



# The importance of liking of appearance, -odour, -taste and -texture in the evaluation of overall liking. A comparison with the evaluation of sensory satisfaction



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## ABSTRACT

The response variable of *overall liking* is often used to measure consumers' overall hedonic response to food. However, little research is done to understand, if liking of all four sensory modalities; appearance, odour, taste and texture, are reflected in the evaluation of *overall liking*, or if a single sensory modality stands out and is of most importance. The term *sensory satisfaction* was recently introduced as an alternative to *overall liking* and should (at least in theory) be used by consumers as a more holistic response variable than *overall liking*. The aim of the analyses reported in the present paper were, to study the importance of the sensory modalities (liking of *appearance*, *odour*, *taste* and *texture*) in consumers' evaluation of *overall liking* and compare the findings to the importance of the sensory modalities (liking of *appearance*, *odour*, *taste* and *texture*) in consumers' evaluation of *sensory satisfaction*. The data came from a cross-over consumer case-study on apple-cherry fruit drinks (n = 67). The fruit drinks varied in: type of sweetener used, and addition of aroma and fibre. The modalities driving *overall liking* and *sensory satisfaction* were studied through slopes of a regression line relating *overall liking* and *sensory satisfaction*, respectively, to liking of the sensory modalities: *liking of appearance*, *-odour*, *-taste* and *-texture*. Results showed the steepest slope between *overall liking* and *liking of taste*, whereas the least steep slope was found for *liking of odour*. The same pattern between slopes was found for *sensory satisfaction* and *overall liking*. Therefore, it was concluded that consumers primarily paid attention to *liking of taste* (to be understood as flavour) and least attention to *liking of odour*, when evaluating *overall liking* and *sensory satisfaction*, respectively, and that consumers did not use *sensory satisfaction* as a more holistic response variable than *overall liking*.

## 1. Introduction

One of the most common ways to determine consumer acceptability of foods is through the measure of *overall liking*, often done via the 9-point hedonic scale developed by Peryam and Pilgrim (1957) (Lim, 2011). The term *overall liking* is scientifically understood as a holistic hedonic response, where the consumer evaluates the appeal of the sensory modalities: appearance, odour, taste as well as texture (Lawless & Heymann, 2010). Little research is done to understand, if liking of all four sensory modalities are reflected in the evaluation of *overall liking*, or if a single sensory modality stands out and is of most importance. Previous research points in the direction of *liking of taste* (understood as flavour) as the most important sensory modality for *overall liking* (Moskowitz & Krieger, 1992, 1995), indicating that the consumer do not pay equal attention to all four sensory modalities. The study of the

contribution of sensory modalities in the evaluation of *overall liking* will, from a scientific perspective, help the interpretation of how participants in consumer studies utilise the term *overall liking* by answering relevant scientific questions like: When a participant says he/she likes the food, which sensory modalities are then considered? Are all sensory modalities considered equal, or do some properties drive liking more than others? A proper understanding of the most important sensory modality (or modalities) for acceptance can further guide product developers in which modalities to emphasize the most during product development.

The term *sensory satisfaction* was recently introduced as an alternative to the measure of *overall liking* when rating the sensory appeal of foods in consumer studies (Andersen, 2015; Andersen & Hyldig, 2015). The term *sensory satisfaction* has been used as a response variable in a number of studies related to the SENSWELL project ([www.senswell.dk](http://www.senswell.dk); Andersen, 2015; Andersen, Byrne, Bredie & Møller, 2017; Andersen &

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Hyldeg, 2015; Andersen, Mielby, Viemose, Bredie, & Hyldeg, 2017; Mielby et al., 2016). When measuring *sensory satisfaction*, consumers were explicitly asked to rate satisfaction based on the food's appearance, odour, taste and texture, altogether (Andersen & Hyldeg, 2015). Thereby, the researcher assumes that the consumer considers all four sensory modalities; appearance, odour and texture as well as taste, and as such, the term *sensory satisfaction* can potentially be regarded a more holistic response variable than *overall liking*. Whether the response variable *sensory satisfaction* is used by consumers in the holistic way in which it is intended (incorporating an equal focus on all sensory modalities), and if the use of *sensory satisfaction* differs from *overall liking* in that regard, are not yet clarified. Such analysis will shed light on whether the measure of *sensory satisfaction* prospectively could replace the response variable *overall liking* when seeking a response variable to measure consumers' overall hedonic response to foods.

The aim of the analysis reported in this paper was to study, the importance of sensory modalities (liking of appearance, odour, taste and texture) in consumers' evaluation of *overall liking* and compare the finding to the importance of the sensory modalities (liking of *appearance, odour, taste and texture*) in consumers' evaluation of *sensory satisfaction*.

It is hypothesised that *liking of taste* is the primary sensory modality in the evaluation of *overall liking*, whereas *liking of appearance, -odour, -taste and -texture* are of equal importance in the evaluation of *sensory satisfaction*, and as such the response variable *sensory satisfaction* is used more holistically by consumers than the response variable *overall liking*.

## 2. Method

The data provided for the analyses in this paper comes from a consumer study focusing on acceptance of fruit drinks.

