# The effects of mastication and orosensory exposure on satiation

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Primary Objective: To determine the independent and combined effects of mastication duration and orosensory stimulation intensity on satiation. Secondary Objective: To investigate whether chewing behaviour type affects satiation through orosensory...

Ethical review	Approved WMO
Status	Recruitment stopped
Health condition type	Other condition
Study type	Interventional

## Summary

#### ID

NL-OMON42808

**Source** ToetsingOnline

**Brief title** Gel-licious study

### Condition

• Other condition

#### **Synonym** Obesity, Overweight

#### Health condition

Overgewicht, Obesitas

**Research involving** Human

### **Sponsors and support**

Primary sponsor: Wageningen Universiteit Source(s) of monetary or material Support: NWO

#### Intervention

Keyword: Mastication, Oro-sensory exposure, Satiation

#### **Outcome measures**

#### **Primary outcome**

The main study parameter is ad libitum intake of the model foods, in gram.

#### Secondary outcome

Secondary study parameters are: perceived sweetness, number of chews, chewing

duration, mastication cycle, mouth behaviour type (according to questionnaire),

food neophobia level and subjective satiety parameters (hunger, fullness,

thirst, prospective consumption desire to eat and nausea).

# **Study description**

#### **Background summary**

Despite the progressed insights in the causes of the obesity problem, much remains unknown while the number of obese people in the western society continues to increase. Many factors have been identified that contribute to the problem. One of the major contributors to obesity is the obesogenic food environment that is characterised by large portion sizes of palatable, high energy dense foods that are relatively inexpensive, making it possible for susceptible individuals to overconsume.However, despite this tempting food environment there are individuals that do not seem to overconsume and are able to maintain a healthy body weight.

The ability of the human body to regulate food intake plays a key role in the prevention of overconsumption. Oro-sensory exposure to food and mastication help to regulate food intake. One of the theories is that these factors regulate intake by inducing and stimulating the cephalic phase response. The cephalic phase response is the first phase of digestion, including all physiological, endocrine and autonomic responses stimulated by sensory cues such as taste, smell and the sight of food. A Lack of, or diminished cephalic phase response induced by modified sham feeding or as a result of quick food consumption has been shown to disrupt the digestive system. Processes affected are metabolism systems such as the insulin and blood glucose regulation and lipolysis together with the reward and satiety systems. In both animal and human studies it has been shown that this disruption of the digestive system is related to decreased appetite responses and weight gain.

In line with this, studies have found that a decreased oro-sensory stimulation due to a fast ingestion rate and little chewing effortare associated with obesity. Ingestion rate determines the size of the meal, as faster consumption leads to a higher intake. For example, liquids are consumed much faster compared to solid- or semisolid foods and therefore ad libitum intakes are found to be higher, even when energy density was kept equal. This confirms the adverse effects of foods that can be eaten in a fast rate without (chew) effort as they induce a shorter orosensory exposure per food unit, resulting in a delayed or decreased satiation response and consequently higher food intake. This suggests that proper (oro-) sensory stimulation and the enhancement of the cephalic phase response may play an important role in the prevention of the obesity problem.

Individuals not affected by the obesogenic food environment may feature distinctive eating behaviour that stimulates the cephalic phase response causing them to refrain from overconsumption through fast increased satiation feelings.

The way food is processed in the mouth when first ingested is one of the characteristics of eating behaviour. Oral processing includes the mastication motility and secretory contributions and has as a primary function to breakdown food in the mouth. Mastication motility affects the oro-sensory stimulation and perception and is dependent of the food properties such as texture and flavour.

