PPP annual report 2018
PPPs which have started under the direction of the top-sectors need to deliver an annual report regarding their research and financial progress. For reporting on research progress this format has to be applied. A separate format 'PPP final report' is available for PPPs that have finalized in 2018. **Annual reports are entirely published on the TKI/topsector website(s). Please prevent the incorporation of confidential matter in the report.**
PPP annual reports have to be submitted - pooled for each research organisation - before 1 March 2019 to the TKIs at info@tkitu.nl, or at info@tki-agrifood.nl. For Wageningen Research the delivery of reports occurs centrally.

General data	
PPP number	**AF-15504**
Title	**Smooth Bite for All**
Theme	**Gezond&Veilig**
Executing research organisation(s)	**Wageningen University and Research**
Project leader research (name + email address)	**Dr. Markus Stieger** **markus.stieger@wur.nl**
Coordinator (on behalf of private parties)	**Michiel Sytsma** **sytsma@tifn.nl**
Contact person of government	**Unknown**
Total project budget (k€)	**2500**
Project website address	**-**
Starting date	**01-05-2016**
Final date	**30-06-2020**

Approval coordinator/consortium The annual report has to be discussed with the coordinator/consortium. The TKI(s) like to be informed regarding potential comments on the annual report.	
The annual report is …… by the coordinator on behalf of the consortium	□ approved □ not approved
Potential comments regarding the final report	

Brief description content/aim PPP What is the matter and what does the project contribute? What does the project deliver and what are the effects of its delivery?
The aim of the project is to determine the influence of structural and textural food properties and expectations of foods on bolus properties, oral processing behavior, dynamic sensory perception and liking in consumer groups varying in age, ethnicity and eating capability. The project delivers scientific knowledge on interrelationships between food structure and structural heterogeneities, bolus properties, food oral processing, expectations, sensory and emotion perception and liking in consumers varying in age, ethnicity and eating capability. The project delivers guidelines for food industry to efficiently and selectively stratify and customize product formulations targeted for specific consumer groups.

Results 2018 Give a brief description of the high-lights in 2018.
The scientific highlights of five studies which were completed in 2018 within the "Smooth Bite for All" project are summarized in the following:

1) Food oral processing plays a key role in sensory perception, consumer acceptance and food intake. However, little is known about the influence of physical food properties on oral processing of different type of food products. The primary objective of this study was to determine the influence of rheological and mechanical properties of foods on oral processing behavior of liquid (drinkable), semi-solid (spoonable) and solid foods (chewable). The secondary objective was to quantify the influence of product liking, frequency of consumption and familiarity on oral processing behavior. Rheological and mechanical properties of 18 commercially available foods were quantified. Parameters describing oral processing behavior such as sip and bite size, consumption time, eating rate, number of swallows, number of chews, cycle duration, and chewing rate were extracted from video recordings of 61 consumers. Subjects evaluated products' liking, familiarity, and frequency of consumption using questionnaires. Consumers strongly adapted oral processing behavior with respect to bite size, consumption time, and eating rate to the rheological and mechanical properties of liquid, semi-solid and solid foods. This adaptation was observed within each food category. Chewing rate and chewing cycle duration of solid foods were not influenced by mechanical properties and remained relatively constant. Liking, familiarity, and consumption frequency showed to impact oral processing behavior, although to a lower degree than the rheological and mechanical properties of food. We conclude that the oral processing behaviors of liquid, semi-solid and solid foods are mainly determined by their rheological and mechanical properties.

