MedicalXpress

New genes involved in food preferences will revolutionize diets and improve health

June 1 2014

New understanding of the genes involved in taste perception and food preferences could lead to personalised nutrition plans effective not just in weight loss but in avoiding diseases such as cancer, depression, and hypertension, Italian researchers will tell the annual conference of the European Society of Human Genetics (ESHG) today (Monday). Knowing why individuals prefer certain food tastes and being able to personalise health interventions based on them will help people age in a healthier way and greatly improve their quality of life, as well as engender considerable savings for health systems, they say.

Dr Nicola Pirastu and Dr Antonietta Robino, from the University of Trieste and the IRCCS Burlo Garofolo Institute for Maternal and Child Health, Trieste, Italy, set out to identify novel genes and pathways involved in taste perception and food preferences, and to investigate their implications in protecting against or predisposing to diet-related disorders such as overweight, obesity, and diabetes. "To date most studies have focused on specific taste receptors, especially bitter ones, and this has been partly successful in an attempt to understand the genetics behind the perception of specific compounds such as caffeine and quinine," says Dr Robino. "Our work has expanded these studies to the whole genome, with the goal of clarifying which specific genes drive individual differences in taste perception and food preferences."

The researchers undertook genome wide association studies (GWAS) to try to unravel the genetic basis for certain food preferences. 2311 Italian subjects participated in the discovery step, while 1755 from other

European countries and from Central Asia were used in order to further verify the findings. They uncovered 17 independent genes related to liking for certain foods, including artichokes, bacon, coffee, chicory, dark chocolate, blue cheese, ice cream, liver, oil or butter on bread, orange juice, plain yoghurt, white wine and mushrooms. Surprisingly, none of the genes thus identified belonged to the category of taste or smell receptors.

"There is still much that needs to be done to understand what are the characteristics of certain foods affected by the genetic make-up of an individual," says Dr Pirastu. "For example, we found a strong correlation between the HLA-DOA gene and white wine liking, but we have no idea which of the characteristics of white wine this gene influences. Our studies will be important for understanding the interaction between the environment, lifestyles, and the genome in determining health outcomes. Although there has been a lot of work on food-related diseases such as obesity, this has rarely taken food preferences into account. This is a major limitation which our work attempts to remedy, and as yet we have only really scratched the surface of this issue."

In a second study, the researchers amassed the response of around 900 healthy adults from North Eastern Italy to salt, and related this to a DNA sequence variation found on the KCNA5 gene, known to be related to taste pathways in mammals. Salt perception and the related genetic variation in taste receptors are important determinants of individual differences in salt intake, which in turn represents an important risk factor for the development of hypertension and cardiovascular diseases. "Genetic variations for taste perception are well known for bitter, sweet, and umami taste, but until now we knew little about their role in salt perception and liking," says Dr Robino. "Identifying the receptor associated with individual differences in the perception of salt could help us better understand how chemosensory differences can interact to influence and predict food choices and hence human nutritional

behaviour. This could also play an important role in the development of salt substitutes, in which there is a growing commercial interest."

Nutritional intervention could be greatly improved by tailoring it to the food preferences of each person, the researchers say. And food preferences are also much easier to collect and study; while it is almost impossible to remember much one has eaten in the past ten years, it is easy to remember food likes and dislikes.

"By uncovering the genetic bases of taste and food preferences, we will be able to increase not only the effectiveness of nutritional interventions, but also compliance with them. For example, we have recently carried out a study where we applied our knowledge of 19 different genes in order to personalise diets for 191 obese individuals for were trying to lose weight. They were divided into two groups, 87 in a test group and 104 controls," says Dr Pirastu.

"We devised a standard weight-loss diet subtracting 600 calories from individual nutritional needs, and analysed DNA from the test group for 19 genes known to affect different metabolic areas and taste. We then modulated the diets according to individual genetic profiles – for example, people whose genetic profile showed that they had less efficient lipid metabolism were given fewer lipids in their diet – but kept the overall amount of calories the same for everyone.

"Although there were no significant differences in age, sex and BMI between the two groups at the beginning of the trial, we found that people in the group who had followed the gene-based diet lost 33% more weight than the controls over two years, and the percentage of lean body mass also increased more in this group," he will say.

Food preferences are the first factor driving food choice, nutrition and ultimately diet-related diseases and as such are the key to understanding

human nutrition and its relationship with health on a large scale, the researchers say. A recent study[1] carried out on more than 40,000 people showed that people who prefer fat have a completely different eating pattern than people who dislike it. "So something as simple as measuring fat liking can provide us with a great deal of information. Understanding the genetics of these traits will open new possibilities for the development of personalised diets and of functional foods aimed at improving people's health and therefore their quality of life," Dr Pirastu will conclude.

More information: 1. Association between intake of nutrients and food groups and liking for fat, Caroline Mèjean et al. *Appetite*, 2014

Provided by European Society of Human Genetics