**Umami measurement in Physalis en Tamarillo (3)**

Ernst Woltering, Food & Biobased Research

1-2-2016

**Background information:** Umami represents the taste of the amino acid [L-glutamate](http://en.wikipedia.org/wiki/Glutamic_acid) and 5’-[ribonucleotides](http://en.wikipedia.org/wiki/Ribonucleotides) such as adenosine monophosphate (AMP) [guanosine monophosphate](http://en.wikipedia.org/wiki/Guanosine_monophosphate) (GMP) and [inosine monophosphate](http://en.wikipedia.org/wiki/Inosine_monophosphate) (IMP). It can be described as a pleasant "[brothy](http://en.wikipedia.org/wiki/Broth%22%20%5Co%20%22Broth)" or "[meaty](http://en.wikipedia.org/wiki/Meat)" taste with a long lasting, mouthwatering and coating sensation over the tongue. The sensation of umami is due to the detection of the [carboxylate anion](http://en.wikipedia.org/wiki/Carboxylate_anion) of [glutamate](http://en.wikipedia.org/wiki/Glutamic_acid) in specialized receptor cells present on the human and other animal [tongues](http://en.wikipedia.org/wiki/Tongue). Its effect is to balance taste and round out the overall flavor of a dish. Umami enhances the palatability of a wide variety of foods. Glutamate in acid form (glutamic acid) imparts little umami taste, whereas the [salts](http://en.wikipedia.org/wiki/Salt_%28chemistry%29) of [glutamic acid](http://en.wikipedia.org/wiki/Glutamic_acid), known as [glutamates](http://en.wikipedia.org/wiki/Glutamate), can easily ionize and give the characteristic umami taste. GMP and IMP amplify the taste intensity of glutamate.

In the first experiment (march 2015) physalis berries with high SSC and with low SSC were compared with 3 types of tomato (beef, round, cherry).

L-glutamate, AMP, IMP and GMP were measured (table 1). It was concluded that, compared to tomato, the amount of the compounds supposed to create a umami taste in physalis were relatively low. L-glutamate was detected in physalis, but AMP, IMP and GMP were not. In this experiment the values were relative as no standards were used.

Table. Measured values are all relative to each other, no absolute values were calculated as no standards were used. Extracts were made from 0.3 gram of fresh fruit tissue.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **sample** | **L-glutamate** | **AMP** | **IMP** | **GMP** |
| Beef tom | 122 | 1.4 | 0 | 0.025 |
| Round tom | 221 | 4.5 | 0 | 0.05 |
| Cherry tom | 154 | 6.8 | 0 | 0.09 |
| Physalis low SSC | 57 | 0 | 0 | 0 |
| Physalis high SSC | 67 | 0 | 0 | 0 |

In a second experiment (January 2016) umami compounds were measured in three batches of fresh physalis berries and one batch of dried fruit that were all delivered to us by Okati.

A more concentrated sample was used for the measurements and for L-glutamate a standard series was also measured. Results are presented in table 2.

Table 2. levels of L-glutamate, AMP, IMP and GMP is physalis samples. Note that the L-glutamate levels are absolute levels. The AMP, IMP and GMP levels are relative levels. Nd=non detectable (level <50)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Batch no | Fruit type | L-glutamate(microg/g FW) | AMPRelativeunits | IMPRelativeunits | GMPRelativeunits |
| 189-3 | Fresh | 89 | Nd | 620 | 220 |
| 1783-4 | Fresh | 88 | Nd | 655 | 207 |
| 2011-3 | Fresh | 125 | Nd | 816 | 297 |
| 1016-3 | Dried  | 1.9 | 1400 | Nd  | 330 |

Results show that the fresh fruit samples contain L-glutamate and trace levels of IMP and GMP (because the used method is more sensitive than the earlier used method we were able to detect these compounds this time, but levels are very low). L-glutamate was a little higher in batch 2011-3 than in the other batches. The level of L-glutamate in physalis is about 100 microgram per gram fresh weight (= similar to 100 milligram per kg). In tomato much higher values are often reported (in the order of 1500 milligram/kg).

As dried fruit had lost about 60% of their water, we expect the concentration in dried fruit to be 2 to 3 times higher than in fresh fruit. This was not the case, the level was much lower than in the fresh fruit samples. Instead of the expected 200-300 mg/kg we found only 2 mg/kg. Apparently during the drying process most of the L-glutamate disappears.

In march 2016, umami compound L-glutamate in tamarillo was measured. Fresh fruit were received from Okati and 2 representative samples were prepared, each from 4 ripe fruit. As a comparison, umami was measured in ripe tasty-tom tomato from local supermarket.

The measurements show that L-glutamate levels were about 10 x higher in tamarillo than in physalis. Tamarillo contained more L-glutamate than tasty-tom.

|  |  |  |
| --- | --- | --- |
| sample | L-Glutamate  |  |
|  | microg/g FW |  |
|   |   |  |
| Tamarillo (1) | 1390 |  |
| Tamarillo (2) | 1210 |  |
| Tasty Tom (1) | 900 |  |
| Tasty Tom (2) | 890 |  |
|   |   |  |
|  |  |  |