

## Associations Between Genetic Predisposition, Fat Taste and Obesity

C. A-M Graham<sup>1</sup>, J. Pipe<sup>1</sup>, J. Holton<sup>1</sup>, K. Tamba<sup>1</sup>, S. Lorente-Cebrián<sup>2</sup>, P. González-Muniesa<sup>2</sup> and Y. Mavrommatis<sup>1</sup>

<sup>1</sup>Faculty of Sport Health and Applied Science, St Mary's University Twickenham, TW14SX and

<sup>2</sup>Department of Nutrition, Food Science and Physiology / Centre for Nutrition Research, School of Pharmacy and Nutrition, University of Navarra, Spain.

Excess dietary fat intake has been associated with an increased risk of obesity and cardiovascular disease<sup>(1)</sup>. The single nucleotide polymorphisms (SNP) rs1761667 of the Cluster of Difference 36 gene (CD36), rs9939609 of the Fat Mass and Obesity-Associated gene (FTO) and the rs17782313 of the Melanocortin 4 Receptor gene (MC4R) have been associated with an increased dietary fat intake and obesity<sup>(2–4)</sup>. Fat taste is being discussed as the sixth human taste, it is hypothesised that individuals who cannot taste fat efficiently (hyposensitive) may consume larger amounts than an average taster. Hyposensitive fat tasters have been defined as detecting oleic acid at more than 3.8 mM/100ml<sup>(5)</sup>. The aim of this study is to investigate the relationship between the aforementioned SNPs, Body Mass Index (BMI), Fat Intake, Fat Taste Sensitivity and Food Preference.

A cross-sectional study was carried out on 96 UK based Caucasian females (aged 32.8 ± 11.4 years, 24.0 ± 4.1 kg/m<sup>2</sup>). The following variables were assessed: rs1761667, rs9939609 and rs17782313 genotype, BMI, food intake (Epic-Norfolk Food Frequency Questionnaire<sup>(6)</sup>), food preference (Food Preference Questionnaire for Adults and Adolescence<sup>(7)</sup>), and fat taste sensitivity (n = 55 for this variable only) (forced choice triangle method<sup>(5)</sup>).

Results were analysed by BMI scale and weight class. The MC4R risk allele (C) was associated with a higher BMI (p = 0.025) in the overweight group (n = 36, BMI 25.0-29.9 kg/m<sup>2</sup>). Within the fat taste sensitivity cohort, a higher percentage of hyposensitive tasters had the MC4R risk allele (C) (p = 0.009, figure 1). Subsequent analysis of BMI class revealed that there was a moderate positive correlation between fat taste sensitivity and BMI in non-overweight (BMI <24.9 kg/m<sup>2</sup>) (n = 35, p = 0.038, r<sub>s</sub> = 0.352).

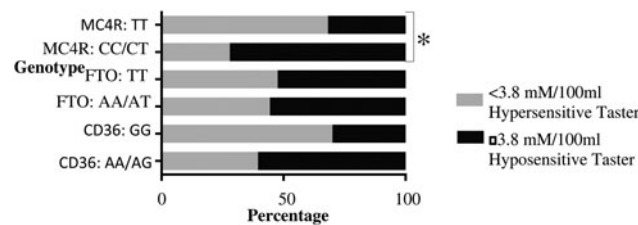


Fig. 1. The Percentage of Hypersensitive and Hyposensitive Fat Tasters (n = 55) by Genotype.

\* = p < 0.05, CD36 = Cluster of Difference 36 rs1761667 single nucleotide polymorphism (SNP): risk allele = A, FTO = Fat Mass and Obesity-Associated SNP rs9939609: risk allele = A, MC4R = Melanocortin 4 Receptor rs17782313 SNP: risk allele = C. Risk allele genotypes have been combined to form a higher risk group.

These results indicate that dietary intake and genetic predisposition are associated with both BMI and fat taste sensitivity. From the three SNPs selected, MC4R risk allele needs to be taken into consideration for Precision Nutrition, either preventively or therapeutically. Nonetheless further research is needed to strengthen these results and investigate if there is a causal relationship.

1. Fung TT, Rimm EB, Spiegelman D, et al. *Am J Clin Nutr* 2001;73:61–7.
2. Degraze-Passilly P, Besnard P. *Curr Opin Clin Nutr Metab Care* 2012;15:107–11.
3. Sonestedt E, Gullberg B, Ericson U, W, et al. *Int J Obes* 2011; 35:1041–9.
4. Qi L, Kraft P, Hunter DJ, Hu FB. *Hum Mol Genet* 2008;17:3502–8.
5. Haryono RY, Sprajcer MA, Keast RSJ. *J Vis Exp* 2014; 88: 51236
6. EPIC. EPIC-Norfolk: Food Frequency Questionnaire 2017. <http://www.srl.cam.ac.uk/epic/epicffq/>.
7. Smith AD, Fildes A, Cooke L. et al. *Am J Clin Nutr* 2016;104:446–53.