# THE TASTE OF SUCROSE AND CITRIC ACID MIXED WITH ETHANOL: CHANGES IN INTENSITY AND DURATION

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Abstract

*Two concentrations (8% and 15 %) of ethanol were combined with three concentrations (135, 303 and 683 mM) of sucrose and three of (5, 15 and 45 mM) of citric acid. As prompted by a computer ten trained panelists assessed intensity/time responses to sweetness and sourness. Mixed and unmixed solutions of the same taste were evaluated, in triplicate, in the same experiment. Maximum intensity, plateau time for maximum intensity, total time and area were extracted from response curves. Ethanol enhanced all four sweetness properties. The amount of increment decreased with concentration. Responses were no significantly affected by increasing addition of ethanol. Persistence was more clearly augmented than the other attributes. The effect on sourness was different for each one of the concentrations. When the weak sample was tasted all four dimensions increased with ethanol. At the moderate concentration sourness was suppressed by the median 8% level but was enhanced with 15% ethanol. At the strong concentration, intensity and area of the two mixed solutions were depressed but duration was not affected. Results suggest that interaction between gustatory and ethanol compounds produce intensity, temporal and qualitative changes in the perceived taste magnitude.*

Several studies have dealt with trigeminal-gustatory interactions but an important question like the effect of ethanol on basic tastes appears not clearly determined today. (See Mattes and DiMeglio, 2001).
Ethanol (EtOH) convey dynamical oral chemical stimuli which elicit various sensations mainly taste, odor and irritation. The present experiments were designed to examine further the extend to which these attributes may modify responses to basic gustatory stimuli. Time-Intensity methodology was applied to rate sweetness and sourness of sucrose and citric acid solutions mixed with ethanol.

## Method

In first set of experiments three concentrations (135, 303 and 683 mM) of sucrose alone and mixed with two levels (8 and 15 % ) of (EtOH) were presented. In a second set stimuli consisted of three concentrations (5, 15 and 45 mM) of citric acid alone and mixed with the same two levels of ethanol. Mixed and unmixed samples of the same taste were presented in the same session.
The same 10 females assessors, aged 20–26 years, participated in all experiments. They received a training period of three sessions in the use of a computerized technique designed to record intensity/time responses to the taste perceived magnitude. As prompted by the computer they sipped, kept the solution in their mouth for about 5 seconds and then expectorate it. They operated a mouse to truck changes from onset to extinction of the taste sensation. Instruction was to rate the intensity of the taste, sweetness or sourness,

disregarding any other clues. Solutions (5 mL) were presented in 30 ml plastic cups at (35 ± 2º C). A period of 3 minutes between samples was allowed for the panelists to cleanse their palate with CMC and distilled water. Samples were evaluated in triplicate. The schedule for testing was set to minimize the effect of desensitization.

## Results and Discussion

TI curves were analysed according to methods suggested by Liu, I. H. and MacFie, H. J. H. (1990). Parameters extracted from the response curve were: Peak intensity (Imax), Plateau time for maximum intensity, Total duration from onset to offset (Ttot), and Area under the curve (AUC).