2) Composite foods consist of combinations of single foods, such as bread with toppings. Single foods can differ considerably in their mechanical and sensory properties. This study aimed to investigate the effect of toppings on oral processing behavior and dynamic sensory perception of carrier foods when consumed as composite foods. Two carriers (bread, crackers) and three toppings (firm cheese, cheese spread, mayonnaise) were selected and six carrier-topping combinations were prepared. Mastication behavior, bolus properties (33, 66 and 100% of total mastication time) and dynamic sensory perception were determined for single carriers and all carrier-topping combinations. Both carriers with cheese spread and mayonnaise were chewed shorter and with fewer chews than single bread and crackers, although twice the mass of food was consumed. These toppings contributed to a faster bolus formation by providing moisture, so that less saliva was incorporated into the bolus during mastication. As a result of the moisture incorporation, carrier boli with toppings were softened and perceived less firm and less dry than carrier boli alone. The largest effects of toppings on oral processing behavior and perception were found for liquid-like mayonnaise, and these effects were more pronounced in dry crackers than in moist bread. We conclude that toppings assist saliva in bolus formation of carriers. Carriers drive oral processing behavior and texture perception whereas toppings drive overall flavor perception. This knowledge contributes to food design tailored for specific consumer segments and future personalized nutrition.

3) The aim of this study was to understand how dynamic and static sensory perception changes when foods are consumed together with condiments. Two carriers (bread, carrot) varying in hardness were combined with condiments (mayonnaises) varying in fat content and viscosity to obtain model composite foods. Dynamic sensory perception was assessed using Temporal Dominance of Sensations (TDS) with attribute lists describing both carrier- and condiment-related attributes. Static sensory perception was evaluated using Rate-All-That-Apply (RATA) with attribute lists descriptive for either bread, carrot or mayonnaise. Carrier foods (bread, carrot) had a larger influence on dynamic and static sensory perception of carrier-condiment combinations than condiments (mayonnaises). Sensations related to mayonnaises (sour, creamy) were dominant at later stages of consumption when these were combined with harder bread or carrots. Hard bread or carrots reduced intensities of several mayonnaise-related attributes (sour, dairy when combined with bread; creamy, after taste when combined with carrots) to a larger extent than soft bread or carrots. Consumer sensitivity to discriminate between foods was not affected by the presence of other food items when differences in bread, carrots or mayonnaise properties were large. In case of smaller differences between food properties, consumer sensitivity to discriminate between foods declined and depended on the food type it was combined with. We conclude that the product properties of both solid carrier foods and condiments and their interaction during consumption impact dynamic and static sensory perception of carrier-condiment combinations.

4) This study investigated the effect of mechanical contrast and particle flavour concentration of carrot particles added to soups on expected and perceived sensations and liking. The properties of a chicken soup were varied by addition of real carrots, model carrots and model chicken particles differing in size, fracture stress, and/or carrot flavour concentration. The four aims of the study

were: (1) To study the effect of mechanical contrast on expected and perceived sensations; (2) To investigate the role of particle carrot flavour concentration on perceived sensations and liking; (3) To study the effect of dis/confirmation of expected by perceived sensations on liking; (4) To investigate the consumer's preferences and ideal profile of soups. Expected sensory properties were affected by particle size: the larger the particles, the higher the expected intensities for hardness, chewiness, and crunchiness of soups. Perceived sensory properties were significantly influenced by size and fracture stress of carrot particles. Increasing flavour concentration in model carrot particles added to soups marginally influenced liking suggesting that flavour concentration in particles added to soups has a limited effect on liking. When model carrot particles were added to soups, expected sensory properties were confirmed by perceived sensory properties, and consequently liking did not change considerably. The congruency and familiar appearance of the model carrot pieces probably contributed to the confirmation of expectations. When model chicken pieces were added to soups, expected sensory properties were disconfirmed by perceived sensory properties leading to a significant decrease in liking. Soups containing medium-sized, soft carrot particles were the closest to the consumer's ideal product profile. To summarize, consumer expectations and physicochemical properties of chicken and carrot particles added to chicken soup contributed to perception and liking of soups. We conclude that the sensory product profile of common products such as soups can be optimised by addition of congruent and familiar particles that match consumer' expectations.

