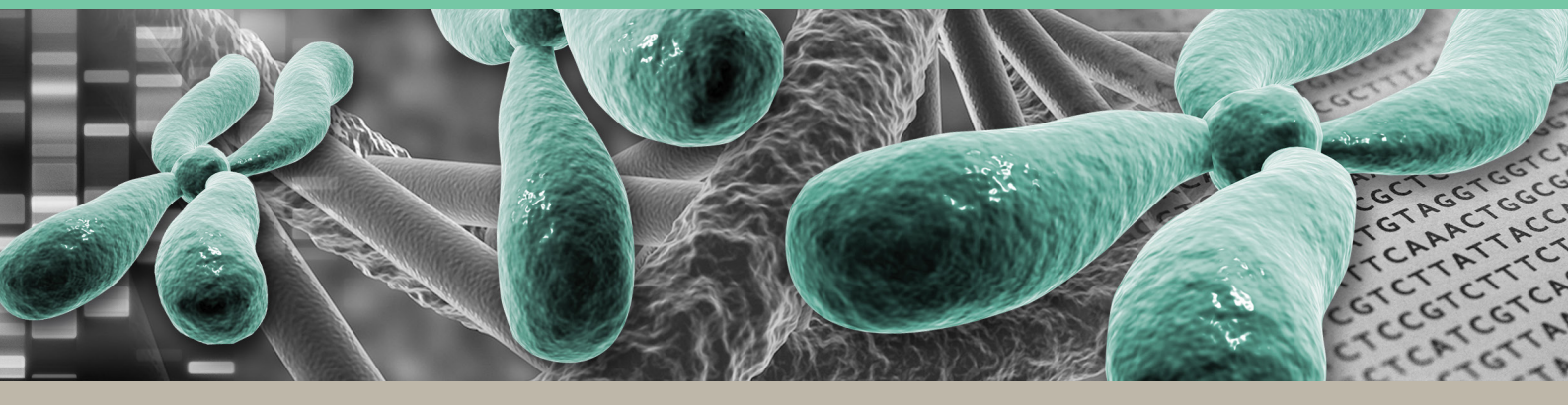
SNP JOURNAL

A reference ebook for the FOUNDATIONS IN NUTRIGENOMICS course



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Welcome to the SNP JOURNAL

The SNP JOURNAL ebook has been developed to provide you with clear and concise information on the SNPs you will most commonly encounter in commercial nutrigenetic tests. The list of SNPs is by no means comprehensive, but is an excellent place to start. The SNP JOURNAL provides an easy to use reference ebook for the course, as well as for clinical practice.

In the Table of Contents the SNPs have been divided into the three modules of the Foundations course, where you will encounter them. By clicking on the name of the SNP you will be taken to the relevant page.

For each SNP we have provided you with the following information:

- An overview of the gene
- Full name of the gene
- Symbol of the gene
- Nucleotide/base change
- Amino acid change (where appropriate)
- Population frequencies
- Impact of SNP on biological pathway/s
- Nutrient interaction
- Established diet-gene interactions
- Potential dietary recommendations
- References

In addition, you will be able to make notes alongside each SNP as you proceed through the course and SNP JOURNAL. You will be able to save these notes and edit them, as you proceed, making the SNP JOURNAL, - YOUR SNP JOURNAL. A working document for your growing knowledge.

The SNP JOURNAL will also be available for purchase as a printed book, should you work better that way.

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ANGIOTENSIN 1 CONVERTING ENZYME (ACE) INSERTION/DELETION

Overview	Salt sensitivity is estimated to be present in 51% of hypertensive and 26% of normotensive populations. The ACE gene codes for the angiotensin-converting enzyme and is part of the renin-angiotensin system, which controls blood pressure by regulating the volume of fluids in the body.
Name of gene	Angiotensin 1 converting enzyme (ACE) gene
Symbol of gene	ACE
rs number	rs4646994
Base change	The presence or absence (insertion or deletion) of the enzyme is based on a 287 bp Alu repeat element in the gene
Population Frequency	• Non-hispanic whites DD=28.8%, ID=51%, II=19.6% • Non-hispanic black DD=33.8%, ID=49.8%, II=16.4% • Mexican American DD=20.7%, ID=51.9%, II=27.4%
Impact of SNP on biological pathway/s	Levels of circulating enzyme are associated with the presence or absence of the (rs4646994) 287 bp Alu repeat in this gene. The deletion means there is no enzyme activity.
Nutrient interaction	Sodium
Established diet-gene interactions	• Meneton et al. found that the prevalence of salt sensitive hypertension in those with the II genotype and ID genotype were significantly higher than DD genotype. • Zhang et al. found that in individuals with the ID+II genotype, hypertension was increased by a high salt intake, while in the DD genotype it was not. The interaction was more prominent in the overweight group than in the non-overweight group.