Chewing behaviour is consistent within individuals but varies widely between subjects. Typical chewing patterns in adults are developed in early childhood with only some minor adaptations due to positioning of permanent teeth and tooth loss. Four main eating behaviour patterns have been described in literature; chewers, crunchers, smooshers and the suckers. Chewers and crunchers are characterised by their preference to break down food with their teeth. Crunchers are distinct from chewers as they prefer foods for which more force is needed to breaking down the food, chewers on the other hand prefer a long chewing time. Smooshers and suckers prefer to manipulate foods with use of their tongue and palate. The main difference between these two eating types is mouth behaviour and the preference for hard foods (lolly pops) by the suckers and soft foods (pudding) by the smooshers. Although a person may be classified in one of these eating behaviour types based on his or her preferences they may still show other eating styles upon eating certain products.

How food is processed in the mouth determines the sensations that are perceived when eating the food. However, the manner of food processing is also dependent of the food eaten, for example, a study of Wijk et al. found that oral processing time and oral movements increases when increasing the sweetness of a semi-solid food. It has been suggested that the balance between efficiency and perception determines the individuals eating behaviour or oral processing style and that this is dependent of the food and its pleasantness. Meaning that individuals chew food in such a way that it provides the, for them, optimum flavour and flavour intensity.

Mastication and orosensory exposure are therefore closely related but the respective roles of both factors in their effect on satiation are unknown. Therefore the main objective of this study is to determine the independent and combined effects of mastication duration and oro-sensory stimulation intensity on satiation (ad libitum intake). The second objective is to investigate whether chewing behaviour type affects satiation through orosensory exposure time.

#### Study objective

Primary Objective: To determine the independent and combined effects of mastication duration and orosensory stimulation intensity on satiation.

Secondary Objective: To investigate whether chewing behaviour type affects satiation through orosensory exposure time.

Primary study hypothesis:

When magnitude of the oro-sensory stimulation intensity and mastication are increased this will lead to an equal and additive reduction on food intake.

Secondary study hypothesis: People with chewing and crunching eating styles have shorter orosensory exposure time compared to smooshers and suckers and consequently will have greater reduction of the ad libitum intake when mastication and orosensory factors are increased.

#### Study design

The study has a randomized cross-over (2x2) study design; all participants receive each treatment and are their own control (within subject effects). The duration of the study will be approximately 3-6 months (depending on the recruitment) and will take place in the sensory lab of Wageningen University.

#### Intervention

Information meeting and first part screening:

Once the study is explained to the participants and when willing to participate the participants sign informed consent. After that, participants take part in the first part of the screening where they will be asked to fill in the Dutch Eating Behaviour Questionnaire and texture preference questions together with questions about the in- and exclusion criteria questions. When subjects fulfil all in- and exclusion criteria they will be invited for the second part of the screening.

#### Second part screening:

During the second part of the screening participants will be asked to answer general questions about the model food including the liking. Subjects will only join the four test sessions when they score at least once (out of two) a 5 on a nine point hedonic scale for both model food structures (chewy and not chewy). The model foods have a gel-like structure similar to pudding or panna cotta. The four types will differ either in structure (chewy vs. not chewy) or perceived sweetness (low and high intensity) in a 2x2 design: Model food 1: Chewing duration Long, sweetness Intensity High (CLIH) Model food 2: Chewing duration Short, sweetness Intensity Low (CSIL) Model food 3: Chewing duration Long, sweetness Intensity Low (CLIL) Model food 4: Chewing duration Short, sweetness Intensity High (CSIH)

During the second part of the screening subjects will also be asked to rate liking for the sweetness of 6 gels with different sweetness levels, on a line scale (100 mm visual analogue scale VAS). Based on this, two individual based sweetness levels will be chosen in such way that palatability for both sweetness levels is equal. Meaning that 2 sweetness intensities for each subject will be chosen, one that is \*just not sweet enough\* and one that is \*just too sweet\*. Furthermore, weight and height will be measured to calculate their daily energy need (based on the Schofield formula) and food neophobia level will be determined based on a questionnaire.

#### Test sessions:

When sweetness levels and overall liking of the model foods is determined, and participants fulfill al in- and exclusion criteria four sessions will be scheduled.

