Abstracts

(1) A comparison of two rapid methods for dynamic sensory profiling: TDS and temporal CATA

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Temporal dominance of sensations (TDS) data consist of temporal sequences of dominant attributes. TDS has been conventionally performed with trained assessors, but recently TDS has been proposed as a rapid method using consumers. The main potential problem of this approach is consumers' understanding of the concept of attribute dominance. Alternatively, temporal check-all-that-apply (temporal CATA, or TCATA) is introduced as a novel method for dynamic sensory characterization. TCATA extends the use of check-all-that-apply questions by allowing continuous selection of attributes based on applicability or presence. Multiple attributes can be selected concurrently. Deselection indicates that the attribute is no longer applicable. TCATA can be used with trained assessors or consumers. When used with consumers it meets criteria for being a rapid method and easy for consumers to understand. In the present work TCATA and TDS were assessed as potential rapid methods for dynamic sensory profiling with consumers. A consumer study involved the evaluation of 6 orange juices (P1 to P6) formulated using different sweeteners. Consumers were randomly allocated to the TCATA (n=51) or TDS (n=50) methods. Six sensory attributes were used to characterize samples. Conclusions regarding differences among samples were similar for both methodologies. However, several differences were identified. Various products showed high levels of concurrent attribute selection in TCATA. Matching times in TDS showed a damping effect, in which attributes competed, pushing proportions of each attribute closer to chance proportions (as in P5) or a kingmaker effect, in which the dominance of one attribute lead to underemphasis of other attributes (as in P3). Where the latter effect prevails, the dominant attribute is not necessarily considered applicable at higher levels, which suggests TDS is somewhat sensitive to panelist heterogeneity. Results from the present work suggest that TCATA could be more appropriate than TDS for dynamic sensory profiling with consumers.

(2) Can consumers cope with rapid profiling methods? An overview and comparison of flash profiling, napping, and polarized sensory positioning

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Over the recent years, with an ever competitive and fast-moving marketplace, traditional descriptive analysis techniques have been considered too time-consuming. This has led to the development of more rapid methods of descriptive analysis with trained panelists, semitrained panelists, and naïve consumers. The aim of this project is to evaluate and study three rapid profiling methods: flash profiling, napping, and polarized sensory positioning (PSP) with naïve consumers. The objectives were 1) to investigate whether naïve consumers can be used for rapid profiling methods and 2) to determine the degree of similarity between the sensory spaces and the usefulness of the data of the three methodologies. Flash profiling is a combination of free choice profiling (FCP) and ranking methods based on the evaluation of individual attributes generated by respondents. Napping consists in collecting the sensory distance perceived between products by positioning the products on a white tablecloth. PSP is based on the comparison of samples to reference samples called "poles" using line scales ranging from "exactly the same" to "completely different." A total of three consumer tests with eleven samples of strawberry jam were carried out at Leatherhead. Each test was completed by 40 or more naïve consumers. In summary this study showed that the three methodologies are all quick, easy, and able to be carried out in a single session. The methods were not easy for the naïve consumers, which was reflected during the sessions and in the respondents' lack of repeatability when duplicates were presented. The output of the three methods were quite similar but the amount of data did vary across the methods. To further our investigation as to whether naïve consumers can be used, research is being conducted this year (2014) on the same rapid methods with trained and semitrained judges.

(3) Comparison of rapid methodologies for sensory characterization

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Interest in rapid methodologies for sensory characterization has largely increased in the last decade. These methodologies have been used for a relatively short time and in a limited number of applications. Thus, it is necessary to study their applicability, reliability, and reproducibility for characterizing products of different sensory complexity before they get established as standard tools in sensory and consumer science. The aim of the present work was to compare four rapid methodologies with consumers and descriptive analysis for sensory characterization of powdered drinks. Two sets of six commercial powdered drinks were considered, one with large differences among samples and the other with small differences. A trained assessor panel evaluated the samples using descriptive analysis. Besides, each sample set was evaluated by four groups of 50 consumers in two sessions using CATA questions, projective mapping (PM), polarized sensory positioning (PSP), and polarized projective mapping (PPM). The four methodologies provided information similar to descriptive analysis. However, the similarity between sample configurations from the different methodologies depended on the degree of difference among samples, being larger for the sample set with the largest differences. Reproducibility was high for all methodologies (RV coefficient between sample configurations higher than 0.95). Regarding vocabulary generation, the terms used by consumers to describe samples in PM and PPM were similar to the descriptors used by trained assessors. The four rapid methodologies also differed in the stability of sample configurations (evaluated using bootstrapping) and the number of consumers needed to achieve stable configurations, with PPM as the most stable methodology. Results from the present work suggest that sensory characterizations of simple products can be obtained in short time frames and directly from consumers using rapid methodologies. Methodological aspects that should be taken into account for selecting the most appropriate methodology are discussed.

(4) Theoretical underpinnings of sensory science: SWOT of bending the rules in practice

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Many sensory scientists have gained their expertise on the job. Often, such training relies on a "cookbook" approach, with an emphasis on the steps to follow to successfully complete common tests. While this allows the practitioner to rapidly get up to speed and begin conducting studies quickly, unfortunately this approach only minimally explains the theoretical underpinnings that led to that sequence of steps be utilized. Without understanding the underlying theory, these steps become rules which are strictly followed lest the test results be invalid. However, not all rules are equal. While some should never be violated, others are more flexible. An overview of several of these implicit rules and their relevant theories will be outlined, as well as the strengths, weaknesses, opportunities, and threats of breaking these rules.

(5) Combining highly efficient methods can reduce costs without compromise

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Studies that investigate drivers of consumer liking involve both descriptive sensory and consumer data collection. These two components can be run in parallel to reduce project time, but at significant expense. To reduce costs associated with large-scale projects, some researchers have proposed the use of rapid methods to collect both product profiles and consumer data. The cost of panel training is eliminated, but the precision of the data is compromised. Rapid methods by themselves are not the only way in which substantial cost reductions and time savings can be achieved. The combination of efficient methods can substantially reduce costs associated with a large optimization study. The integrated process commences with a screening step, in which rapid methods like projective mapping reduce the sample range to appropriate representative products. Then a descriptive panel is trained using immediate on-screen feedback calibration, which cuts training time and delivers highly precise sensory descriptive profiles. The consumer component of the study is also performed in an accelerated manner. Sensory-informed balanced incomplete block design (SIBIB) is used to create incomplete blocks in which sensory contrasts are maximized, nested designs enable internal validation, and the size of the consumer study is radically reduced. The use of SIBIB helps to reduce fatigue and other contextual effects that interfere with data quality in a consumer sensory test. Expectation–maximization (EM) algorithm-based imputation is used to obtain a full data set. The data is used to identify consumer preference clusters and their drivers of hedonic response. This method requires that sensory and consumer data collection be conducted in sequence. Unlike the current generation of rapid methods, this approach provides acceleration and cost reduction without compromising data quality. The method is illustrated using examples from two large-scale bread studies.

(6) The relevance of flavor complexity to consumer acceptability of food products

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It requires a holistic view of the eating experience to deliver food that is sustainably accepted by consumers. Traditional descriptive analysis is often used to interpret consumer responses to food products, which in turn is used to guide reformulation efforts during product development. As descriptive analysis only provides intensity ratings for the singular sensory attributes associated with the products, the complexity of the flavor experienced by consumers is not measured. Since development of complexity measures based on Medel et al. (8th Pangborn Sensory Science Symposium, 2009), we have been researching selected measures of complexity with descriptive panelists, namely harmony, balance, and blend. Through comparisons to consumer acceptability ratings for several product categories, we have expanded our understanding of how differentiated complexity can drive liking or purchase interest. Ultimately multiple sources of information (e.g., consumer response, complexity profile, descriptive analysis) are required to provide key product insights that maximize development efforts. Our presentation will illustrate that optimizing the harmony, balance, and/or blend of flavors can translate to improved consumer acceptability of products, despite minimal differences in the descriptive flavor profiles of the products and consumers' inability to articulate product differences.

(7) The surrogate consumer: Mining chefs' intuitive heuristics

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In order to remain competitive in the global marketplace, food companies seek to increase their products' speed to market and deliver cost innovation. As a result, project timelines are shorter and consumer research budgets are tighter. Product development teams and, in particular, sensory and consumer practitioners must be more creative in gathering and leveraging consumer information. One creative solution is to employ chefs in the product development process. Whether instinctual or experiential, successful chefs have a special intuition for understanding and delivering what consumers want. Many food companies now employ chefs to help with concept development while some companies have gone a step further to gather the world's chefs into one place to stimulate creativity. Modern cuisine now drives many of the flavor combinations seen in frozen foods, packaged goods, and fast, casual restaurants. The same techniques employed for many years in consumer research are now applied with a new group of subjects. One-on-one interviews, qualitative discussions, and surveys with chefs provide an indirect route to understanding consumers and the results can be inspiring.

(8) Comparison of rapid sensory profiling techniques: check-all-that-apply (CATA), sorting, and polarized sensory positioning (PSP) with astringent stimuli

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Multiple rapid sensory profiling techniques have been developed as a more efficient alternative to traditional sensory descriptive analysis. Here, we compared three sensory profiling techniques including check-all-that-apply (CATA), sorting, and polarized sensory positioning (PSP) using an identical set of astringent stimuli that included polyphenols, acids, and salts. While these methods differ in theory, implementation, and data analysis, the relative

advantages and limitations are unknown. In experiment 1, subjects (n=41–47 depending on specific session) were asked to rate the overall intensity of each stimulus as well as to endorse any number of terms (out of a possible 13) which characterized the sample. In experiment 2, subjects (n=30) sorted intensity-matched stimuli into groups 1-on-1 with the experimenter. In experiment 3, (n=41) subjects first sampled three blind references ("poles"). They then rated each sample relative to the three poles on an unstructured line scale (0="exactly the same" to 10="completely different"). MFA (CATA and PSP) and MDS (sorting) plots generated from these tasks were remarkably similar, with normalized RV coefficients indicating significantly similar between sorting and PSP (p=0.007) and CATA and PSP (p=0.001). The maps for sorting and CATA appeared similar on visual inspection, but the configurations did not reach the criterion for significant similarity (p=0.11). Although sorting is a rapid alternative to traditional pairwise comparisons (55 pairs needed for 11 stimuli), due to the cognitive difficulty of the sorting task, it is unclear if this method can be used without the involvement of the experimenter. Comparatively, PSP and CATA are more time and labor efficient as they can be conducted in isolated sensory booths rather than 1-on-1 with the experimenter.
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(9) Using real time panelist feedback to fast track high quality consensus descriptive analysis

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Descriptive analysis of large numbers of samples presents a challenge to sensory professionals working in fast-paced environments. The challenge is to capture all the qualitative sensory nuances within the product set under study while maintaining high levels of discrimination across products. With consensus profiling, members of a trained sensory panel work in concert to agree magnitude ratings for each sensory attribute rather than providing independent ratings in duplicate or triplicate (Meilgaard, 2006). This makes the profiling process a lot more rapid and the method is used by many sensory practitioners as a result. Consensus profiling typically embraces essential features of regular sensory profiling, such as lexicon and protocol development and individual panelist scoring, but the process bypasses panel alignment training phases and replicated in-booth scaling by substituting both stages with round-table quantification, discussion, and agreement of attribute scores. This is often achieved with panelists scoring products on paper ballots around the table, measuring up and calling out their scores to the panel leader and other panelists, one attribute at a time. This stage is critical for individual panelists and the panel leader to identify attributes for which scores are not aligned between panelists and to lead to the appropriate discussion in order to maximize panel agreement and resulting product discrimination. The process, however, can still be time-consuming, particularly when dealing with high numbers of panelists and attributes, thus limiting the amount of products that can be assessed during the panel session. Modern technologies such as tablets and online data capture can further shorten the consensus process time by providing panelists with real-time feedback without the need to measure up and call out scores. This study investigates the use of instant feedback tools to increase the efficiency of consensus profiling and compares the results to traditional approaches.

