Balancing consumers' taste expectations with nutrition delivery

Dr. Ciaran Lynch
NPD Manager,
Ireland
Overview

- Introduction to Carbery Group
- Delivering dairy taste in high protein applications
- Taking the bitter with the sweet: bitterness masking in BCAA applications
- Addressing the taste challenges of non dairy protein sources
Carbery Group

Headquartered in CORK, IRELAND

Leading Global manufacturer of Nutrition Ingredients  Flavours  Cheeses

Founded 50 Years ago (1965)

Sales of €340m (2016)

Selling in over 50 International markets
Research scope

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Delivering dairy taste in high protein applications
Challenges in formulating with whey protein isolate (WPI)

- Due to its attractive nutritional profile (higher protein, and lower lactose and fat levels) WPI is the protein of choice for many sports nutrition consumers over WPC80.
- However, manufacturers can encounter challenges while formulating with WPI versus WPC80 such as:
  - WPI has a thinner mouthfeel than WPC80.
  - WPI has a more watery, less creamy and cardboard taste than WPC80.
  - Manufacturers may have to adapt their flavours to have a more enhanced creamy taste to fit the WPI base.
  - Fruitier profiles often work best for WPI as vanilla and chocolate profiles are impacted from the lack of creaminess in the base.
  - Additionally the WPI flavour profile may vary considerably from supplier and country of origin.
Synergy sensory analysis on WPI - background

Description & Aim

Testing has been done on the effect of 2 dairy enhancers on the WPI profile of various sources of WPI (Irish, American and German). There were two principle aims:

- Explore the taste differences between 3 sources of WPI (Irish, American and German)
- Compare the effect of the dairy enhancers on the profile and liking of WPI between these 3 sources of WPI.

Method

- To investigate taste differences between the 3 sources of WPI, a group taste session was organised. Each WPI was sweetened (final concentration 0.015% sucralose) and evaluated in a group discussion to describe the differences.
- For profiling, participants were asked to taste all samples and rate attributes astringent, milky, creamy (taste), creamy (mouthfeel), sweetness, cereal (only American WPI) and biscuit (only German WPI) on a line scale (0 - 10) for each sample.
Synergy sensory analysis on WPI – Key findings on country differences

- Irish WPI was found to be the most neutral tasting, milky and creamiest (mouthfeel) compared to American and German WPI.
- American WPI was found to be less milky and creamy (mouthfeel) and quite creamy in taste and had presence of cereal notes.
- German WPI was not very creamy and had biscuit notes.
Effect of addition of dairy enhancers – key findings

- Overall addition of dairy enhancers did increase liking scores
- It can be concluded that addition of dairy enhancer YDF-35505 had a positive effect on all sources of WPI (Irish, American and German) by increasing the milky taste and creamy taste/mouthfeel
- Addition of dairy enhancer YDF-36221 increased milky taste and creamy taste/mouthfeel in German WPI.
Taking the bitter with the sweet

Creating a difference with bitterness flavour maskers for BCCA-based nutritional products
Background

- Athletes of all levels are looking for alternative ways to optimise their performance by implementing targeted training and nutrition programmes.

- While protein remains the bedrock of sports nutrition, more and more (casual) athletes are recognising the performance advantages of using advanced nutrition products.

- Some of these include innovative ingredients, such as beta alanine, individual amino acids and combination products, like branched chain amino acid (BCAA) mixes and all-in-one pre-workout supplements.
Masking bitterness

• BCAAs typically possess an extremely bitter taste profile, as well as an unpleasant aroma, which is often anecdotally described as ‘burnt’. Leucine in particular, which is considered the most effective of the three BCAAs at promoting muscle protein synthesis, is also the most bitter.

• Masking agents are often used for BCAA-based products. Such agents operate by lowering the perceived intensity of the whole flavour or by blocking a receptor site without eliciting a bitter response.

• However, bitterness maskers are generally only effective against a small class of bitter molecules with a similar molecular structure.

• Umami compounds such as monosodium glutamate (MSG), for instance, initiate a reduction in the perception of bitterness in quinine and whey protein hydrolysate (WPH). The same cannot be guaranteed for BCAAs though, due to the variation between bitter compounds. In other words, only ingredients which possess a very similar molecular structure to the bitter receptor, or the “lock”, will be able to effectively modify bitterness, acting as “keys”
Masking bitterness

- The most commonly used method for reducing bitterness in BCAA-based nutritional products is the addition of a combination of sweeteners and acids, such as sucralose, stevia and citric acid at high levels. Here, basic tastes, including bitterness, sweetness and acidity, are prone to mixture suppression effects. This means that components with a basic taste of their own (e.g. sweetness) can be used to decrease the perception of undesirable notes (e.g. bitterness) in the finished product.

- Meanwhile, sucralose has been shown to reduce bitterness in BCAAs with a patent claiming 0.1g of sucralose is able to mask the bitterness of 0.9g mixed BCAAs in 40ml water.

- While this method is effective in reducing bitterness in BCAA products to a certain extent, it is not without its limitations. For instance, highly sweetened and acidified products are prone to tasting artificial and unbalanced.