### 2.1. Fruit drinks

Four apple-cherry fruit drinks were used varying in: type of sweetener (sucrose vs *Stevia Rebaudiana* (Granulated Pure Circle Alpha, NP Sweet A/S, Denmark)), addition of fibres ({1–3, 1–4} PromOat® beta glucan, Sweden) and addition of lime flavour (Döhler, Germany). Product characteristics are reported in Table 1. The fruit drinks were originally developed for a series of studies on functional fruit drinks. Mielby et al. (2016) have presented details regarding the development of the fruit drinks. In addition to the fruit drinks described in the paper by Mielby et al. (2016) a sucrose-sweetened variant was included in the present study (Suc.Fla-Fib-). The recipe for this fruit drink was, besides for the type of sweetener, the same as for the plain fruit drink sweetened with *Stevia Rebaudiana* (Stev.Fla-Fib-, Table 1).

A sensory panel conducted a descriptive analysis to clarify the sensory attributes that characterised and significantly discriminated the fruit drinks (results will be published elsewhere). For the purpose of the

**Table 1**  
Fruit drink characteristics.

| Product                       | Sweetener          | Level of added lime flavour | Level of added fibre |
|-------------------------------|--------------------|-----------------------------|----------------------|
| Suc.Fla-Fib - <sup>*</sup>    | Sucrose, (26 g/L)  | 0 g                         | 0 g                  |
| Stev.Fla-Fib - <sup>*</sup>   | Stevia, (0.09 g/L) | 0 g                         | 0 g                  |
| Stev.Fla + Fib - <sup>*</sup> | Stevia, (0.09 g/L) | 1 ml/L                      | 0 g                  |
| Stev.Fla + Fib + <sup>*</sup> | Stevia, (0.09 g/L) | 1 ml/L                      | 10 g/L               |

\* Product name interpretation. Suc. = Sucrose, Stev. = Stevia, Fla. = Flavour, Fib = Fibre, “-” = none, and “+” = present E.g. Suc.Fla-Fib- = A sucrose sweetened fruit drink with no added lime flavour and no added fibres.

study reported in the present paper, we can inform that the fruit drinks were significantly different in sensory attributes related to the modalities: appearance (all  $p < 0.001$ ), odour (all  $p < 0.01$ ), texture (all  $p < 0.001$ ) and flavour (all  $p < 0.01$ ), but no significant differences was found in basic taste attributes.

### 2.2. Consumer study

A total of 67 subjects completed a randomised cross-over consumer study, 37 males and 30 females between 18 and 60 years of age. Inclusion criteria: likers of fruit drinks between 18 and 60 years of age not suffering from food allergies. Subjects should be able to participate in four sessions minimum one day apart. Fruit drinks were served as 25 ml samples in neutral plastic jars with lids. Subjects drank and evaluated all four fruit drinks four times each, once in each session. Presentation order was randomized for each session and between subjects. The fruit drinks were evaluated based on *overall liking, liking of appearance, liking of odour, liking of taste, liking of texture and sensory satisfaction*, in the order presented here, with the possibility of re-tasting between each evaluation. *Overall liking* was rated by asking “How much do you like the fruit drink?” and questions about liking of sensory attributes followed the form “how much do you like the ... (e.g. the appearance)?”. The variables were rated on a 9-point categorical scale labelled at the anchor points 1: “do not like at all” and 9: “like extremely”. *Sensory satisfaction* was evaluated by asking “considering the fruit drink's appearance, odour, taste and texture altogether, how satisfied are you then?”. Ratings were collected on a 9-point categorical scale labelled at the anchor points 1: “not at all satisfied” and 9: “extremely satisfied”. The order of the questions followed the general recommendations for good practice when creating questionnaires in sensory and consumer science (Lawless & Heymann, 2010) which includes; 1. To go from general to specific. As such, the question about *overall liking* was asked before asking about liking of single sensory properties. 2. To follow the logical order of perception. As such, the question about *liking of appearance* was asked before asking about *liking of odour, -taste and -texture*, respectively. 3. To check for satisfaction at the end. As such, the question about *sensory satisfaction* was asked last while taking into account the total sensory experience.

In addition to the hedonic evaluation of sensory properties, the study included questions about post-ingestive sensations after intake of the fruit drinks. These results are outside of the scope of this paper but are reported in the paper by Andersen et al. (2017). As the questions about post-ingestive sensations were presented in separate questionnaires answered after intake, it is unlikely that these questions had an impact on the hedonic ratings conducted during intake.

### 2.3. Statistical analyses

Initially, mixed models were applied to the data to study session and sample effects for each of the six variables; *overall liking, liking of appearance, -odour, -taste and -texture* respectively, and *sensory satisfaction*. Consumers were treated as random effect. Session and samples were treated as fixed effects.

The relative importance of the sensory modalities (appearance, odour, taste and texture) in consumers' evaluation of *overall liking and sensory satisfaction*, respectively was investigated via three steps of analyses.

In step one, the relation between liking of a sensory modality and *overall liking and sensory satisfaction*, respectively, was analysed. The analysis was repeated for the four sensory modalities: appearance, odour, taste and texture. To analyse the relations between liking of a sensory modality and *overall liking and sensory satisfaction* respectively, individual slopes of a regression line were calculated based on four corresponding (x,y) observations, one for each sample. Y was either *overall liking or sensory satisfaction*, and X was *liking of one of the four sensory properties: appearance, odour, taste and texture*. In all cases the

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