(10) – Withdrawn

(11) Determination of 4-ethylcatechol in faulted wine using sensory evaluation and the electronic tongue

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When the wild yeast Brettanomyces grows in wine, it produces several compounds that can alter the sensory properties of a wine. At low levels, some winemakers feel that these compounds exert a positive effect on wine. However, at high concentrations, these Brettanomyces-related compounds generally exert a negative effect. While several of these Brettanomyces-related compounds have received research attention to determine aroma thresholds, one of these compounds, 4-ethylcatechol (4-EC), has received less attention. Thus, the objective of this study was to determine the sensory impact of 4-EC to the sensory profile of Brettanomyces-contaminated wine. Different concentrations of 4-EC (493, 714, 1035, and 1500 µg/L) were added to a Washington state Merlot wine. Using sensory evaluation panels, both the consumer detection threshold (DT) and the consumer rejection threshold (CRT) of 4-EC were determined. The electronic tongue (e-tongue) was also used to distinguish among the different concentrations of 4-EC. The threshold value of 4-EC in the Washington Merlot was determined to be 823 µg/L. No differences in consumer preference were found between the control wine (no 4-EC) added and the wine containing the highest concentration of 4-EC (1500 µg/L). The electronic tongue was able to discriminate (DI=82%) among the samples of 4-EC (base wine and four concentrations of 4-EC). The lowest concentration distinguished by the e-tongue was 493 µg/L, which was lower than the sensory threshold determined in this study. These findings suggest that for the detection of 4-EC in Merlot wine, the e-tongue may more sensitive than many consumers. These results show great promise as they demonstrate the e-tongue as a methodology for the detection of subthreshold concentrations of chemical compounds in wine. The results also further illustrate the many applications of the e-tongue in wine research, including early detection of wine faults.

(12) In search of the ideal high intensity sweetener: Understanding the impact of repeated consumption using temporal sequential profiling

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With many consumers turning to low-calorie diets and seeking to reduce sugar intake, the development of high-intensity sweeteners (HIS) has allowed manufacturers to create a wide range of sweetened products without the calorific intake associated with sugar-based equivalents. However, the intrinsic sensory characteristics of some natural HIS may be a limiting factor in their acceptability and long-term consumption. In past studies, HIS have been found to differ from sugar-based equivalents with some eliciting perceived off-notes, including metallic and bitter tastes, even in low concentrations. Previously, sensory analysis has compared sweeteners to sugar-based equivalents using descriptive profiling or temporal assessments to primarily identify characteristics occurring over the course of a single exposure. However, to fully understand the implications of replacing sugars with HIS, we need to establish a method for profiling these sweeteners that provides a better representation of their actual usage, where consumers often ingest larger volumes in a single sitting. Our study demonstrates both the importance of temporal assessment of HIS products and the effect of repeat consumption on the development of perceived sensory characteristics. The study uses sequential profiling to investigate the effect of repeated

consumption of a range of HIS solutions (aspartame, acesulfame K, sucralose, stevia, and xylitol), highlighting the sensory characteristics that build up or decline throughout when drinking larger volumes and comparing this directly with equivalent sugar-based solutions (sucrose, fructose, and glucose). The conclusions provide clear recommendations to food and drink manufacturers on how to select the most appropriate HIS, based on full consumption information, for the effective sweetening of diet or reduced calorie products.

(13) Non-nutritive sweeteners are not supernormal stimuli

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Non-nutritive sweeteners (NNS) are often claimed to be supernormal stimuli that are able to elicit sweetness responses that are "sweeter than sugar." Tinbergen and Perdeck (1950) described supernormal stimuli as exaggerated stimuli that evoke responses more effectively than the stimulus for which the response evolved. The objective of this study was to investigate the perceived sweetness of nutritive (sucrose, maple syrup, and agave nectar) and NNS (acesulfame-K [AceK], rebaudioside A [RebA], aspartame, and sucralose) using a general labeled magnitude scale (gLMS) and a large cohort of untrained participants. Participants (n=401) rated the sweetness, bitterness, and metallic intensity for nutritive and NNS in water using the gLMS in four experiments conducted on separate days. Sigmoidal dose–response curves were observed for all stimuli except RebA. If data are not artifactually linearized a priori via panel training, sucrose follows a sigmoidal function. There was no evidence that NNS have a maximal perceived sweetness greater than sucrose; indeed, maximal sweetness for AceK, RebA, and sucralose was significantly lower than for concentrated sucrose. For these sweeteners, mixture suppression due to endogenous dose-dependent bitterness appears to limit maximal perceived sweetness. In contrast to reports which suggest sucralose is not bitter, we show sucralose is bitter above ~10mM. Aspartame did not increase in bitterness, which may explain why there was no significant difference in sweetness between aspartame and sucrose. On a weight basis, the maple syrup and agave nectar were slightly more potent than sucrose, although this is likely a result of molar composition (monosaccharides versus disaccharides). In conclusion, we fail to find evidence that NNS are super-normal stimuli, at least in regard to perceived sweetness. Supported by funds from the Pennsylvania State University and NIH grant DC0010904.

(14) Differentiation: Methodology for testing liking and intensity

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In consumer research, it can be difficult to differentiate stimuli based on standard liking and intensity alone. Frequently two or more stimuli are equally liked, not significantly different from one another based on liking and intensity scales. We have developed a new methodology for differentiating the liking/intensity of similarly liked stimuli by combining traditional with psychophysiological measures: heart rate (HR), skin conductance (galvanic skin response, GSR), and facial electromyography (fEMG). Subjects (n=25) are exposed to a group of stimuli consisting of three fragrances for 10 seconds each through a neat bottle sniff while being measured for HR, GSR, and fEMG. Subjects are then asked to rate the fragrance using seven-point Likert scales for liking and intensity. We then expose the subjects to a product concept for 10 seconds, followed by a scent exposure combined with the concept for an additional 10 seconds while measuring for HR, GSR, and fEMG. Subjects are then asked to rate the appropriateness of the fragrance for the product concept. Analyses show significant differences among the fragrances for liking and appropriateness. We are able to successfully differentiate the stimuli based on psychophysiological measures for liking and intensity as well as assess attribute appropriateness for fit to concept. This novel methodology will provide product developers and consumer scientists with a sensitive and efficient way to differentiate changes to product attributes.

(15) Effects of background sound on consumers' sensory discriminatory ability among foods

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Earlier research on the influences of background sound has been limited to the perceived intensities of specific sensory attributes such as odor, flavor, taste, and texture. However, since overall perception of a food is often developed through multisensory integration, conclusions cannot be drawn that a change in one attribute will be influential. Employing several background sounds, this study was designed to provide a complete picture to the overall difference perceived during the consumption of different food stimuli. Participants were asked to conduct overall difference tests of potato chips (original versus lightly salted) and carbonated sodas (original versus sugar free) in the presence of five sound conditions: 1) carbonation sound, 2) crisp chewing-sound, 3) classical music, 4) shadowing task, and 5) white noise. The performance of discriminating potato chips did not significantly differ among the five sound conditions. However, participants were unable to discriminate overall sensory differences between carbonated sodas while listening and repeating a newscast (i.e., shadowing task). In addition, compared to the shadowing task condition, participants showed better performance in discriminating the overall difference of carbonated sodas in the presence of the carbonation sound and classical music. In conclusion, this study demonstrates that depending on the types of background sound and food stimuli, participants' ability to discriminate overall differences can be affected.

(16) Multi-attribute time intensity texture breakdown path study of fruit chews

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Fruit chews are a consumer-friendly alternative delivery form with active ingredients from fruit and/or vegetable concentrates. Formulation of this functional food requires providing an acceptable flavor and texture throughout the consumption experience. Product development wanted to develop a fruit chew for the global market, optimizing flavor and texture performance against an aggressive timeline requested by marketing. In support of this development initiative, a conventional descriptive panel was used to conduct a category appraisal on market samples sourced globally (United States, Germany, and Russia) and included prototypes demonstrating various texture types (gummy vs. taffy type chews). Multiple attribute time intensity (MATI) was conducted on select samples with both trained panelists and consumers to understand the changes in consumption experience over time. MATI offers a more efficient data collection paradigm by collecting ratings on multiple attributes concurrently compared to classical single attribute time-intensity methods. MATI paces

respondents through multiple attributes and cycles within a run. An enhanced MATI methodology was applied for this work to capture, in addition to attribute intensities, mastication stages and events during chew-down and after swallowing. MATI curves for different products were compared. Descriptive and consumer MATI curves were examined for patterns and relationships. Three strategies and methodologies were used for the comparisons and examinations. They are ANOVA for parameters of curves; HANOVA, an adaptive high-dimensional analysis of variance for curves; and FANOVA, functional analysis of variance for functional data analysis (FDA). FDA is an advanced statistical technique. It is a useful framework for analysis of MATI data. MATI descriptive and consumer results were used to deliver product category understanding and guidance to quickly target improvements to maximize consumer liking. Focus areas were identified toward optimizing the chew consumption experience, including flavor character, blend and duration, texture breakdown, and mouthfeel after swallowing.

(17) – Withdrawn

(18) Pay attention to timid scale users and everybody else

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A review of 196 consumer tests revealed that samples with higher average liking scores had lower standard deviations. Examination of the distributions of the ratings revealed that lower average scores resulted from a small number of respondents using the lower end of the scale as opposed to a general downward shift in the scores by all respondents. This explains why higher standard deviations are associated with lower liking ratings, plus it led to the hypothesis that discrimination among products may be driven by the respondents who use a large part of the scale as opposed to those who use only a small range of ratings. Three studies with clearly discriminated products were selected to explore this hypothesis. For each of study, respondents were classified based on the ranges they used to rate the overall liking of the products. The patterns of significant differences among the products were compared among the segments. Contrary to expectations, respondents who used only a small range of values to rate the products (when aggregated) often matched the pattern of differences exhibited by the total respondent base. This finding has several practical implications. Firstly, all respondents should be included in the analysis. Secondly, when running cluster analyses to generate preference segments, liking ratings should be normalized (subtract the respondent's average and divide by the respondent's standard deviations), so all respondents are given equal weight in the analysis, regardless of their scale usage. Thirdly, products with historically low average liking scores may be harder to discriminate because of their naturally higher standard deviations.

