

Positive association between the sensitivity to the bitter taste of PROP and the rs2274333 (A/G) polymorphism on exon 3 of the CA6 gene

E. Atzori, A. Zonza¹, V. Carracoi, I. Tomassini Barbarossa¹, A. Padiglia

Department of Sciences Applied in Biosystem

¹Department of Experimental Biology, University of Cagliari, Italy

The purpose of this study was to study individual differences in sensitivity to 6-n-propylthiouracil (PROP) analyzing a single nucleotide polymorphism (SNP) at nucleotide position 269 of the gustin/carbonic anhydrase VI (CA6) gene, and using the predicted genotype result, determine how well it correlates with the expressed phenotype. For this purpose, the phenotype of 75 individuals was determined by tasting solutions of different PROP concentration. Taste sensitivity varies greatly among individuals and can strongly influence food choice and satiety. PROP sensitive and non sensitive individuals are defined tasters and nontasters, respectively. Tasters can be further divided into those who are very sensitive to this compound, (i.e., supertasters), and those who are moderately sensitive, (i.e., medium tasters) [1]. Given that PROP phenotype may have broad implications for nutritional status, it would be of great interest to characterise other factors that may contribute to differences in the genetic predisposition to taste thiourea compounds. Salivary proteins are involved in gustatory function and could be correlated with taste differences. Among them, CA6, a zinc metalloprotein secreted by the serous acinar cells of parotid, submandibular and von Ebner glands in humans may play a crucial role. Some authors suggest that gustin/CA6 is a trophic factor that promotes growth and development of taste buds by acting on taste bud stem cells [2]. In this study were examined associations between PROP status and the gustin gene polymorphism rs2274333 (A/G). We investigated this polymorphism because it may modulate taste function due to its location at exon 3 of the CA6 gene which encodes amino acids residues forming the zinc-binding site. The A to G substitution at position 269 of gene, changes the codon CAG (serine) to a non-synonymous codon CGG (glycine), and also creates *HaeIII* restriction enzyme recognition sequence GGCC. In this study methods of DNA extraction, PCR amplification of exon 3, direct sequencing

and restriction enzyme digestion of PCR products were used. The CA6 gene polymorphism rs2274333 (A/G) was associated with PROP sensitivity when 75 individuals were divided in supertasters, medium tasters and non tasters as described above. The genotype AA and allele A were more frequent in supertasters individuals, while genotype GG and allele G were more frequent in nontasters. In fact, twenty out of twenty-seven supertasters had the AA genotype, only four were heterozygous AG and nobody had the GG genotype; eleven out of twenty nontasters had the GG genotype, four were heterozygous AG and five had the AA genotype. Thus the 92.59% of the supertasters carried the A allele while the 65.00% of nontasters carried G allele at this location. Medium tasters were fourteen out of twenty-eight homozygous AA, ten heterozygous AG, and only four homozygous GG, thus allele A was more frequent (67.86%) than allele G (32.14%) also in those individuals. In conclusion, these novel findings suggest that gustin polymorphism rs2274333 contributes to variation in taste ability which could impact differences in food perception and preference across PROP taster groups. Furthermore, our study indicates that genotyping of the gustin (CA6) gene may represent a reliable and specific marker for individual differences in taste perception and may find application as a survey tool in studies aimed at evaluating eating behaviour and taste function impairment.

References

- [1] Bartoshuk L.M., Duffy V.B., Miller I.J. 1994. PTC/PROP tasting: anatomy, psychophysics, and sex effects. *Physiol Behav.* 56: 1165-71.
- [2] Henkin R.I., Law J.S., Nelson N.R. 1988. The role of zinc on the trophic growth factors nerve growth factor and gustin. In: Hurley L.S., Keen C.L., Lonnerdal B., Rucker R.B. Eds. *Trace elements in man and animals.* Vol 6. New York: Plenum Press, 385-388.