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Sensory analysis of traditional balsamic vinegars: current state and future perspectives / Lemmetti, Federico; Solieri, Lisa; Bonciani, Tommaso; Zanichelli, Gabriele; Giudici, Paolo. - In: ACETIC ACID BACTERIA. - ISSN 2240-2845. - ELETTRONICO. - 3:(2014), pp. 1-6. [10.4081/aab.2014.4619]

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## Appendix: Vocabulary

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### Acidity

Sourness is due to the presence of undissociated organic acids, which convey a feeling of acidity varying in intensity, and often associated with other sensory perceptions (taste and/or trigeminal sensations). The intensity of the acidity is related to the level of maximum stimulation achieved during a taste, while its persistence quantifies the temporal duration of the acid stimulus. The sour taste is usually intensified at low temperatures. In the traditional balsamic vinegar (TBV) samples, the acid taste comes from the influence of all the acid species present in the product that contribute to the fixed acidity (mainly malic acid, tartaric acid, succinic acid, citric acid, gluconic acid, lactic acid) and acetic acid (the most intense) also responsible for the pungency of volatile acidity.

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### Adaptation

Adaptation is the reduction or interruption of the transmission of the perception signal by the sensory receptors when they are subjected to a stimulus that persists for too long and with the same intensity.

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### Addiction

Addiction is similar to adaptation: the sensory receptors develop certain insensitivity to flavors after prolonged exposure, so the intensity of the receptor response is reduced according to the duration of the stimulus. Addiction is an advantageous behavior developed during the evolution because, in natural environments, the

smell serves to identify new odors in a short period of time by resetting the perception of environmental odors. Therefore, in the olfactory test of the sensory analysis, appropriate breaks must be inserted.

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### Antagonism

Antagonism originates from the competition between different molecules insisting on the same sensory receptor. The overall perception depends on the bond strength and the concentration of the species that form the agonist-antagonist pair. Very briefly, some substances that produce a sensory stimulus are not felt because the receptors on which they act are occupied by other substances.

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### Aroma

Aroma usually refers to pleasant smells, as a synonym of fragrance, scent; it is the set of olfactory sensory perceptions triggered by gas molecules that reach the olfactory epithelium. The perception of the flavor is generally enhanced by the temperature increase.

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### Astringency

Astringency is the simultaneous feeling of freshness and dryness as result of trigeminal type stimulation. Astringency is due to the presence of substances that cause the aggregation and precipitation of the proteins of the saliva, resulting in a decrease of the oral lubrication. Astringency is often combined with a bitter taste due to molecules responsible for both effects. As bitterness, astringency is exacerbated by

low temperatures. At low intensity, astringency.

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### **Bitterness**

Bitterness is usually an aftertaste and it is intensified at low temperature. If moderate, bitterness can be a pleasant character in TBV. The bitterness of TBV comes from several natural organic substances from the grapes and the wood of the barrels, as well as from the technological processes (for example overcooking) and microbiological processes.

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### **Brilliance**

Brilliance is referred to the surface gloss, *i.e.* the capacity to reflect the light creating the effect of lucidity, similar to a polished metal surface or a drop of mercury but transparent. Many pictures of commercial balsamic vinegar play on the brilliance as an attractive attribute for marketing purpose.

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### **Clearness**

Clearness is an attribute for the visual assessment of the transparency of the sample. Looking at a thin layer of TBV through a transparent surface, such as glass, the presence of fine material in suspension may affect the clearness and turn the sample opalescent or turbid, depending on the size of the particulates.

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### **Color**

The color can be precisely defined and measurable, but with very expensive equipment. For the evaluation of the color of a food by a panel of tasters, details of the procedure have to be defined, such as the intensity and temperature of the source light.