(19) Rapid category understanding: An alternative approach for competitive assessment using consumer-generated CATA

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As companies are faced with ever increasingly compressed timelines and fierce competitive entries into new or existing categories, there is a heightened need for a consumer method to rapidly assess competitive product features. Traditional drivers studies are limiting from a time, resource, and cost perspective. This research proposes a rapid assessment approach combining several standard methodologies in a qualitative environment as an alternative to a drivers study. Three 8-person focus groups (n=24) were conducted. Twelve commercially available beverages evaluated in a previous drivers study were used and results were compared between the two methods to ascertain the utility of this approach. Panelists performed several tasks with the samples: they rated overall liking, sorted products, and developed a CATA list used for product rating. Specific CATA terms were different between the groups, but all were related in similar themes. Compared to the traditional approach, the most and the least liked samples were consistent, with less differentiation among the middle samples. The rapid assessment had the additional benefit of terms developed by consumers (including emotional and functional terms) and an understanding of the importance of each attribute. Analysis of the overall liking scores and individual sorts determined an area of greatest acceptability. When interpreted with the CATA results, an ideal product profile was determined and aligned with the positive and negative drivers. The smaller sample size may limit the generalizability of the information provided, but the entire study was conducted three times quicker and at a quarter of the cost compared to standard drivers. With time and cost constraints, this rapid method has the opportunity to provide clear product development direction and understanding of the general competitive category landscape.

(20) – Withdrawn

(21) Temporal dominance of sensation as new tool for sensory shelf life in food products

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Sensory shelf life is defined by the ASTM (2005) as "the time period during which the product's sensory characteristics and performance are as intended by the manufacturer." It is measured using discrimination, descriptive, and affective testing. The objective of this work was to study the sensory shelf life of sucrose-replaced products in a solid food (chocolate mousse) and a beverage (citrus soft drink) with different sweeteners. Sucrose plays an important role, providing sweetness, modifying texture, and also acting as a bulking agent. When sucrose is removed the stabilizer and preservative properties are affected. The authors aim to highlight possible attributes that may come during and after the eating process using TDS (Temporal Dominance of Sensations) and which would have an impact on consumer acceptance. In addition to the sensory profiles physical properties such as texture and color changes were measured at each point in time. The sucrose replacers used in this study were: sucralose, acesulfame-K, maltitol, and erythritol. Whilst little changes were observed for the chocolate mousse during storage, significant changes were observed in the dynamic sensory profiles and the color of the citrus drink which had an impact in consumer acceptance. The sensory attributes which had an impact in consumer acceptance were the decrease of sweetness, increase of bitterness (especially for sucrose), and the change in color.

(22) Test methodology comparison for fragrance screening: Forced choice vs. rating scales

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The following research is a comparison between three test methodologies for fragrance screening: a balanced incomplete design using a 5-point liking scale, a balanced incomplete design using a 7-point liking scale, and a forced choice design (adaptive maxdiff). The 5-point liking scale has been helpful in identifying those fragrances that should not be tested or moved forward any further but often does not offer differentiation among the top

testers. The 7-point scale has not been tested in the context of a sniff test before. The 7-point scale has the potential to be a better alternative because it gives consumers more space to rate the products or fragrances. The idea behind an adaptive maxdiff design is that consumers are confronted with a situation where they are forced to make a choice between a set of products that they evaluate at the same time. The products used in this study will be a shampoo base with different fragrance character types. A total of 12 different fragrances will be included in the testing. The fragrance characters cover a broad cross section of the olfactive map. A total of 450 consumers will participate in this study—150 consumers per experimental design. Scent seeker consumers will be recruited to participate in this study. These three different approaches, however, have not been compared directly using the same set of products. The purpose of the proposed research is to directly compare the three methodologies using the same set of products and identify which methodology is better suited for fragrance screening purposes.

(23) Too many questions, not enough room in the design! How combining conjoint data with follow-up preference questions can provide valuable insights.

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Color is consistently a top consideration in flower purchase decisions. Hundreds of shades of flowers are available and unfortunately, due to design constraints, only a handful can be included in a conjoint study. However, most research papers that examine flower purchase drivers use conjoint analysis. It was therefore suspected that due to this design constraint a piece of the preference puzzle could be missing. Discussions with local growers in Ontario, Canada, revealed disagreement between in-store consumer demand for some rose colors and the preferred colors reported in the literature. The current study took two approaches to elucidate color preferences: conjoint analysis (six color categories) followed by a question asking consumers (n=2053) to pick their three most preferred rose color shades from a color chart of 60 different colors. The study revealed that the two most-liked color shades (out of 60) did not belong to the most popular color categories identified through conjoint analysis. This disagreement was attributed to different shade tolerances within the color categories. Red was the most popular overall color category and consumers were tolerant to many variations of red. In contrast, although a single shade of yellow was among the top shades tested, consumer tolerance for the shade of yellow was quite narrow. A small deviation to a different shade of yellow would result in a sharp drop in consumer liking. By using conjoint analysis for a global overview of purchase drivers then diving deeper with follow-up preference questions on specific features, it was possible to answer questions that were not previously possible with pure conjoint analysis. This study also uncovered a potentially new way of looking at consumer preference: the establishment of consumer tolerance for a sensory dimension (such as color shades or possibly flavor types) as an important indicator for managing risk in new product development.

(24) Utilizing CATA analysis to help differentiate across a range of prototypes to ensure strategic objectives are met

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An action standard of parity or better vs. control on overall liking can help to determine winning prototypes, but this measure cannot tell how well prototypes ultimately deliver against strategic objectives. This is particularly true when conducting flavor screenings. We have employed two separate approaches in two separate research projects with similar objectives to provide guidance on performance of key attributes. Both approaches collected a full battery of product diagnostic questions. The differences in the research focus on the question type used to determine how the prototypes fulfilled strategic objectives. 1) The first approach asked consumers agree/disagree questions to determine how well each prototype delivered on specific attributes. The data was then correlated to overall liking. This approach did not show strong differentiation among the prototypes. In this research, all of the prototypes were well-liked and the each of the attribute statements were highly correlated with liking. This made it difficult to narrow down the prototypes for selection. 2) In a separate study, a CATA analysis was used in which all data were normalized to control. Across a range of attribute statements, consumers indicated all of the statements which applied to the prototype. This approach provided much better differentiation. We wish to compare and contrast these two research projects to demonstrate how CATA analysis is a more powerful tool than using a traditional agreement scale.

(25) Application of conceptual profiling to GI antacid tablet and chewable product category

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Traditional category appraisal methods focus on the way that sensory attributes of products drive liking within a product category. The “conceptual profiling” method recently proposed by Thomson and co-workers (Thomson, 2010; Thomson, Crocker, & Marketo, 2010; Thomson and Crocker, 2014) proposed a new way of investigating product performance by adding conceptualization of functional, emotional, and abstract constructs to the evaluation. In addition, this method also provides a measure of consonance between the conceptual profiles of the product and brand to indicate if the same conceptual message is conveyed consistently by the product and brand. To date, published work focuses on the food and beverage category. This presentation describes extension of the method to a new category, OTC products. This research applied conceptual profiling combined with sensory profiling to the gastrointestinal antacid tablet and chewable product category. In this study, 24 antacid tablets/chewable products were selected to represent key competitors from the U.S. market and a range of product formats and flavors. Lexicons of 14 emotional/abstract attributes and 13 functional attributes were created using qualitative research with antacid users. Quantitative conceptual profiling used bullseye scaling (Thomson and Crocker, 2014) to determine the functional and emotional profiles of the antacid products and key market place brands. Sensory profiling was conducted using a panel of trained sensory assessors using sensory descriptive analysis methodology. The results of this research confirmed that conceptual profiling provided deeper insights than regular category appraisal methods by defining the functional and emotional benefits that differentiate the products. Product format had more influence on product performance and conceptualizations than flavor for the antacid tablet/chewable category. Sensory characteristics that drove particular conceptualizations were identified allowing product design to cue particular emotional and functional benefits. Differences in consonance between particular product formats and the brand provided clear guidance for brand development.

(26) Aspirations to attributes: Linking aspirational personas to desired product attributes in the homecare category

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It is well known that utilizing aspirational desires (psychological, social, and/or economic) to segment consumers can be a powerful way to understand what drives their behavior. However, less is understood about how to best link those aspirational personas to the consumer's desired product experience. This research provides practical guidance on how to offer the product attributes that can help consumers fulfill their aspirations. A hybrid method was utilized to better understand the underlying aspirations in the homecare category. First, in-home interviews were conducted with category users to observe their current behaviors and probe their aspirational needs. Next, multiple sets of sensory stimuli were created based on the insights gleaned from the in-home interviews. Finally, focus groups were run with the same consumers from the in-home interviews to understand the sensory boundaries of their desired experience. This hybrid method offered the ability to triangulate data from multiple aspects of the consumer experience helping to ensure consumers' revealed sensory priorities were uncovered and not simply their stated priorities. This research identified two distinct aspirational personas in the homecare category and showed how the desired product attributes align with each persona. The hybrid methodology not only provided a better understanding of which product attributes are important to each persona, but also how to best combine and prioritize those attributes to create an ideal experience. Finally, this research explored the importance of brand equities and their ultimate role in creating a holistic link between the aspirational personas and the desired product experience.

(27) Assessing variability in product quality

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Every manufacturing process is associated with a certain amount of product variability. This variability may result in differences in sensory characteristics, which may in some cases be large enough to effect consumers' quality perception (or liking). Measuring the degree and impact of such variability is important in a number of situations, for example as a prelude to optimization, setting sensory specifications, evaluating process consistency of a new product, or troubleshooting a production process which has resulted in consumer complaints. Understanding the degree of existing variability also helps gauge the impact of changes in formulation or production process. When the ongoing variability is large, small changes in specification (due to changes in product design or process) are less likely to be noticed than when the product is highly consistent. We present a consumer-based approach to tracking product quality. An ongoing production process is systematically sampled over time and evaluated by consumers. Analytical data (e.g., trained sensory panel data and instrumental measures) are collected for each production pull as well. The observed variability over time is used to describe short-term and long-term trends in liking. The observed variability is also the basis for identifying process improvement opportunities, via cross-referencing of the trends in liking with trends in analytical measurements or via nonexperimental optimization techniques. Lastly, the data are used to define the difference in liking that results from normal production variability. This average difference is considered the "noise level" that must be exceeded in order for a difference between two product formulations to be deemed meaningful.