ANGIOTENSIN 1 CONVERTING ENZYME (ACE) INSERTION/DELETION

Potential dietary recommendations	In those patients with hypertension and with the ID or II genotype, aim to eat no more than 2,300 milligrams (approximately 1 level teaspoon of salt) of sodium per day.
References	• Armando, I., Villar, V., & Jose, P. (2015). Genomics and pharmacogenomics of salt-sensitive hypertension. *Current hypertension reviews*. • Hunt, S. C., Cook, N. R., Oberman, A., Cutler, J. A., Hennekens, C. H., Allender, P. S., . . . Williams, R. R. (1998). Angiotensinogen genotype, sodium reduction, weight loss, and prevention of hypertension: trials of hypertension prevention, phase II. *Hypertension, 32*(3), 393-401. • http://www.nutritionfoundation.org.nz/nutrition-facts/minerals/sodium

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ANGIOTENSINOGEN (AGT) -6 G>A

Overview	The angiotensinogen gene has been linked to essential hypertension and increased blood pressure. A functional AGT gene variant has been associated with hypertension and has been shown to affect blood pressure response to sodium and weight reduction, and the development of hypertension.
Name of gene	Angiotensinogen (AGT) gene
Symbol of gene	AGT
rs number	rs5051. The AGT -6 G>A is in full linkage disequilibrium with the rs699, often written as M235T
Base change	G>A
Population Frequency	• European GG=21.7%, GA=65.2%, AA=13% • African American GG=4.2%, GA=25%, AA=70.8% • Asian GG=7%, GA=41.9%, AA=51.2%
Impact of SNP on biological pathway/s	The AGT -6 G>A gene variant has been demonstrated to be functional and is believed to contribute towards hypertension susceptibility. The A allele alters the binding of a nuclear protein, resulting in increased gene transcription compatible with increased angiotensinogen levels.
Nutrient interaction	Sodium
Established diet-gene interactions	Hunt et al. reported that AA genotype individuals develop hypertension to a greater degree than those with the other genotypes when there is no intervention, they also respond more favorably to salt reduction and/or weight loss intervention. Whereas the GG genotype group may comprise primarily salt-insensitive individuals.

Potential dietary recommendations	In those patients with hypertension, and with the AA genotype, aim to eat no more than 2,300 milligrams (approximately 1 level teaspoon of salt) of sodium per day. Weight loss should also be encouraged where appropriate.
References	• Armando, I., Villar, V., & Jose, P. (2015). Genomics and pharmacogenomics of salt-sensitive hypertension. *Current hypertension reviews*. • Hunt, S. C., Cook, N. R., Oberman, A., Cutler, J. A., Hennekens, C. H., Allender, P. S., . . . Williams, R. R. (1998). Angiotensinogen genotype, sodium reduction, weight loss, and prevention of hypertension: trials of hypertension prevention, phase II. *Hypertension, 32*(3), 393-401. • Norat, T., Bowman, R., Luben, R., Welch, A., Khaw, K. T., Wareham, N., & Bingham, S. (2008). Blood pressure and interactions between the angiotensin polymorphism AGT M235T and sodium intake: a cross-sectional population study. *Am J Clin Nutr, 88*(2), 392-397.

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CYTOCHROME P450 1A2 (CYP1A2 A>C)

Overview	Twin studies reveal that genetics plays a role in individual variability in caffeine consumption as well as in the direct effects of caffeine. At low doses, caffeine effects include mild euphoria, alertness, and enhanced cognitive performance, but at higher doses, it can produce nausea, anxiety, trembling, and jitteriness. Caffeine is metabolized primarily by the CYP1A2 enzyme. and accounts for approximately 95% of caffeine metabolism. The clearance of caffeine can vary to up to 40-fold within and between individuals.
Name of gene	Cytochrome P450 1A2
Symbol of gene	CYP1A2
rs number	rs762551
Base change	A>C
Population Frequency	• European AA=54.2%; AC=33.3%; CC=12.5% • African American AA=26.1%; AC=56.5%; CC=17.4% • Asian AA=41.7%; AC=54.2%; CC=4.2%
Impact of SNP on biological pathway/s	The occurrence of the CYP1A2 C allelle leads to a decreased enzyme inducibility, resulting in impaired caffeine metabolism.
Nutrient interaction	Caffeine

Established diet-gene interactions	• Individuals who are homozygous for the CYP1A2 A allele (AA genotype) are "rapid" caffeine metabolizers, whereas carriers of the variant CYP1A2 C allelle are "slow" caffeine metabolizers (AC and CC genotypes). • Cornelis et al. reported that increased coffee intake is associated with an increased risk of non-fatal MI, but only among individuals with the "slow" C allele. • Palatini et al. demonstrated that carriers of the "slow" A allele are at increased risk of hypertension.
Potential dietary recommendations	For the general population it is recommended to drink coffee or caffeine containing products in moderation. I.e. consuming 3-4 cups (300-400 mg) of coffee per day. Slow metabolizers may do better restricting coffee to less than 2 cups of coffee per day and monitoring their overall caffeine intake.
References	• De Caterina R, El-Sohemy A. Moving towards Specific Nutrigenetic Recommendation Algorithms: Caffeine, Genetic Variation and Cardiovascular Risk. *Journal of nutrigenetics and nutrigenomics. 2016;9*(2-4):106-115 • Cornelis, M. C., El-Sohemy, A., Kabagambe, E. K., & Campos, H. (2006). Coffee, CYP1A2 genotype, and risk of myocardial infarction. *JAMA, 295*(10), 1135-1141. doi: 10.1001/jama.295.10.1135 • Palatini, P., Ceolotto, G., Ragazzo, F., Dorigatti, F., Saladini, F., Papparella, I., . . . Santonastaso, M. (2009). CYP1A2 genotype modifies the association between coffee intake and the risk of hypertension. *Journal of hypertension, 27*(8), 1594-1601. • Yang, A., Palmer, A. A., & de Wit, H. (2010). Genetics of caffeine consumption and responses to caffeine. *Psychopharmacology, 211*(3), 245-257.

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CYTOCHROME P450 1A2 (CYP1A2 A>C)

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