5) In the 'classic' Temporal Dominance (TD) method, panellists are instructed to select a dominant attribute, which remains dominant until another attribute is selected. This procedure does not allow recording 'no dominance (ND)'. ND periods can occur because of indecisive selection behaviour due to hesitation or uncertainty about attribute selection and time needed to switch from one attribute to another. ND periods may create noise in TD data. ND can be recorded implicitly using a 'Hold-down' procedure, where panellists actively hold down the attribute button that is perceived dominant, but release it when no longer dominant. The 'Hold-down' procedure allows subjects to report indecisive behaviour simply by not holding down a button. This study compared the 'classic' and 'Hold-down' TD methodologies. One hundred and thirty-seven participants evaluated four dark chocolates in two sessions, one for sensory (TDS) and one for emotion (TDE) evaluations. Participants employed either classic (n=68) or Hold-down (n=69) TD following a between subjects design. Similar dominance rates and dynamic evolutions of attributes during consumption were observed for both methods. ND durations between attribute selections were shorter than 1 s during sensory and emotion evaluations. Such short ND durations unlikely reflect periods of true hesitation, but rather reflect the time needed to switch between dominant attributes. No evidence is found for Hold-down TD outperforming classic TD in terms of sensitivity and discrimination ability. In conclusion, irrespective of the conceptual likelihood regarding the occurrence of 'no dominance' periods, the present study failed to demonstrate moments of hesitation using the 'Hold-down' procedure.

Number of delivered products in 2018 (give titles and/or description of products, or a link to the products on the project website, or other public websites).

Scientific articles	Reports	Articles in professional journals	Lectures/workshops/ posters
7	2	-	43

Titles/descriptions of prominent products in 2018 (max. 5) and their targets groups

5 scientific papers in peer-reviewed Q1 journal for academics and food industry:

1) Aguayo-Mendoza et al. Oral processing behaviour of drinkable, spoonable and chewable foods is primarily determined by rheological and mechanical properties. Food Quality and Preference 71 (2019) 87–95.

2) Santagiuliana et al. Mechanical properties affect sensory detectability of texture contrast in heterogeneous food gels. Food Hydrocolloids 80 (2018) 254-263.

3) Santagiuliana et al. Effect of mechanical contrast on sensory perception of heterogeneous liquid and semi-solid foods. Food Hydrocolloids 83 (2018) 202-212.

4) van Eck et al. Oral processing behavior and dynamic sensory perception of composite foods: Toppings assist saliva in bolus formation. Food Quality and Preference. (2019) doi: https://doi.org/10.1016/j.foodqual.2018.05.009

5) Van Bommel et al. Dutch consumers do not hesitate: Capturing implicit 'no dominance' durations using Hold-down Temporal Dominance methodologies for sensations (TDS) and emotions (TDE). Food Quality and Preference 71 (2019) 332-342.

Annex: Titles of deliverables or a link to products on the project website or other public websites

1) Aguayo-Mendoza et al. Oral processing behaviour of drinkable, spoonable and chewable foods is primarily determined by rheological and mechanical properties. Food Quality and Preference 71 (2019) 87–95.

2) Santagiuliana et al. Mechanical properties affect sensory detectability of texture contrast in heterogeneous food gels. Food Hydrocolloids 80 (2018) 254-263.

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5) Van Bommel et al. Dutch consumers do not hesitate: Capturing implicit 'no dominance' durations using Hold-down Temporal Dominance methodologies for sensations (TDS) and emotions (TDE). Food Quality and Preference 71 (2019) 332-342.

6) Santagiuliana, M.; van den Hoek, I.A.F.; Stieger, M.; Scholten, E.; Piqueras-Fiszman, B. (2019) As good as expected? How consumer expectations and addition of vegetable pieces to soups influence sensory perception and liking. Food & Function (in press)

7) van Eck, A.; Fogliano, V.; Scholten, E.; Stieger, M. (2019) Adding condiments to foods: How does static and dynamic sensory perception change when bread and carrots are consumed with mayonnaise? Food Quality and Preference (in press)