(28) Comparing the results of check-all-that-apply questions versus open-end questions in angel food cake

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In consumer research, there is often an interest in understanding why the consumer answered hedonic or preference questions a certain way. One typical way to collect this understanding is through a follow up open-end (OE) question. The challenge of OE questions for researchers is the time required to read participants responses, decoding spelling and grammar errors to interpret what the participant was trying to convey. For the participant, time is taken to write or type their response. The check-all-that-apply (CATA) questions offer participants the opportunity to read through a list of most probable responses to the question and select those that are relevant to them. Currently, there has been no published researcher comparing the use of CATA questions to replace OE questions. To compare these methods, two consumer studies were conducted. Both groups tasted two cake samples (serving order randomized), were asked a preference question, and were then asked a follow up question. The control group (N=99) had two follow-up questions. The first question was an open-end format. Secondly, the same question was repeated using CATA (N=98). The test group had only one follow-up question in the CATA format. Comments collected from the OE did not add insight beyond what was found from the CATA data. The CATA question took consumers an average of 42 seconds (significantly less than the OE 1:09 average time). In addition, the CATA data could be statistically analyzed, providing the researcher a better understanding of the consumers' response. From this study, the CATA method provided similar results to the OE responses and was more cost-efficient and time-efficient (to both the researcher and the participant) and enabled statistical analysis that ultimately provided more insight than the OE responses.

(29) Consumer profiling with CATA to determine optimal flavor attributes for a product

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The use of consumers for profiling prototypes can facilitate fast-track product development. In the check-all-that-apply (CATA) method, consumers typically rate perceived intensities of named attributes. The objective of this study was to compare two approaches to consumer profiling with CATA for their efficacy to provide guidance to optimize a fruit flavored prototype. The consumer panelists evaluated five market products and one prototype (all of similar flavor and product type) and rated ideal and perceived intensities for 32 attributes. Sixty panelists used CATA methodology with intensity scales (CATA-Intensity) and 60 used CATA without intensity scales (CATA). The attribute list was developed from consumer comments from previous tests. The CATA and CATA-Intensity data were analyzed using Cochran's-Q Test and ANOVA, respectively, and results demonstrated panelists' ability to detect attribute differences between the samples. Similar trends for many attributes were observed from the two methods, but more attributes (e.g., ripe fruit, jammy) were perceived as significantly different between samples from the CATA-Intensity method. Correspondence analysis on the CATA data (CATA-CA) and principal component analysis on the CATA-Intensity data (CATA-PCA) showed some sensory spatial concurrence and similar predictions for prototype optimization. For example, both methods predicted that increased intensities of creamy flavor and fresh fruit and ripe fruit flavors would bring the prototype closer to panelists' ideal product. From the perceptual maps, (CATA-CA, CATA-PCA),

the two CATA approaches provided similar fast-track right-direction guidance for prototype optimization, even though CATA-Intensity ANOVA indicated more significantly different attributes between the samples. However, the CATA method without intensity scales was less time-consuming and demanding on the panelists, and thus might be a more practical approach.

(30) Consumer sensory evaluation and validation of baking time using various heating methods on frozen ready-to-bake peach pastries

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The objectives of this study were 1) to evaluate the effect of baking parameters (including oven type and baking time; determined by the manufacturer) on the final baked peach pastry, 2) to validate the appropriate baking times for each oven type, and 3) to identify and recommend optimum baking conditions based on colorimetry and consumer evaluations. Preliminary baking trials were performed to determine equivalent bake time of the peach pastries using five types of ovens, two separate bake sheets, and three predetermined bake times. Colorimetry values and photographs were taken of each peach pastry in order to determine which bake times to use for the consumer tests. Consumer acceptability tests were carried out in two separate sessions (n=73, n=64) with selected users. Five peach pastry samples were tested, one from each of the following ovens at the specified bake time: convection (18 min), conventional gas (25 min), countertop convection (25 min), electric (25 min), and toaster oven (18 min). A nine-point hedonic scale was used to evaluate overall liking, appearance, crust appearance, crust texture, flavor, and aftertaste. A JAR scale was used to evaluate crust appearance and crust texture. Colorimetry results were highly variable due to the surface of the peach pastry. The pastry was prescored during manufacture and dipped in sugar prior to baking which resulted in a wide range of baked product surface variability. Colorimetry was not a reliable method to validate peach pastry baking times for consumers. Based on the consumer testing, the convection oven (18min), conventional gas oven (25 min), and countertop convection oven (25 min) were the most successful and equivalent baking methods.

(31) Cross-category market mapping of mango-flavored products as inspiration for new product development

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Consumer packaged goods companies strive to differentiate their products from the competition to not only attract consumers initially, but also to keep them interested long-term. They use many different ideation techniques as inspiration for new product development. A market assessment is one approach to better understand current market offerings, product similarities, and differences and potential white space opportunities for future development. One way to approach a market assessment is from a flavor perspective. Flavor is a key driver of consumer acceptance and can be manipulated to produce a product that not only tastes great, but is unlike any other on the market. This study highlights a unique and rapid approach to flavor differentiation and optimization. The approach involves conducting consensus descriptive flavor profiling on a large set of market products and mapping the resulting data using principal components analysis and cluster analysis. The output includes a visual representation of the market from a flavor perspective, including areas of flavor saturation and white space opportunities. Consumer packaged goods companies can leverage this information to pursue unique and promising flavor directions for their new products. The study included profiling 57 mango-flavored market products across multiple food and beverage categories within a span of three weeks. From the market mapping, eight different mango flavor directions were identified. The results were used by flavorists to develop well-liked, differentiated mango flavors that could be used in a variety of different product types. The eight different flavors were optimized in a specific application and submitted for consumer testing to identify the most promising options to pursue.

(32) Drivers of vaginal drug delivery system acceptability from internet based conjoint analysis

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Vaginal microbicides potentially empower women to protect themselves from HIV and other STIs, especially when culture, religion, or status prevent them from negotiating condom use. However, the open literature contains minimal information on the factors that drive acceptability of women's health products, including vaginal drug delivery systems. By understanding what potential users find to be of most important in terms of product functionality and sensory attributes, developers can iteratively formulate a more desirable product. Conjoint analysis is a technique frequently used in market research to determine what combination of elements will influence a consumer's willingness to use a product. We applied this technique to better understand what sexually active woman want in an ideal microbicide product in terms of both sensory and nonsensory attributes, including shape, color, wait time, partner awareness, messiness/leakage, duration of protection, and function, towards our goal of formulating a product that is highly acceptable to women. Three hundred and two reportedly sexually active women between 18 and 35 completed an anonymous conjoint survey using IdeaMap software from Moskowitz Jacobs Inc. Via IdeaMap, attributes (product elements) were randomly presented, and women rated their willingness to use the described product on a scale from 1 (very unlikely) to 9 (very likely). Our data suggest factors such multifunctionality, short wait time prior to efficacy, and potential for covert use all increased a women's willingness to use a microbicide product.

(33) Formulations: A stable chemical/sensory equivalent to natural products for permeation/package testing

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Natural products (such as fruits, vegetables, etc.) are composed of an abundance of chemical compounds that can stimulate the human olfactory senses. These volatile and semivolatile organic molecules are responsible for creating the characteristic scent and flavor of the product. During the lifetime of natural products, their pleasant aromas can change as a function of time and move toward a rotting decomposing odor or loose desirable intensity. The packaging materials designated for these types of products are facing many challenges as they need to protect the quality of the product by preserving its freshness, color, aroma, and flavor. A stable chemical formulation mimicking the aroma/flavor of certain foods (fruits, vegetables, etc.) can be useful as a challenge material for a variety of testing of packaging materials such as permeation, sensory evaluation, and remediation in the case of odors. Multi-dimensional gas chromatography/mass spectrometry/olfactometry (GC/MS/O) analytical technique that combines sensory and

instrumental analysis can be utilized to identify the high impact priority aroma notes from the samples—in this case, a natural organic, food-related material. The aroma notes can be correlated to their respective chemical compounds through the mass spectrometer detector. These high impact chemical compounds can be recombined at the same ratio as detected in the natural product within an inert matrix. This process yields a formulation which essentially provides the same sensory experience as the original natural source. The formulation is far more stable than the original natural product and its use in different types of testing leads to more reproducible results (for example in permeation testing). The preparation of an "onion formulation" (as shown here) demonstrates the use of GC/MS/O methodology.

(34) Hedonic data analysis of the shelf life of ready-to-drink mango nectar with sweeteners and fructooligosaccharide

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Low-calorie products are developed particularly for people with specific dietary restrictions. The purposes of this study were 1) to determine the acceptability of mango juice, which contained one of five high-intensity sweeteners in lieu of sucrose and 3.0% fructooligosaccharide, in a 100 ml aseptic pouch and 2) to determine the shelf life of these products using two multivariate statistical analyses: principal component analysis (PCA) and hierarchical cluster analysis (HCA). Six samples of mango juice were formulated: five were sweetened with different sweetener blends (100:50:1 acesulfame-K/sucralose/neotame blend, stevia with 97% rebaudioside A, neotame, sucralose, and 1:1 thaumatin/sucralose blend) and one contained sucrose. All of the samples exhibited a sweetness equivalent to that obtained with 7% sucrose, and all of the samples contained 3.0% FOS. The samples were presented in balanced block design (sequential monadic). The acceptance tests were carried out in individual air-conditioned booths with white light using 150 mango juice consumers. The samples were stored at a temperature of 20ºC and analyzed after 0, 60, and 120 days. The consumer data were analyzed by multivariate PCA to show the internal preference map and HCA to group the consumers by preference dissimilarities. After 120 days of storage, all of the samples presented preservation of acceptance with an increase in sweetness (detected in the observations written by 45% of the consumers); in fact, an increase in sweetness most likely contributed to an increase in the acceptance of all of the samples. The aseptic pouch system was found to be a good way to preserve the acceptance of ready-to-drink mango juice with sweeteners and FOS during 120 days of storage. The HCA and PCA were important and, in this case, complementary because the PCA showed the preferences of consumers in relation to the samples and the HCA defined the consumer segmentation.

(35) How does product preparation affect sensory properties? An example with coffee

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Many products are sold that will be prepared by consumers in ways that suit them. For example, coffee may be prepared in various ways by consumers and is prepared differently when it is "cupped" for quality grading and may be prepared differently for controlled sensory testing by trained panels. How do the sensory properties of a controlled sensory study or a quality grading compare to those from possible consumer preparation methods? This study compared three high-quality Colombian coffees prepared with four different brewing methods: consumer coffee maker, home or food service automated espresso machine, coffee grader "cupping" infusion (containing particulate matter), and filtered infusion method (cupping method with filtration) that might be used by trained sensory panelists. Six highly trained panelists evaluated the samples that were prepared at the same concentration of ground coffee to water. Differences were found in the intensity of attributes for aroma, flavor, and aftertaste of all three samples. The espresso machine method showed the highest intensity for some attributes (e.g., roasted, burnt, acrid) but not all attributes. The cupping method showed the lowest intensity in some attributes such as chocolate and coffee ID, but again not for all attributes. Flavor and aroma attributes both varied with preparation methods but not necessarily in the same way. These results suggest that differences in the intensity of aroma, flavor, and mouthfeel attributes of coffee samples depend on the brewing method that is used to prepare it. Thus, using only one method to conduct sensory or quality testing may not provide appropriate information for other preparation methods. In this case, the brewing method will be a critical factor to consider in future coffee studies; the best option will vary depending on the objectives of each researcher and the ultimate goal of each study.

