CODEX ALIMENTARIUS COMMISSION

Food and Agriculture Organization of the United Nations

World Health Organization

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Agenda Item 2 **MAS-CRD/05**

ORIGINAL LANGUAGE ONLY

JOINT FAO/WHO FOOD STANDARDS PROGRAMME

CODEX COMMITTEE ON METHODS OF ANALYSIS SAMPLING

MATTERS REFERRED TO THE COMMITTEE BY THE CODEX ALIMENTARIUS COMMISSION AND OTHER SUBSIDIARY BODIES

Comments of AOAC, ISO and IDF on the Measurement of Sweet Taste in Follow-Up Formula

Executive Summary

In 2019, the Codex Committee on Nutrition and Foods for Special Dietary Uses (CCNFSDU) agreed to revise the Codex Standard (CXS) for follow-up formula (FUF; Section B: drink/product for young children with added nutrients/drink for young children i.e. FUF 12-36 months), specifying that "for products based on non-milk protein, carbohydrate sources that have no contribution to sweet taste should be preferred and in no case be sweeter than lactose." Based on this specification, CCNFSDU referred the matter to the Codex Committee on Methods of Analysis and Sampling (CCMAS) for guidance on internationally validated methods to measure sweetness of carbohydrate sources for these products.

Currently, there are no analytical methods to determine sweet taste of carbohydrate sources relative to lactose for regulatory compliance of FUF. There are several official methods/standards for analyzing individual carbohydrates or sugar profile in foods, but these methods determine carbohydrate composition and not sweet taste.

Sweet taste can be determined by standard sensory analysis methods. However, no sensory intensity reference value for sweetness of carbohydrate sources can be defined as an indicator for sweetness in FUF. This is true for two important reasons. First, it is impossible to define an accurate sweetness reference value. Second, it is impossible to selectively measure perceived sweetness of carbohydrate sources in FUF due to the taste perception of other ingredients in the FUF matrix. Also, processing effects (e.g. thermal treatment) may modulate perceived sweetness of the finished product.

Recommendations to CCMAS41

The revised Codex Standard for FUF specifies the use of carbohydrate sources not sweeter than lactose. However, our findings indicate there are no internationally validated methods to enforce this proposed specification. Therefore, based on the findings presented within this Conference Room Document (CRD), we recommend that CCMAS advise CCNFSDU to reconsider the provision "and in no case be sweeter than lactose" from footnote 5 in relation to Carbohydrates in Point 3 "Essential Composition and Quality Factors" of Section B. If CCMAS cannot determine a suitable objective method, then we recommend that CCMAS advise CCNFSDU to remove the provision entirely.

Agenda Item #2: Matters Referred to the Committee by the Codex Alimentarius Commission and Other Subsidiary Bodies

Codex Committee on Nutrition and Foods for Special Dietary Uses (CCNFSDU41)

Methods to measure sweetness in Drink/Product for young children with added nutrients / Drink for young children

Introduction

In 2019, the Codex Committee on Nutrition and Foods for Special Dietary Uses (CCNFSDU) agreed to revise the Codex Standard (CXS) for follow-up formula (FUF; Section B: drink/product for young children with added nutrients/drink for young children i.e. FUF 12-36 months), specifying that "carbohydrate sources that have no contribution to sweet taste should be preferred and in no case be sweeter than lactose" for products based on non-milk protein. The AOAC INTERNATIONAL (AOAC) delegation intervened to express doubt about the ability to analytically measure and enforce a requirement for sweet taste objectively. CCNFSDU41 agreed and referred the matter to the Codex Committee on Methods of Analysis and Sampling (CCCMAS) for guidance.

CCNFSDU41 agreed to ask CCMAS41 whether there were internationally validated methods to measure sweetness of carbohydrate sources for these products.

To assist CCMAS in its guidance, AOAC INTERNATIONAL formed the AOAC Ad Hoc Expert Panel on Sweetness in November 2020 with participation of the International Standardization Organization (ISO/TC 34/ SC 12 – Sensory analysis) to assess the landscape of methods of analysis for determining sweet taste of carbohydrate sources in FUF 12-36 months. The International Dairy Federation was also consulted. This document presents findings and recommendations.

Findings

Standards for Analytical Methods to Determine Carbohydrate Compositions in Foods, but Not Sweet Taste

To the best of our knowledge, there are no stand-alone analytical methods for determining the sweet taste of carbohydrates in FUF or other foods.

An abundance of analytical methods for quantitating carbohydrates in foods have been reported in the literature. Most state-of-the-art methods use well-accepted analytical instruments to selectively determine a single carbohydrate or multiple carbohydrates simultaneously (i.e. sugar profile methods that generally include two or more of the most common mono- and disaccharides – glucose, fructose, galactose, lactose, sucrose, and maltose) in ingredients and finished products. Specifically, chromatographic methods like high-performance anion-exchange chromatography with pulsed amperometric detection and high-performance liquid chromatography with tandem mass spectrometric, evaporate light-scattering, or refractive index detection continue to be developed and optimized to extend their applicability to various complex food matrices while providing good accuracy and precision, high sensitivity and resolution, and required LOD and LOQ. Alternative, highly specific, enzyme-based methods are also well established and validated for the measurement of individual sugars or groups of sugars.