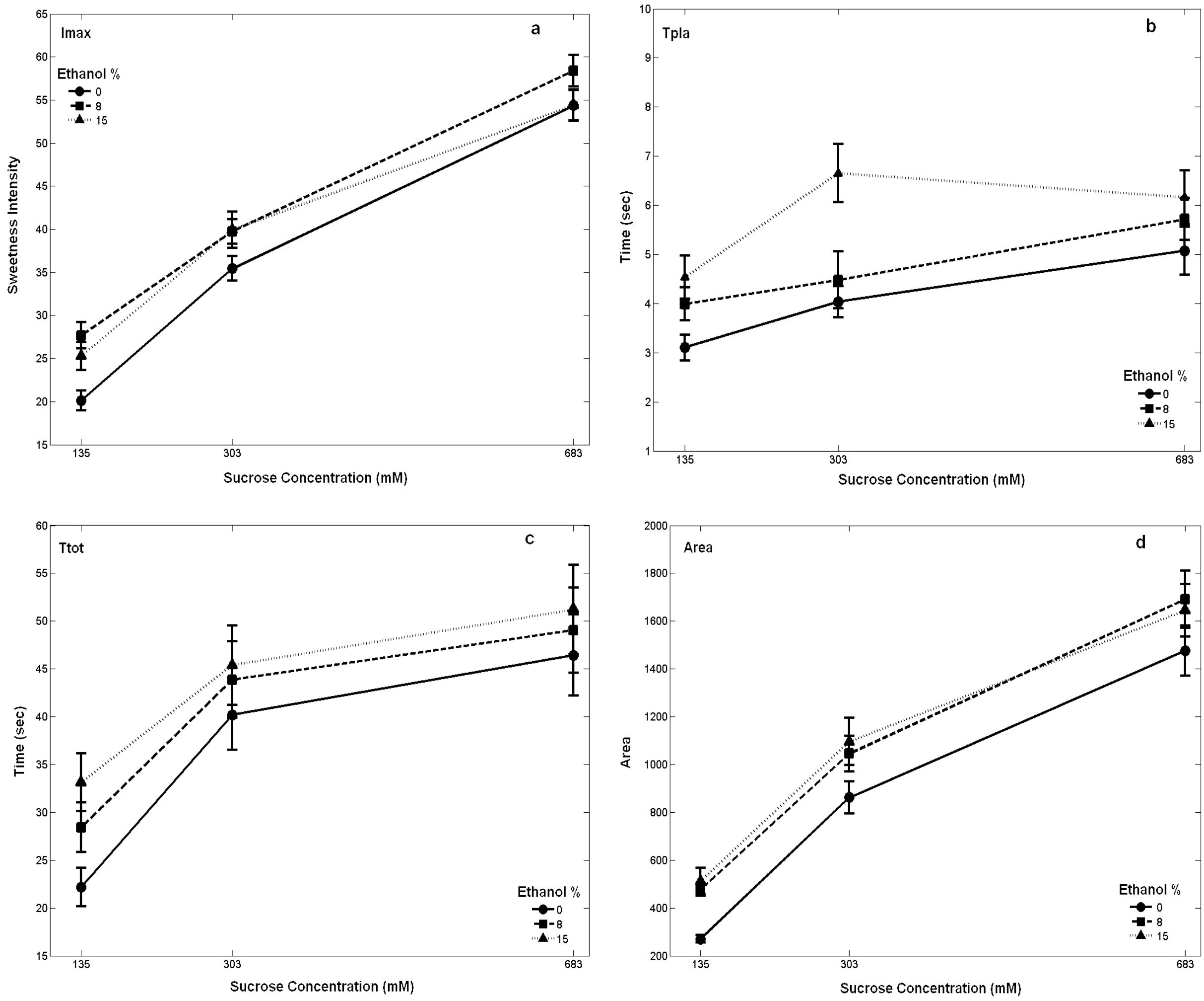


Fig. 1. Geometric mean and standard error of TI responses for sweet taste: a) maximum intensity ratings, b) plateau time for maximum intensity, c) total duration, d) area under curve. N = 30.

The ratings were analyzed by repeated measures of ANOVA (SPSS v. 7.5) with tastants concentrations and ethanol levels and replicates as factors. P-values ≤ 0.05 were considered statistical significant for all experiments.

As seen in Fig. 1, ethanol enhanced the four sweetness attributes. The size of increment decreased with concentration and was no significantly affected by increasing addition of ethanol. Duration (Ttot) seems more clearly augmented with concentration than intensity and area.