(36) How does seasonal variation affect flavor profile? A case study with black walnuts

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The objective of this study was to determine how seasonal variation impacts the flavor profile of agricultural food products. This is important to understand as many processors pay more attention to type of product (e.g., cultivar or variety) and less attention to the effects seasonal variation can have on the product. To research this, seven black walnut cultivars from two different growing seasons (2011 and 2013) were analyzed using descriptive analysis. A trained panel developed a lexicon for the black walnuts and scored the intensity of 22 flavor attributes for each sample. Results showed an interaction effect between year and cultivar for 11 of the 22 flavor attributes. However, about half of these interactions were caused by a single sample from 2011 that most likely was nonrepresentative of the cultivar due to late harvesting or hulling. After removing this nonrepresentative sample, four flavor attributes (black walnut ID, overall nutty, fruity-dark, and rancid) had an interaction effect of year and cultivar, while six attributes showed a main effect of year (brown, caramelized, floral/fruity, piney, musts/dusty, and oily). Two attributes had a main effect of cultivar (oily and bitter). In general, flavor attributes had higher intensities in 2011 than in 2013. These results suggest that seasonal variation may influence flavor profile more than cultivar. They also indicate that seasonal variation is a critical factor to consider when determining flavor profile of agricultural products, and the results highlight the importance of having representative samples for testing. Thus, using samples from only one growing season when testing agricultural products may not provide adequate information for the long term.

(37) Impact of food consistency in dynamic perception of simple model systems

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This study investigates a dynamic aspect of the sensory perception of artificial sweeteners. The main focus is how the food matrix will influence the perception of the sweetness. Simple model systems

were initially to explore dominance across retronasal smell, taste, and texture attributes. The systems used were 1) aqueous solutions of a range of sweeteners (maltitol, fructose, mannitol, sorbitol) and sucrose—sweet taste perception only; 2) aqueous solutions of sweeteners, citric acid, and a flavoring component (mango flavor)—sweet/sour taste and retronasal smell attributes; 3) aqueous solution of sweeteners, citric acid, flavoring, and a gel to solidify the solution (K-carragen)—sweet/sour taste, retronasal smell, and texture attributes. This study showed that temporal dominance of sensation is a relevant tool to capture the sweetness perception of sucrose and artificial sweeteners in different food forms. TDS was useful at different levels: firstly it gave an easy-to-read and interpretable overview of what Leatherhead's trained panel perceived as being dominant along consumption of the different samples. The comparison between the sensory perceptions of the different samples was done by looking at the shape of the TDS curves. However, to make the comparison easier and also to be able to check whether a particular sweetener was close to the sucrose response, oral sensory trajectory was used. The second part of the data analysis was based on analysis of variance. Using nonstandardized data, ANOVA allowed the determination of whether significant differences exist between the different matrix forms used: flavor/no flavor and gel/liquid. One of the findings of the study showed that the matrix form/composition will play a significant role in the perception time of the sweetness and of the flavor itself.

(38) Impact of storage time on consumer preference of chocolate with high-intensity sweeteners

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The objective of the current study was to determine the acceptance of dietary milk chocolates after storage. Four milk chocolates were sweetened with sucrose, sucralose, rebaudioside, or neotame, and four other milk chocolates were formulated with the same sweeteners and using soy extract instead of milk (lactose-free chocolates). The prototypes were stored at 18ºC in individual aluminized packages for a period of 12 months. The acceptance tests were conducted by 150 consumers who analyzed the samples after 0, 3, 6, 8, 10, 11, and 12 months. Acceptance was determined using a nonstructured 9 cm hedonic scale. The consumer data were analyzed through linear regression for each sample over time and through an internal preference map using principal component analysis (PCA) to study the consumer preferences in relation to all of the samples after all of the storage times. The acceptance of chocolates with soy extract decreased after six months, whereas the chocolate formulated with milk presented good acceptance and higher preferences at all storage times (up to 12 months). The impact of the storage time on acceptance was higher for the samples formulated with soy extract in lieu of milk. For this reason, it is possible to suggest that the storage time of chocolate formulated with sucrose or other sweeteners is 12 months, whereas the storage time of chocolates formulated with soy extract and sweetened with sucrose or other sweeteners is 6 months.

(39) Improving acceptability of vaginal drug delivery systems by using sensory methods

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Vaginal microbicides contain pharmaceutical agents that block transmission of HIV and other sexually transmitted infections; they can be inserted prior to coitus, empowering women to protect themselves. Prior clinical trials indicate microbicides can reduce HIV transmission, but effectiveness depends on user compliance and acceptability. We are investigating softgel ovules as a continuous release vaginal drug delivery system to release antiretroviral drug(s), providing protection from HIV. We have prepared softgel ovules of varying size, shape, and firmness and conducted qualitative and quantitative studies ex vivo to determine how physical attributes affect women's willingness to try the product. Preferred firmness varied with presence or absence of an applicator: when not using an applicator, they preferred larger, firmer ovules because they thought softer ovules would easily break in hand during insertion. In order to keep the firmness level constant while making the ovules less fragile and more elastic, the gels were reformulated. To assess the performance of the reformulated elastic gels vis-à-vis the previous brittle formulations, two central location tests were conducted. For test one, elastic and brittle ovules were formulated at three different firmness levels and women were asked for their preference. For test two, the firmness preferred from test one was compared with an additional firmness for willingness to try and imagined ease of insertion followed by ranking samples in order of preference to guide further development. The biophysical performance of the two gel varieties were also compared and they behave differently in terms of their breakdown as well as drug release profiles in contact with vaginal simulant fluid. Studying sensory acceptability in parallel with biophysical performance enables an iterative design process that considers what women prefer in terms of physical attributes as well as use parameters such as frequency of application and duration of protection.

(40) Integrating qualitative and quantitative methods to build a dynamic narrative for product optimization

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CPG companies conduct preference mapping to monitor competitors, guide product improvement, and identify innovation opportunities. Additionally, learning from this research provides recommendations for quality and cost optimization. Using a variety of multivariate techniques to integrate and analyze data such as descriptive analysis (DA) and consumer quantitative research offers deeper understanding of the consumer relationship to products which ultimately translates learning into efficient product development guidance. In this study, a three-phase test design included: 1) focus groups to inform the quantitative design by understanding "how consumers talk about the product," investigating product usage, and assuring key product attributes were included; 2) descriptive analysis (DA) to select a broad product set encompassing all key product dimensions, to pick products for consumer test, and to relate consumer response to product profile through mapping techniques; and 3) quantitative consumer testing to evaluate selected samples for liking and key product concepts developed by the focus groups. Statistical techniques employed include PCA, Bayesian modeling, and preference mapping with multiple factor analysis (PrefMFA). The multivariate results coupled with consumers' ideal product plot and qualitative learning tell a full story. This paper highlights texture. The PCA separated the products from springy-to-dense/chewy on dimension 1 and soft-to-hard on dimension 2. The Bayesian network showed that consumer texture liking relates directly to consumer perceived moistness, which links to both DA moisture and consumer preferences for edges/centers and product thickness. The PrefMFA demonstrates that products with moderately high moisture and texture complexity that are dense and chewy are preferred to those that are dry, springy, and airy in structure. This multifaceted research allowed the research team

to optimize the texture of the product (as well as other attributes), which led to improved products and an ability to match liking of market leaders with decreased cost formulas.

(41) Investigating potassium chloride as a salt replacer in food products—How much is too much?

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Excessive sodium intake is associated with adverse health effects and common salt is the greatest dietary source. However, salt is an essential ingredient in various food products, making reduction difficult. KCl is used as an NaCl replacement but may have bitter side tastes. The degree to which NaCl can be replaced by KCl in a food product before becoming objectionable is unclear. The study aimed to determine 1) if absolute rejection could be reached, 2) the acceptable range for replacement with KCl in a model food (vegetable juice), and 3) if bitterness ratings of KCl in water predict preferences in juice. Six pairs of vegetable juice were presented in a 2AFC design. Each pair contained an NaCl control and a KCl spiked sample, and KCl concentration increased in series. After all pairs, participants rated the bitterness of KCl in water, which was used to segment consumers. At the highest KCl concentration, 94.5% of the participants chose the unspiked control; universal rejection was not achieved. Across all subjects, a 48% reduction of sodium in vegetable juice was acceptable. When bitterness from KCl in water was examined, those in the top and bottom 25% of bitter intensity ratings had significantly different best estimate thresholds for KCl. This suggests that rejection of KCl is largely due to bitterness, and that replacement of NaCl with KCl may be more acceptable to some than others. It is also important to consider that acceptability levels may be context-dependent, thus the results here may not generalize to other food matrices. Finding effective ways to reduce sodium in food products is essential for improved health in the future, and the determination of acceptable levels of KCl as an NaCl replacement in different food products will aid this goal.

(42) Sensory characterization of dry dog food with different fiber composition

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Raw ingredients such as protein, fiber, and grains can influence the sensory characteristics of extruded dog food. The objective of this study was to develop a sensory profile for eight extruded products with different fiber compositions. Guava fiber (3%, 6%, and 12%), sugar cane fiber (9%; small and large particle size), wheat bran fiber (25%; small and large particle size), and a control sample were studied. A highly trained descriptive sensory panel evaluated the samples using fifty-four sensory terms (4 appearance, 13 aroma, 18 flavor, 13 aftertaste, and 6 texture). ANOVA analysis revealed significance differences ($\alpha < 0.05$) for several appearance, aroma, flavor, aftertaste, and texture attributes. Different fiber content did not impact the color of the sample. Wheat fiber samples (large and small particle size) showed the highest porous appearance scores, while the sugar cane large particle size sample was higher in fibrous appearance and texture. Several aroma samples showed differences for two off-notes (oxidized oil and dusty/earthy). Samples with the higher guava fiber levels (6% and 12%) were the bitterest samples and had the highest level of oxidized oil and barnyard notes among the samples. Sugar cane samples showed the lowest fracturability and initial crispness levels. The study results indicated that both fiber source and the amount of fiber influence the sensory properties of extruded dog food.

(43) Sensory characterization of Marquette and Frontenac wine grape cultivars by descriptive analysis

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Marquette and Frontenac, red wine grapes released by the University of Minnesota in 2006 and 1997, respectively, comprise almost 75% of the cold-hardy vines planted in Minnesota. Maturity of wine grapes at harvest is an important factor in the quality of the resulting wine. The purpose of this study was to explore the changes to the aroma, flavor, and astringency that occur during the ripening of Marquette and Frontenac wine grapes. Fourteen trained panelists performed descriptive analysis on Frontenac and Marquette grape berries. For each cultivar, four replicates were grown in the research vineyard at South Dakota State University. These grapes were harvested at different time points corresponding to different degrees of ripeness indicated by degrees Brix. Grape berry samples were frozen until testing and served at room temperature. Panelists evaluated the skin and pulp separately. Sixteen sensory descriptors were generated that characterized the berries of both Frontenac and Marquette. As expected, the sweetness increased and the sourness and astringency decreased as the grapes ripened; however, the overall intensity of aroma and flavor, as well as the fresh fruit aroma, citrus flavor, and fermented fruit flavor, decreased. The next step is to examine the wine made from these grapes to determine whether the aroma and flavor changes are also present in the wine. Cold-hardy wines tend to have high levels of acidity, so they are often left to mature on the vine to achieve a balance of sugar and acid. In this case, the gain in sugars may be at the loss of flavor and aroma complexity.