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### **Consistency**

This attribute, during the gustatory-olfactory test, refers to the overall tactile sensation perceived as soon as the sample is put on the mouth. The consistency refers to the syrupy effect due to the viscosity and specific weight, thus related to the dry extract and the presence of high molecular weight substances responsible for the rheological behavior. Even the oiliness and granularity contribute to the consistency of the sample. Relative high temperatures accentuate the perception of consistency, which is indeed distinctly felt as soon as the sample is heated on the tongue.

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### **Density (relative)**

Relative density, also specific weight, in physical terms is the ratio between the density of a substance and water at the same temperature. In the TBV samples it depends on the nature and amount of substances other than water. The density should not be confused with the viscosity as they are two different measures: the density is the amount of matter per volume unit; the viscosity is a measure of the cohesive force of a fluid.

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### **Flavor**

The flavor refers to the total integrated response of all the sense organs involved in tasting (gustatory, olfactory, and trigeminal).

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### **Hybridization**

Hybridization originates from the olfactory perception of a mixture of substances, which generates a smell different from that of the components.

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### **Persistence**

Persistence stands for the duration of the sensory stimulation. With regard to the olfactory test, persistence indicates whether the perception of pungency and aroma lasts for a relatively short or long time after the interruption of the stimulation. In the gustatory-olfactory test, the persistence descriptor is coupled with the intensity to precisely define the type of acidity of the sample.

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### **Pseudo-heat and pseudo-freshness**

These sensations are trigeminal perceptions of temperature different from the actual temperature of the sample, due to the action of specific classes of molecules. Some typical examples are alcohols (pseudo-heat) and some acids (pseudo-freshness).

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### **Pungency**

The pungency is the simultaneous feeling of irritation, pain and burning, which are trigeminal stimulations felt during the olfactory test. In the TBV samples, pungency is due to the acetic acid in the gaseous state, and it is thus closely related to volatile acidity.

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## Saltiness

Saltiness is generally felt more distinctly at the end of the tasting, when the sweet and sour sensations fade. The strong persistence of salivation over the swallowing is a sign of high salinity. The perception of saltiness is due to the presence of cations (mainly sodium and potassium) of the salified substances.

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## Sensitization

Sensitization is the opposite phenomenon to addiction. The intensity of the receptor response, and therefore of the perception, remains high even if the intensity of the stimulus decreases, until adaptation takes over again.

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## Spiciness

The spiciness is a trigeminal perception of a simultaneous feeling of heat and irritation.

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## Synergy

The synergy originates from the sensory perception of a mixture of substances, which generates a stimulus more intense than the sum of the stimuli of the single components.

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## Suppression

Suppression originates from the sensory perception of a mixture of two or more substances, which generates the annulment of the stimulus caused by a single substance (unidirectional suppression) or both (two-way suppression).

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## Sweetness

In TBV, sweetness is the first taste perceived during the gustatory test. The sweet taste initially tends to mitigate the acidity. The sweetness strongly contributes to the feeling of fullness, softness and texture of the sample and it is mitigated by a low temperature.

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## Trigeminal senses

In addition to the olfactory and the gustatory senses, the sensory system connected to the trigeminal nerve is sensitive to tactile/mechanical stimulations (consistency, viscosity, lubricity, grittiness, temperature, etc.) as well as to other chemical induced perceptions (astringency, pungency, spiciness, pseudo-heat, pseudo-freshness, etc.).

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## Viscosity

The viscosity is a measure of the strength that the molecules of a fluid oppose to the flow and it is easily measurable instrumentally. More specifically, viscosity is the resistance that a fluid opposes to gradual deformation by shear stress or tensile stress. Viscosity is therefore influenced by the presence of substances able to increase the intermolecular forces, generally with high molecular weight. There is no physical relationship between viscosity and density, although high density balsamic samples are often the most viscous. The viscosity, perceived during the gustatory-olfactory test, is included in the descriptor *consistency*. In the visual evaluation, the viscosity refers to the thickness and the persistence of the layer of sample sliding along the walls of the flask.