Although we were unable to find any official methods of analysis for quantitating carbohydrates in FUF specifically, we identified several sugar profile methods for milk/milk product and infant formula (ISO 22184|IDF 244), foods of low/high protein or sugar matrices (AOAC 2018.16), fruit/fruit juices (AOAC 971.18), cereals (AOAC 982.14), milk chocolate (AOAC 980.13), and instant coffee (AOAC 995.13, ISO 11292). In addition to the sugar profile methods, there are official methods for quantitating individual carbohydrates, including lactose in raw/processed milk (AOAC 2006.06; ISO 22662|IDF 198:2007) and powdered infant formula (AOAC 2020.01). Lastly, there are also official methods for quantitating complex carbohydrates in relevant foods. These include fructans in foods and animal feeds (AOAC 999.03, 2018.07) and pediatric nutritional and infant formulas (AOAC 2016. 14, AOAC 2016.06, ISO 22579 | IDF 241) as well as galactooligosaccharides in foods/cereals/dairy products (AOAC 2021.01).

There are no methods of analysis or provision for carbohydrates in FUF in CXS 234-1999. However, there are several for carbohydrate ingredients and foods. These include Codex Type II methods for sucrose in fruits juices and nectars (EN 12630, IFU Method No. 67 (1996), NMKL 148 (1993)); fructose and glucose in sugars (fructose) (ISO 10504:1988); lactose in sugars (lactose) (ICUMSA GS 4/3-3 (1994)); and lactose

in dried milk, dried ice-mixes and processed cheese (ISO 5765-1/2 | IDF 079-1/2:2002). Additionally, CXS 234-1999 includes Codex type III methods for glucose and fructose in fruit juice and nectars ((EN 12630, IFU Method No 67 (1996), NMKL 148 (1993)); and carbohydrates in Foods for Special Dietary Uses (Method described in CAC/VOL IX-Ed.1, Part III).

Indeed, the results of the analytical methods mentioned above do not indicate the sweet taste of individual carbohydrate sources for FUF products. Sweet taste can only be determined by standard sensory analysis methods.

Standards for Sensory Analysis Methods

Sensory evaluation in the food industry aims at understanding the perceptual impact generated by a molecule, an ingredient, or a final product. Among existing methodologies, Quantitative Descriptive Profile is a test in which sensory attributes of a product are determined and the perceived intensity of each attribute is quantified on an intensity scale by a trained panel of human taste-testers as described in ISO standards [1-2]. This sensory methodology is general to any food-related stimuli and perception and can be applied to measure the sweetness of any carbohydrate source as well as FUF.

A well-designed sensory analysis helps ensure objective results on perceived intensity of each attribute. First, trained taste panelists are recruited according to their acuity in detecting and recognizing basic tastes and other specific sensory attributes depending on the targeted product category. Second, evaluation performed in sensory booths prevents human testers from interacting and influencing each other's judgements. Third, randomized and balanced order of product presentation allows for statistical suppression of carry-over effects (i.e. influence of one stimulus on perception of next evaluated stimuli). Finally, the number of stimuli evaluated in a single session is defined per product category to avoid sensory fatigue and saturation.

Even with a well-designed study and training to limit variability between individual panelists' responses, it is still impossible to define a reference sweetness intensity value as a quality control indicator for each carbohydrate source relative to lactose that is identical over time and across global taste panels. This is because variability exists inherently in sensory response due to physiological and psychological differences between individuals such as differences in sweet perception threshold, hunger, and mood [3]. Additionally, the perceived sweetness of a carbohydrate source dissolved in aqueous solution at a given concentration does not indicate equivalent sweetness for the same carbohydrate at the same concentration in a finished product. Indeed, manufacturing processes (e.g. thermal processing) and other ingredients in the finished product can modulate the sweetness of carbohydrates. Examples include sourness of organic acid, bitterness of peptides, flavouring odour, and recipe texture through physicochemical, physiological and/or perceptual interactions [4-7].

In summary, existing sensory methodologies can be used to measure sweetness. However, no sensory intensity reference value for sweetness of carbohydrate sources can be defined as an indicator for sweetness of FUF because:

- Inherent psychological and physiological differences between trained taste panelists prohibit the development of an accurate sweetness reference value that can be globally harmonized across food companies and is stable over time;

- The selective measurement of perceived sweetness of carbohydrate sources as an indicator for sweetness of FUF is impossible because matrix and processing effects modulate perceived sweetness in the finished product.

Conclusions

There are currently no internationally validated methods which can accurately measure sweetness of carbohydrate sources for FUF products. Analytical methods determine carbohydrate composition. Sensory methods can determine a perceived sweetness of an ingredient or product. However, it is impossible to define a reference sweetness intensity value as a quality control indicator for a carbohydrate source relative to lactose sweetness in FUF.

Since there are no internationally validated methods to enforce the proposed specification in the revised Codex Standard for FUF, we recommend that CCMAS consider these findings presented in this CRD and

advise CCNFSDU to reconsider or remove the provision “and in no case be sweeter than lactose” from footnote 5 in relation to Carbohydrates in Point 3 “Essential Composition and Quality Factors” of Section B. If CCMAS cannot determine a suitable objective method, then we recommend that CCMAS advise CCNFSDU to remove the provision entirely.

References

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2. ISO 6658:2017. Sensory analysis – Methodology – General guidance.

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