(44) Sensory profile and consumer study: Preferences and descriptor terms of low-calorie and lactose-free chocolate

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The purposes of this study were 1) to determine the sensory profile of sucrose- and/or lactose-free chocolates and preference drivers through the application of external preference mapping and 2) to reveal the relationship between descriptive attributes and hedonic judgments using two multivariate statistic methods: partial least square (PLS) and principal component analysis (PCA). Descriptive sensory profiles were determined by 15 assessors through four repetitions. The acceptance test was conducted with 150 chocolate consumers. Eight different milk chocolate prototypes were analyzed: four milk chocolates (sweetened with sucrose, sucralose, rebaudioside, and neotame) and four soy-based chocolates (soy extract was used instead of milk). The samples were presented to the assessors in the descriptive analysis and to the consumers in the acceptance tests in complete balanced block design (sequential monadic). The correlations between the QDA and the consumer test data were determined by PLS regression analysis and PCA to explain the sensory variation among the samples and the preference mapping of consumers using the XLStat 2012 software. The overall impression was the dependent variable (Y-matrix), and the QDA attributes were the independent variables (X-matrix). The external preference mapping was conducted by first using principal components analysis (PCA) to analyze the descriptive sensory analysis data and then relating each of the consumers to this PCA space through regression analysis. The external preference

mapping by PLS and the PCA shown that the descriptor terms "bright," "melting," "sweetness," "milk flavor," and "buttery" contributed positively to the acceptance of chocolate samples. Increases in the intensity of sandiness, hardness, soy flavor, and bitter aftertaste were the main factors responsible for the lower acceptance of the lactose-free samples. The contour plot graphic generated through the preference mapping by PCA clearly shows the preferences of consumers toward samples produced with milk, regardless of the sweetener applied to replace sucrose.

(45) The effect of consumption temperature on sensory characteristics and consumer acceptance of milk

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Although milk is a healthful beverage choice, consumption has continued to decline in recent years, particularly among adolescents. Milk temperature can vary widely in school food service settings or over the course of consumption, which may impact the sensory characteristics of the product. This research was conducted to understand the relationship between sensory attributes and consumer acceptability of milk at different temperatures. Two fat levels (skim and whole) and three temperatures (40 °F, 50 °F, and 60 °F) were investigated. Six highly trained descriptive panelists evaluated the six milk samples in triplicate over flavor and texture attributes. Responses were elicited from 109 consumers for the six milk samples for overall liking, liking of sweetness, liking of milk aftertaste, amount of aftertaste, and amount of off-flavor. Whole milk samples were significantly higher in fatty and sweet attributes than skim milks. Skim milks were significantly higher in refrigerator and light oxidized, which may be characterized as off-flavors. Temperature played an important role in skim milks, with the 60 °F sample significantly higher in bitter, cardboard flavor, and cardboard aftertaste than the 40 °F skim milk. Temperature was important for consumers, with overall liking, liking of sweetness, and liking of milk aftertaste significantly higher in the coldest sample for both skim and whole milks. Consumers also rated the amount of off-flavor significantly higher in the 60 °F samples for both skim and whole milk. These differences in consumer ratings across temperatures, despite few significant differences in descriptive results, indicate the importance of temperature in consumer perception of milks.

(46) Understanding the Impact of 4-ethylphenol and 2-isopropyl-3-methoxypyrazine on the acceptability for sale of Ontario riesling wines

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The impact associated with a faulty product in the retail space can be detrimental to the brand, retailer, and consumer confidence. Proactively identifying faulty products before they reach the consumer mitigates the potential impact on reputation and financial costs. Contamination due to micro-organisms and/or insects during the winemaking process can evolve into sensory faults, which if undetected can reach the consumer. The research objective was to determine a Rejection Threshold (RT) level that winemakers can employ to assist in evaluating an Ontario Riesling. Two chemical markers, which in sufficient concentrations can render a wine faulty, were considered: 4-ethylphenol (4-EP) and 2-isopropyl-3-methoxypyrazine (IPMP). These chemical markers are associated with the wine faults Brettanomyces and multicolor Asian lady beetle respectively. This research was conducted to determine detection threshold (DT) and RT using a same–different methodology. One hundred twenty-eight experienced and trained wine assessors were presented with wine samples spiked with a single marker in ascending concentrations. Assessors were asked 1) to nose each spiked sample and compare it with a reference "unspiked" sample; 2) if the samples were different, to identify the specific wine fault; and 3) to determine whether the spiked sample was acceptable for sale. The results of the assessor's DT of the markers were consistent with literature findings regarding wine. The DT and RT were positively correlated with an increase in fault concentration (R= 0.98 [IPMP] and R = 0.96 [4-EP]). The RT was higher than the DT and although the specific wine fault could not be identified, assessors still rejected the spiked wine. A rejection threshold for these chemical markers has not been established as this study is still in progress. This research gives an approach for assessing the impact of these faults in wine and in assisting the development of rejection threshold criteria for winemakers.

(47) Use of cluster analysis to compare the acceptability of full-fat and reduced-fat sausage and the results from industry and university sensory testing centers

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Reduced-fat bratwurst and Italian sausage were produced commercially by replacing a portion of pre-rigor pork with chicken thigh meat. Consumer acceptability tests (n>50 per panel, n>300) were conducted at companies (Johnsonville, WisconsinA) with panelists who were familiar with sausage consumer testing, commercial sensory providers who recruited category users (Chicago and Oklahoma), and two universities to determine variability between location and panelist type. For full-fat and reduced-fat bratwursts, average scores were between 6 and 8 on the 9 point hedonic scale, indicating between "like slightly" and "like very much." Full-fat bratwursts were preferred ($P<0.05$) over reduced-fat in all locations but Chicago. In addition, the Chicago and university panels rated bratwursts higher ($P<0.05$) on the scale than WisconsinA and Johnsonville, which is likely due to the familiarity of the participants with the product and the task. For Italian sausage, no differences existed ($P>0.05$) between acceptability at companies and universities. However, Oklahoma and Chicago panels preferred full-fat Italian sausage over reduced-fat, which is likely due to the fact that their panels consisted of category users. For each location, panelists were grouped into 3–6 clusters for bratwurst and Italian sausage. Thirty-eight percent of panelists had no preference between original and low-fat bratwurst. Fifty-one percent preferred the original formulation, nine percent did not like reduced-fat, seventeen percent preferred low-fat, and five percent did not like original bratwurst. For Italian sausage, 30% of panelists had no preference, 40% preferred the original formulation, 20% preferred low-fat, 13% did not like mild Italian, and 12% did not like low-fat. It was evident from consumer testing and cluster analysis that reduced-fat sausages were acceptable to a large percentage of consumers, and cluster analysis was an effective indicator of market acceptability of reduced-fat pork sausages and differences in results between location and panelist type.

(48) What happens to the product when consumers don't follow preparation instructions? An example of a descriptive sensory tolerance test for cooked porridge.

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Products must be tolerant to many conditions, particularly when those products are prepared by consumers. Consumers may not measure (or mismeasure) added ingredients, add or leave out ingredients specified in recipes, or change cooking and holding times for foods. Porridge products are widely used around the world and fortified blended foods, such as porridge products, are used extensively in food aid for disaster or famine relief. A preliminary field study in Tanzania showed that porridge products typically are eaten by children for breakfast, but frequently may be cooked with varying water amounts, addition, or sugar, for differing times and may be held in thermos-type containers for eating later. This study was intended to evaluate the tolerance of a new porridge product (WSSB) intended for food aid. Such products must have high tolerance because the products are used by diverse people in diverse conditions and often are used by people with low literacy and few resources for measuring and timing during preparation. In this study, most sensory properties were only marginally affected by variations in ingredients or procedures other than expected differences in properties such as thickness when solids content varied or sweetness when sugar was added. Tolerance testing showed that the sensory properties of WSSB had high tolerance to variations in cooking procedures, which is positive in terms of product development. It also means that the product can be modified during preparation by consumers without having a major impact on most sensory properties.

(49) Beyond acceptance: Aligning sensory cues with product function, emotional impact, and acceptance

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Traditionally, product development initiatives have relied on consumer overall liking to strategically improve products. In recent years, however, many product launches failed in the marketplace even though hedonic performance was strong. In those cases, the product failed to deliver against consumer expectations: brand image, product promises, and product sensory identity were misaligned. As consumers purchase products, they not only seek sensory satisfaction, but also product experiences that address specific needs. Depending on context and situation, they may be looking for products that deliver more strongly against perceived efficacy, performance or other functional benefits, anticipated emotional impact or health-related added value. This study provides examples that span both the personal care and the foods and beverages categories. In some cases, products deliver similarly on overall liking but vary widely in sensory, imagery, functional, and emotional profiles. In other cases, products significantly differ in overall acceptance but are associated with similar consumer-derived sensory, health, functional, and/or emotional profiles. In both cases, differentiation is possible and success in the marketplace within reach if product positioning aligns with consumer expectations. The important role of sensory cues in communicating benefits beyond hedonic value is highlighted in that context. Building these sensory cues into products can, in conjunction with delivering on liking, ensure "cognitive consonance" in the mind of the consumer and justify product repurchase. When acceptance no longer tells the whole story, product success depends on building key sensory cues into products that fully align with consumers' expectations for functional and emotional benefits. Sensory professionals are encouraged to augment their tools and techniques to accurately determine, rank, and measure consumer needs and, in turn, identify the sensory cues related to these needs that best deliver a consistent message to the consumer.

(50) – Withdrawn

(51) Considerations and implications of including auxiliary products in design CLTs for benchmarking purposes: Case studies from industry

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Design of experiment (DOE) central location tests (CLTs) are powerful and efficient tests that are capable of providing rich learning. DOE CLTs are primarily used to gain an understanding of the synergies between product attributes and their impact on product liking; however, there is often still an incremental need for consumer product companies to compare test scores to a benchmark, such as the current product formula or a competitive product. Addition of this secondary learning objective can often create complexity in the research plan. The benchmark is sometimes a natural part of the design, but when it is not, several factors need to be considered before including it in the test. Of primary concern are the sensory-related context effects that may bias the data in an unpredictable manner, for which no mathematical correction can be made. To better understand the implications of including a benchmark with a design CLT, we reviewed several internal case studies in which benchmarks were included as part of or as an extension of a DOE CLT. In some studies, when the benchmark falls outside of the sensory space established by the design, one strategy has been to fix the sample outlier in the last position in an attempt to avoid context effects within the main DOE. We are able to show that this creates severely misleading data. Conversely, when the benchmark, non-DOE sample falls within the range created by the other products, inclusion of the product can be considered, with minimal risk of negatively impacting key learning. Based on our review, we developed scenarios for appropriate inclusion of benchmarks, along with clear communication on the potential consequences that may occur. Sharing of these case studies have lent credence to our recommendations, ultimately improving the guidance given to business teams in meeting project objectives.