The addition of citric acid is only viable in conjunction with fruit flavours, due to an increase in acidity.
Masking bitterness

• Intense confectionery flavours and odorants are also commonplace for masking off notes in BCAA bases, since they pair well with the extremely sweet and sour BCAA bases.

• Such flavours include blue raspberry, sour lemon and lime or fruit punch. These are often perceived as sickly, particularly before an intense workout. Also, many athletes are looking for natural and healthy products to use as part of their daily exercise and diet regime, rather than those which are loaded with sugar or artificial sweeteners.

• Manufacturers are therefore looking for next generation solutions to tackle bitterness and ultimately cater to ever growing consumer demand with great tasting BCAA nutritional beverages.
Blending flavour creativity with science

• Manufacturers typically incorporate simplistic, blanket-block ingredients into their nutritional products to decrease bitterness perception.

• Finding a more selective, tailored approach to bitterness masking is one way to solve these flavour challenges. By applying knowledge recently gained in the field of bitter responsive TRCs, leading suppliers, including Synergy, are increasingly incorporating ingredients specifically tailored to interact with either the target bitter molecules or the bitterness receptors on the tongue, which they activate.

• This helps to prevent bitterness detection completely. In doing so, manufacturers are able to achieve reduced bitterness and a more neutral taste profile, without the need for high levels of sweetener and acid. Allowing the incorporation of fresh, delicate, fruity flavours, such as citrus, apple, raspberry, pineapple and watermelon, for a more pleasant consumption experience.
Addressing the taste challenges of non-dairy protein sources
Introduction

Understanding the off notes in plant based proteins.

Plant based proteins are increasing in popularity, despite their documented unpalatability when compared to whey.

Understanding their inherent flavour profiles is crucial to delivering a superior vegan product.

Synergy is involved in ongoing research to understand the flavour profiles of plant based proteins using a combination of liquid extraction, GC-MS, GC-O and sensory analysis.
Extraction method

- During **liquid-liquid extraction** a water immiscible solvent is used to extract volatile components from the matrix.

- **Solvent Assisted Flavour Evaporation (SAFE)** is a specialised technique for fat removal from liquid extracts.

- Using liquid extraction followed by SAFE, a clean extract containing **only the volatile components** from the food matrix is obtained.
Gas chromatography- mass spectrometry (GC-MS)

A technique for separation and identification of 1000s of flavour compounds.

- GC-MS was used to determine which flavour compounds were present in the plant based proteins.

- Extracts were injected into an Agilent 7890A Gas Chromatograph fitted with an FFAP column (Phenomenex) and coupled to an Agilent 5977 Mass Spectrometer. The GC oven was 45°C initially with a temperature ramp of 4°C/minute to a final temperature of 220°C, which was maintained for 20 minutes. The Mass Spectrometer was operated in Scan mode for masses between 40 and 300.

- The gas chromatogram (left) represents the volatile components of typical plant protein. For each peak, the corresponding mass spectrum (right) represents the masses of the ions detected, and permits identification of the volatile by reference to a spectral library.
Sensory methods

• A group of experienced protein panellists (n=10) tasted in a group session and selected descriptors.

• The panellists then individually rated the samples in the sensory booths on the descriptor scales.

• The results were combined and considered as an average.
Gas chromatography olfactometry

• Instead of using an electrical detector at the end of the GC column, a human assessor is used as an aroma detector.

• As the sample is separated by GC, the assessor sniffs the nose cone and notes any odours they may perceive.

• The olfactogram and chromatogram can then be overlaid and the descriptors compared to literature in order to identify the odorants in the sample.
Pea - Sensory and GC-O results

Pea Protein Sensory Results

- 2-pentyl furan (Bean, vegetable)
- 2,4 decadienal (Fatty, oily)
Flavour pairing

• When different foods share certain key aromas they are more likely to pair well in a recipe.
• Food pairing is a method for identifying which foods go well together.
• The method is based on the principle that foods combine well with one another when they share key flavour components.
• Think of Chocolate Peanut Butter Cups, both peanuts and chocolate contain roasted and cocoa aromas. The two foods can be successfully combined because they share these flavour compounds in common.
Pea protein – flavour pairing

Conclusion

• Understanding vegan proteins profiles has driven knowledge of how best to flavour them:

  • Using specialised in-house analytical and sensory techniques the flavour of vegan proteins has been mapped and explained.
  • Incorporating the theory of flavour pairing, complementary flavours which work with key odorants in the base have been identified.
  • This work demonstrates the importance of understanding a food matrix and tailoring flavours to complement it
Come and try our science in action

Visit us at stand H63 to sample the following:

• WPI flavoured concepts with dairy enhancers
• BCAA concepts with bitterness masking
• Non dairy protein concepts (flavour pairing)
We love questions

Synergy Flavours
Hillbottom Road,
Sands Industrial Estate,
High Wycombe,
Bucks. HP12 4HJ

P: +44 (0) 1494 492222
E: marketing.uk@synergytaste.com

uk.synergytaste.com