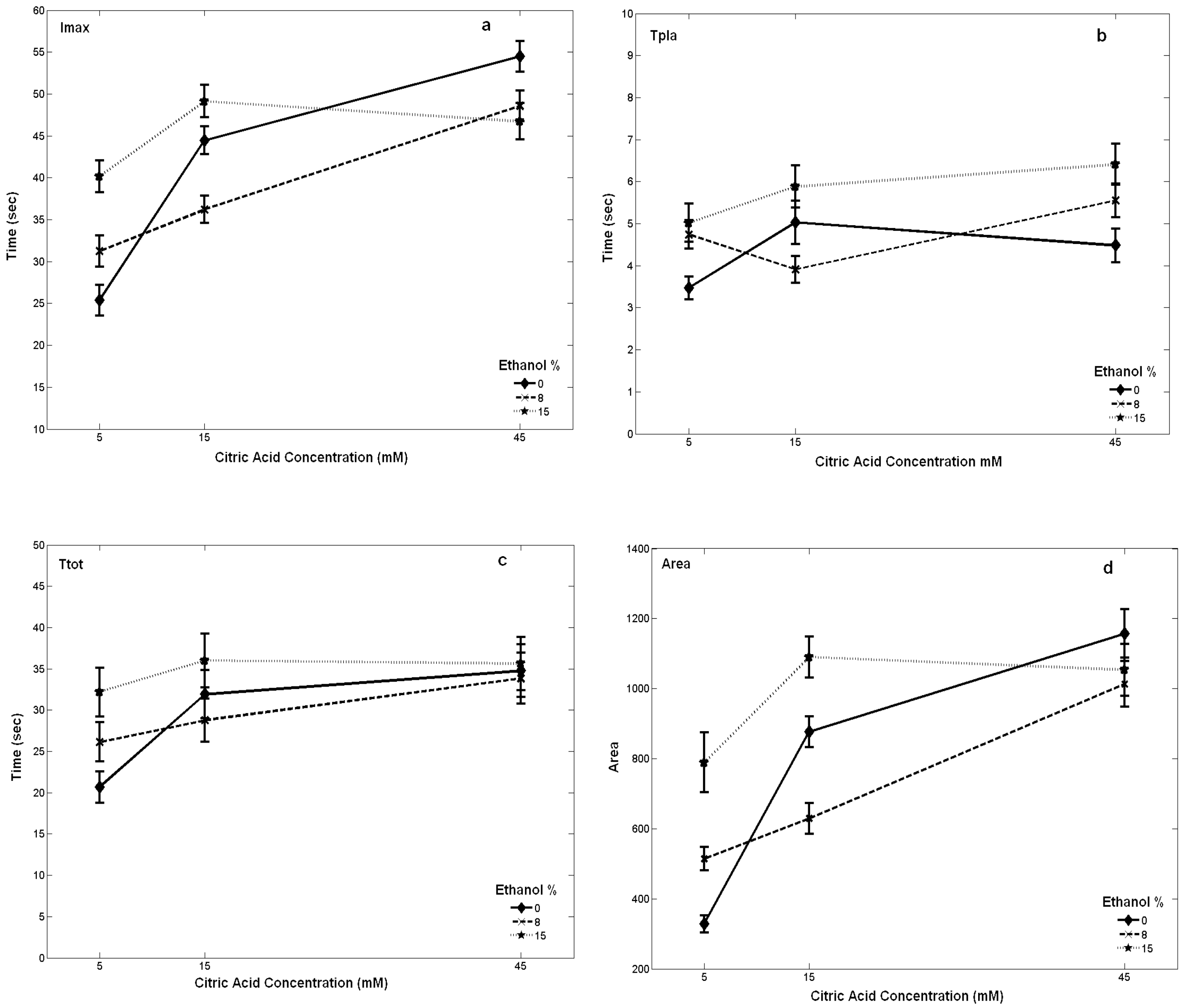


Fig. 2. Geometric means and standard error of TI responses to sour taste: a) maximum intensity ratings, b) plateau time for maximum intensity, c) total duration, d) area under curve. N = 30.

As **s**hown in Fig. 2 the effect on **s**ourness was different for each one of the three concentrations. Enhancement of all four dimensions at the two EtOH levels occurred only at the weakest solution. Instead at the moderate concentration, two different effects were observed. Sourness was reduced with 8% (EtOH) but increased when (EtOH) was raised to 15%. At the highest concentration both mixed solution resulted less intense and also smaller in area than the simple one . Plateu time was unaffected and persistence was slightly increased. The effect on duration and intensity was about the same for the two lower concentrations. For the strong one changes in intensity appear more evident that changes in the persistency of the taste.

Ratings in intensity are similar to data obtained before by other authors who examined taste interaction of sucrose with ethylalcohol applying other psychophysical methods (Martin and Pangborn 1970, Calviño. 1998). As for the sourness their data could only be partially replicate. The main difference is that they observed suppression also at the moderate concentration.

The data presented here confirm that in the interaction taste-oral trigeminal involves more properties other than intensity. Given the integration of these components in EtOH flavor, the odor compound could also be involved in the taste modifications observed here.

Other attributes emerge because of a complex interaction between the taste and the trigeminal compounds. For instance in sweetness a main effect of the mixture is reflected in the larger duration of aftertaste and the expansion of the area space. Instead in sourness the effect is more complex very likely because the sensation changes quality along the taste continuum. As it has been pointed out before citric acid induce taste responses other than sourness like bitter and other taste whereas the sweetness of sucrose maintained its singularity. (Schiffman 2000). In citric acid – EtOH interaction, irritation seems to be a salient quality. The weak simple taste was intensified by the stronger irritation of the alcohol compound and the irritant compound of the very sour solution seems to predominate over the stinging trigeminal compound. It was postulated that the bitter could have different perceptual stages which may relate to distinct oral peripheral mechanisms. (Keast & Roper 2007). In this sense the sour and bitter systems could be responding not necessary to the same but to similar mechanisms.

In order to clarify trigeminal-taste interactions it is important to emphasize the role played in modulating their compounds no only by the intensity magnitude but also by quality and time dimensions.

## References


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