(52) Development and validation of screening tools for classification consumers of food products based on eating healthy criteria

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To have a reliable consumer study, the most important step is to determine the target population from which to collect representative data. However, healthy food products do not have a specific tool used for consumer screening based on consumers' diet or degree of healthy eating habits. This study aimed to determine a set of questions that could classify consumers who belong in a different status according to the stages of change model, as well as those who have a different diet quality based on their Healthy Eating Index (HEI) score. The survey was conducted in the United States and Thailand in order to determine applicability to varying countries. The Food Neophobia Scale (FNS), Food Involvement Scale (FIS), and Health and Taste Attitude Scale (HTAS) were included in the questionnaire with a

set of stages of change questions and a 7-day, self-administered food recall questionnaire. According to FNS, FIS, and HTAS, U.S. consumers are more involved in food activities and are more open to trying new foods or unfamiliar foods than Thais. Furthermore, consumers who belong in different groups, according to the stages of change model, responded differently to some HTAS subscales. However, statements from FNS, FIS, and HTAS were not capable of distinguishing consumers belonging in different groups according to HEI scores or belonging in different stages according to the stages of change model. Considering all possible methods for screening consumers (using HEI, stages of change model, and statements from FIS, FNS, and HTAS) the stages of change model may be the best way to segment consumers interested in healthier eating. Using the stages of change required less time and the least effort from consumers because there were only three questions, and interpreting results does not require calculation or analysis.

(53) Do claims really make a difference to the price consumers are willing to pay? A study of the price sensitivity meter with orange juices

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Claims? Yes! But at what price? In today's competitive market, consumers are confronted with an overwhelmingly level of choice and availability of products. Products can be labelled with a number of different claims enticing consumers to buy a product over another. When purchasing a product consumers normally balance the value against the price, and it takes them approximately 2.5 seconds to decide whether to purchase the product or not. The aim of this project is to evaluate and study the Van Westendorp PSM. A total of four consumer tests with three different samples of orange juice (control—no claim, organic claim, and fair trade claim) were carried out across the U.K. (only concept) and at Leatherhead (concept and tasting samples). Each test was completed by more than 130 consumers. The PSM consists of a series of four questions relating to price and quality and it is based on the hypothesis that every category and each perceived level of quality within a category have a reasonable price. It is well used, validated for higher and lower priced for individual products, concepts and ,services. It can be a useful step in the development phase to establish the right price or to investigate opportunities to increase or decrease the price. It is very simple to incorporate into any quantitative survey and the analysis is quick, inexpensive, and easy to interpret. In this study, the results showed that products with claims can really make a difference to price consumers are willing to pay. However, each claim will have a different impact on the price. As shown in this study the claim '"organic" seems to provide some increase in optimal price, whereas "fair trade" was less able to do this. Thus a claim will entice consumers to pay more.

(54) Driving brand and product alignment (consonance) by quantifying the emotional and functional conceptualizations of sensory characteristics and brands using shortbread cookies

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Consumers attach meaning (i.e., emotional and functional conceptual associations) to products and brands. It is important that the messages communicated by the sensory characteristics of the product and the values projected by brand communication are aligned (consonance). This is especially valuable when transferring a product from an established market to a new country. Differences in category experience and cultural heritage between markets can result in consumers interpreting the product and brand messages quite differently, creating dissonance between brand expectations and product delivery. American consumers are relatively unfamiliar with shortbread cookies (called biscuits in Europe), despite this style of cookie being very successful in Europe. A trained sensory panel in the United States was used to define the sensory characteristics of U.K. marketplace shortbread cookies using sensory descriptive analysis methodology. The same products were tasted by consumers in the U.S.A., who rated their overall opinion of each product and used best–worst scaling (BWS) to define emotional and functional profiles of each product. An online survey was used to assess the emotional and functional profiles of shortbread cookie brands. The sensory profiles were used to explore possible ways in which product attributes changed the emotional and functional profiles associated with each product. The degree of consonance between the product and the brand conceptual profiles was calculated, highlighting areas of dissonance between brand expectation and product delivery and paths for improvement. This approach combines traditional sensory descriptive analysis methods with consumer research to provide product developers and marketing professionals with a powerful diagnostic tool that can be used to harmonize the way products and brands communicate to improve marketplace success.

(55) Exploring how the perception of ethanol and alcoholic beverage liking relate to alcohol misuse

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Alcoholic beverages elicit multiple taste and chemosensory sensations. Perceived sweetness of alcoholic beverages are associated with increased liking, whereas bitterness negatively influences liking. The alcohol use disorders identification test (AUDIT) has been developed to measure hazardous and harmful alcohol use. Here we explore how bitter, sweet, drying, and burning sensations from sampled ethanol associate with remembered liking and AUDIT scores. Participants (n=149, 44 males) of European ancestry took part in a study involving two one-hour sessions in the Sensory Evaluation Center at Pennsylvania State University. Individuals were trained on the use of two scales, the generalized labeled magnitude scale (gLMS) and the generalized bipolar hedonic scale. Participants rated the intensity of samples on the gLMS for seven sensations (bitterness, sweetness, sourness, saltiness, drying, burning/stinging, and tingling/pricking). The relevant samples reported here are 4%, 8%, and 16% (v/v) ethanol in water. Participants also completed the 10-item AUDIT questionnaire. Liking for 19 different alcoholic beverages was also collected as part of a food preference survey. Participants' ratings of bitterness and burning/stinging were significantly correlated for all concentrations of ethanol (R2= 9%, 23%, and 22%). Liking for all concentrations were correlated with both bitterness (R2=36%, 32%, 28%) and burning/stinging (R2= 7%, 5%, and 5%), respectively. The ethanol phenotypes that best predicted AUDIT scores were bitterness and liking of 4% ethanol along with burning/stinging from 8% ethanol (R2=8.6%). Reported liking of alcoholic beverages was also associated with ethanol sensory phenotypes. This study shows that multiple sensory qualities are associated with alcoholic beverage liking. Measuring ethanol phenotype, in addition to the AUDIT may help to provide greater insight into risk of dependence.

(56) Global exploration of consumer psychographics for the phytonutrient supplement product category

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Phytonutrient supplements are consumed to increase dietary consumption of nutrients. Regular consumption of phytonutrient supplements varies by consumer psychographic segments. This research addresses the opportunities and the challenges to better understand consumer choice and consumption using psychographic measures for research within this product category, in addition to the demographic measures: gender, age, and user group segmentation. Consumers (n=303) across four countries (Germany, Japan, Korea, and the United States) measured numerous psychographic variables, including: wellness (past month), sense of wellbeing, product involvement¸ price–quality consciousness, general neophobia, sensation seeking, medication adherence/compliance, general self-efficacy, and resilience. These scales were selected based on face validity and association with the product category under investigation (wellbeing, compliance, etc.) or brand support/image (product involvement, price–quality, self-efficacy, and resilience). Self-administered questionnaires were used to collect the consumer psychographic responses in conjunction with a phytonutrient supplement aroma hedonic and sensory test. All psychographic scales had been previously developed and validated in the literature. Significant differences were observed across countries, genders, ages, and user-groups for most of the psychographic scales measured. For example, sense of wellbeing, product involvement, price attitudes, compliance, self-efficacy, and resilience all discriminated product users, and deserve further research. Cluster analysis was conducted on consumer responses to each of the psychographic questions for each of the countries. Some of the consumer segmentations based on the responses to psychographic questions show cluster effects on consumer hedonic and sensory attributes. Results suggest these are important variables impacting consumer choice and consumption behaviors. Compliance is a clear psychographic differentiating user-type that needs further exploration to support the product category. Psychographic research should be expanded as it adds additional information to strengthen understanding of this category beyond usual consumer liking ratings.

(57) Informational bias and demographic crossover in Curcumin Dairy Mocha Bar evaluation seen between new recruits and seasoned NCO military leaders

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Curcumin is a primary component of turmeric and offers a number of desirable physiological effects (such as anti-inflammation and antioxidation properties that can aid in muscle recovery). These effects are of interest to the military. Curcumin as an ingredient was evaluated for its impact on acceptability in dairy mocha bars with and without ingredient information. Researchers at the Natick Soldier Research, Development, and Engineering Center (NSRDEC) looked at two different forms of curcumin (a standard ingredient form and a nanoparticle form that is more easily absorbed by the body). Researchers formulated three dairy mocha bars: 1) a reference bar with no curcumin, 2) a treatment bar with standard particle formed curcumin, and 3) a treatment bar with nanoparticle-formed curcumin. These bars were then presented to soldiers for evaluation with varying degrees of information on the package. The intent of the research was to determine if (a) the addition of either type of curcumin had a significant effect on liking as compared to the reference bar and (b) determine if ingredient information had an effect on liking/disliking of the samples. Four groups of soldiers evaluated the products. Interesting and opposite direction of liking/disliking effects of ingredient information appear apparent between two of the groups and suggests information can be perceived positively or negatively along the liking/disliking continuum. One explanation may be due to negative bias and distrust within the new recruit group. Whereas the more seasoned group may have greater trust. National Guard Reservists seemed least influenced by the presence or absence of information. In general, the addition of curcumin appears to lower acceptability of the dairy mocha bar.

(58) Investigation of facial coding as a means of evaluating NPD concepts

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There is a strong theoretical link between human facial expression and the emotional reaction of people to stimuli of all types. This study explores the additional value that coding and quantifying facial expression may deliver over more conventional methods in the evaluating of NPD concepts. There were five different concepts covering sweet snacking, oral care, and dairy. Participants (n=200) were recruited to evaluate three from five concepts at a central facility. Simultaneous videoing and eye-tracking was used throughout the interview to record where people were looking and their corresponding facial expressions. All three concepts were then re-presented and researched using conventional research tools. At the close of the interview participants completed an affect intensity measure (AIM) psychometric questionnaire. Results show that manual coding of facial expression, using a skilled interpreter to review the video footage, augments insight by revealing not only what people are looking at but how they are reacting to that stimulus. From this, emotional journeys were plotted that revealed how respondents' emotional reactions unfolded. Hot spots, which allow participants to highlight areas of the concept that they like/dislike, focused predominantly on functional aspects, whereas facial expressions seemed to focus on the more emotive features of the concept. It was also observed that negative rather than positive facial expressions had a stronger relationship with ratings of liking/disliking. With the AIM data, a negative relationship was observed between those with a higher AIM (i.e., experience emotions more strongly) and total facial response suggesting, perhaps, that those who experience emotions more strongly tend to internalize them. A comparison of manual versus automated coding (using computer algorithms) demonstrated clearly that manual facial coding provides a more sensitive read on facial expression.

(59) Significant relationships between liking of sampled spicy foods and self-report and behavioral measures of risk-related personality traits

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Based on work done in the 1980's and early 1990's, there is a widespread belief that personality traits like sensation seeking are related to the enjoyment and intake of spicy foods, though actual evidence supporting this is quite limited. Recently, we showed strong-to-moderate correlations between remembered liking of spicy foods and the personality traits of sensation seeking and sensitivity to reward. In the present study, participants sampled strawberry jelly spiked with two concentrations of capsaicin to estimate liking for sampled spicy foods. Additionally, we used a laboratory-based behavioral measure of risk taking (the momentary balloon analogue risk task; mBART) to complement a range of validated self report measures of risk-related personality

traits. Here, we confirm prior results showing that sensation seeking is significantly correlated with both remembered liking of an overall spicy meal and liking of the burn of a spicy meal, and extend these findings to show a relationship with the liking of sampled capsaicin stimuli. Other personality measures, including sensitivity to punishment, sensitivity to reward, and the impulsivity and risk-taking subscales of the personality inventory from the DSM5 (PID5) did not show significant relationships with sampled or remembered liking of spicy foods. The behavioral measure of risk taking, the mBART, also did not show a significant relationship with remembered or sampled spicy food liking. Significant relationships were observed, however, between sensitivity to seward, the risk-taking subscale of the PID5, mBART, and reported intake of spicy foods. Finally, we observed strong correlations between sampled and remembered liking for spicy foods (r's=0.42–0.46) and a moderate correlation between sampled liking of capsaicin and intake of spicy foods. These findings confirm and extend our prior work, showing that there is a robust effect of risk-related personality traits on the liking and intake of spicy foods.

(60) Taking the consumer pulse on sustainability

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To ensure the food and drink industry stays in touch with consumers, the Strategic Insight Team at Leatherhead Food Research devised a project based on a program of market research to explore how trends and key food and drink industry issues were affecting consumers' attitudes and behaviors. This part of the project focused on consumer views of sustainability. A mixed methodology of focus groups, surveys with U.K. consumers via Leatherhead's SenseReach panel and desk research was used to develop insights on the topics. Sustainability is a complicated issue which consumers do not generally understand or fully engage with unless they are experts in the area. They tend to engage with sustainability on an issue-by-issue basis and can have strong views on particular sustainability issues, e.g., recycling. In principle, they believe sustainable behavior is positive, but it is clear that most consumers are unwilling to pay a premium for a product sold on a sustainable platform. While their heads might be turned on the odd occasion by labels endorsing the sustainable credentials of a product, the reality is that on everyday products, they will revert to purchasing products that met the quality they require at the right price. Successful food campaigns, however, show consumers do pay more if they feel strongly enough about the issue. Consumers are often skeptical about why companies are behaving sustainably, believing it to be purely for financial gains. They are often uninformed about the work which companies are actually doing in this area and are strongly influenced by companies which market themselves on an ethics platform, assuming these companies to be behaving more sustainably than others without knowing if this is the case.

(61) The effect of chronic stress on consumer sensory perception

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Humans under chronic stress have been shown to display changes in food choice and food intake. Many sensory testing centers recruit panelists from local populations that share a lot of lifestyle attributes with people high in chronic stress. This study aimed to determine whether chronic stress can alter chemosensory perception and overall liking of different foods. A questionnaire regarding perceived chronic stress levels was sent out to the University of Arkansas sensory service center consumer database, which includes over 7,000 people. Fifty participants were selected from the highest 25% of self-reported chronic stress scores and 50 participants were also selected from the lowest 25% of the self-reported scores. On four consecutive days the participants were asked to evaluate two high calorie food stimuli (brownie and potato chips) and two low calorie food stimuli (fruit and popcorn) using a traditional consumer sensory test format. The participants were asked about their overall liking of the foods, the overall flavor intensity, the intensity of the dominant basic taste (sweet/salty), and how satisfying the food was to the participant. The scores of male participants were influenced more by chronic stress when compared to females. The group under high chronic stress rated the food significantly lower for overall liking. Additionally, the high-stress group rated the overall flavor intensity of the high-calorie foods to be lower and also found the high calorie foods to be less satisfying. The results of this study suggest that chronic stress levels significantly influence food perception and the satisfaction felt after eating, especially in males.

(62) Understanding the gap in consumer expectations: A focused and innovative sensory and consumer approach

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Uncovering an unmet consumer need and delivering upon it is the goal of new product development. However, consumer expectations are often not clear, causing risk to this process. This is especially true with regard to flavors. Flavor is a key driver to consumer acceptance of savory products; however, most consumers have neither the vocabulary nor the culinary experience to describe their ideal product. This approach to new product development via flavor consumer understanding and sensory takes into account realizing the gap of unmet expectations and filling the need in a key savory product. These insights were drawn by linking together consumer responses to culinary gold standards and market products with an insightful flavor language developed based in chemical flavor references within Givaudan's Sense It Language. A defining point of the project was providing consumers the gold standards blind and named and having them respond to flavor cues. It became very clear that traditional consumer preparation did not deliver upon flavor expectations but there was a strong emotional tie to the cooking and preparation process. To address this flavor gap and reinforce the emotional connection for consumers, the chemical references together with product profiles provided a foundation for flavor keys utilized in a flavor design of experiments (DOE). The goal of the DOE was to optimize the savory flavor for key segments of consumers. Givaudan's Mini Virtual Aroma Synthesizer (VAS) was utilized with consumers (n=254) to evaluate 55 aromas within one session, allow exploration of a wide but focused sensory space, and identify key drivers of consumer acceptance. The resulting predicted profiles were incorporated into the savory product and were able to bridge the consumer expectation gap and provide the explicit product emotional connection.

(63) Comparison of triangle and tetrad discrimination testing of a variety of products

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The triangle method has been widely used in the food industry for many years when conducting sensory discrimination testing. Recently, however, another discrimination testing method, the tetrad, has begun to gain popularity. Based on currently published research, the tetrad method possesses statistical advantages over

the triangle and would require fewer panelists, reduce testing time, and use less sample material. More testing is needed to confirm these advantages in an applied, industrial approach on a wider range of products. Close to thirty panels with untrained panelists have been completed in order to compare the two methods. Products tested ranged from canned vegetables and fresh fruits to deli meats and baked goods. Panels conducted thus far have provided contradictory results. Inconsistencies have been found within and across product categories. Significant differences were seen with the triangle method but not in the tetrad in a few cases. In one specific instance, the same products were tested alone and then again with a carrier. Panelists were able to perceive the difference between the products with both methods when the product was served alone but were unable to do so when a carrier was present with the tetrad. Differences found with the tetrad agree with differences found with the triangle. Participating panelists were asked to compare the two methods in terms of difficulty on a structured scale and in an open-ended fashion. Overall, panelists perceived the decision-making process involved with the tetrad method more difficult than the triangle method when testing the same products.

(64) Modification of flash profile

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Flash Profiling (FP) is a descriptive method based on the combination of free choice terms selection and comparative ranking evaluation. The disadvantage of FP method is the large vocabulary to describe product differences and the meaning of the attributes is sometimes unclear. In order to increase the development of individual vocabularies while shorten the easiness of sample ranking the increase the interpretability of the results, some modifications have been applied to FP by focusing more on sample discrimination, giving more efforts on definition and reduction of individual vocabularies. In this work, the new version of the FP method was applied to evaluate 16 polenta sticks. Seven judges evaluated the samples during 3 sessions. In the first session, after the judges were trained on the procedure, they performed an Ultra Flash Profile (UFP) by focusing on differences / similarities among samples and naming differences on a sheet. In the second session, judges confronted with their attributes list with that from others and tested the samples to choose the most relevant 10 attributes. Also they gave a definition for each attributes. In the third session judges ranked the samples according to individual vocabulary list into two sessions. Data were analyzed by Generalized Procrustes Analysis. First of all, oven samples and fried samples were well discriminated on the map. Secondly, among fried samples, the judges discriminated frozen and fresh samples. The breading type was a discriminative variant among oven cooked samples. Finally, a concensus was found for the most of the evaluated attributes.

(65) Perceptual maps of chemesthetic stimuli in Spanish and English speakers

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Chemesthetic stimuli, such as capsaicin (chili peppers), zingerone (ginger), and menthol, elicit complex sensory responses that are often difficult to describe, given the range of temperature, touch, and pain sensations experienced. Recently, our team has used sorting to characterize to chemesthetic stimuli while minimizing linguistic contamination of perception. Given the growing influence of Hispanic culture in the United States, we were interested in exploring how ethnic foodways and language may influence the perception of chemesthetic stimuli and the attributes used to describe these stimuli in English and Spanish. The sorting task is especially well-suited to use in cross cultural studies because it relies on the cognitive process of categorization rather than the language-based process of description. A group of native Spanish-speaking Hispanics sorted nine chemesthetic stimuli and two tastants into groups based on perceived similarity and then labeled each group in Spanish. These data were analyzed via multidimensional scaling and were compared to the equivalent data from a group of native English-speaking individuals collected previously. A significant difference was found between the perceptual maps of chemesthetic stimuli in Spanish and English speakers: the Spanish cohort showed less distinction between chemesthetic stimuli, creating fewer clusters with higher stress. Textual analysis showed that the Spanish speakers were less consensual regarding attributes but provided a greater number of unique descriptors than the English speakers. Personality measures and food involvement data were also collected from these participants to further understand the effect of ethnicity on perception of chemesthetic stimuli. Our findings suggest that native Spanish-speaking Hispanics, specifically those who have emigrated to the United States., are more idiosyncratic in their perception and description of chemesthetic sensations than native English speakers. Supported by Pennsylvania State University intramural funds, USDA Hatch Project PEN04332 and NIH grant DC0010904.

(66) – Withdrawn

(67) Using a consensus degree of difference scale as an alternative to triangle testing

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Many product development, improvement, and quality initiatives require product or process changes without noticeably altering sensory properties of the end product. To assess whether such changes will remain unnoticed in the marketplace, discrimination tests have traditionally been used, as they allow for management of alpha- and beta-risks simultaneously and provide clear “pass–fail” decision criteria. However, to ensure optimal risk management, they often require access to a large respondent base and can be costly and time-consuming. Further, in case of failure, they may not provide sufficient diagnostics to accurately explain product differences and to strategically direct development efforts. Expert panels trained in consensus degree of difference (DOD) methodology offer an alternative to these traditional methods. Panels are trained to rate the strength of the overall difference across a wide range of consumer products and quantify whether differences will be noticed or unnoticed by consumers; they provide direction for changes, all with a smaller sample size, in a shorter timeframe, and at lower cost. The current study outlines how to develop a consensus DOD scale and validate its predictive power. Data from the Spectrum Descriptive Panel trained in DOD is compared to findings from traditional triangle testing. Results show a high degree of correlation ($r = 0.97$, $p < 0.001$) between the DOD scores and the number of correct responses in discrimination testing for similarity across two beverage systems. Critical DOD scores along the scale that provide adequate protection against both risk for false positives and false negatives are determined. These results indicate DOD scores can be used as an analog for beta-risk, thereby shortening and strengthening the product development process.