The evening before each session participants will be asked not to do intensive exercise (walking and biking is allowed). Before each session participants will be asked to refrain from eating and drinking (besides water) 4 hours before the measurement.

Before the start of the test session participants will be given pieces of bread with light butter (halvarine) and cheese and one glass of water (150 ml) for them to eat to standardize thirst and hunger/satiation feelings. The amount of bread given will be determined based on the average energy need calculated by the age, weight and height of the participant.

During the sessions subjects will be asked to eat one of the four types of model foods until comfortably full (ad libitum intake). All subjects will eat all four types of model foods in a randomized order, one type per session. During the ad libitum intake video recordings will be made. Markers (stickers) will be placed on the chin and nose of the participant to measure chin movement. Based on the movements of the chin chewing behaviour will be determined. Furthermore they will be asked to rate some model food -specific and appetite related questions. During the last test session participants will be asked to fill in the eating behavior type questionnaire to determine whether they are 'chewers, crunchers, smooshers or suckers'.

#### Study burden and risks

The risk associated with participation is negligible and compared to other studies the burden can be considered as low. Performing sensory tests and ad libitum intake experiments is considered to be a low burden for participants. Participating in the study takes 6 hours per participant and only the 4 hours refraining from eating can be considered a small burden but is considered to be standard practice in sensory research. With this study we would like to determine how mastication and oro-sensory exposure are contributing to the regulation of food intake as they are closely related. This knowledge may be used to develop products or strategies that enhance healthy choices and eating behaviour. In conclusion, we consider the knowledge obtained and possible implications of this study to outweigh the small individual burden.

# Contacts

Public Wageningen Universiteit

Bomenweg 2 Wageningen 6703 HD NL **Scientific** Wageningen Universiteit

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# **Trial sites**

### Listed location countries

Netherlands

# **Eligibility criteria**

#### Age

Adults (18-64 years) Elderly (65 years and older)

### **Inclusion criteria**

-Good general health and appetite -Between 18-55 years old at the day of inclusion -Fluent in Dutch and able to read and understand English (because of a questionnaire tool only available in English) -BMI 18.5-27 kg/m2 -Non-smoking -Men: no facial hair or willing to shave (due to facial markers video) -Liking of the model food by scoring at least once (out of the two) a score 4 on a nine point hedonic scale with not more than a 2 points difference between the two gels (more or less equal preference for texture).

### **Exclusion criteria**

-Dental pathologies such as known caries, full dentures or planning to undergo dental treatment during the study

-Difficulties with swallowing and chewing

-Braces (not including a dental wire) or oral piercing

-Use of medication of which the taker notices (or has noticed in the past) that it influences appetite, taste, mastication and/or salivation or when the description of the medication describes effects on appetite, taste, mastication and or salivation.

-Allergies or intolerance to any ingredient of the model food of standardized pre-meal. -Not willing to eat the model foods or standardized meal because of eating habits, (religious) believes or vegetarianism.

-Followed an energy restricted diet during the last 2 months

-Gained or lost 5 kg over the last half year

-Woman: not pregnant or planning to get pregnant within period of study or breastfeeding -High restrained eater according to the Dutch Eating Behaviour Questionnaire (men: score>2.9, women: score>3.4).

-Dislike for any of the textures according to the texture preference questionnaire (score of 1).

- Signed up for or participating in another research study (with the exception of the EetMeetWeet study)

- Employee of Human Nutrition (Wur)

- Thesis student or intern at the chair group of Sensory Science and Eating Behaviour Human Nutrition (WUR).

# Study design

### Design

Study type:	Interventional
Intervention model:	Parallel
Allocation:	Randomized controlled trial
Masking:	Single blinded (masking used)
Control:	Active
Primary purpose:	Other

### Recruitment

NL	
Recruitment status:	Recruitment stopped
Start date (anticipated):	29-10-2015
Enrollment:	65
Туре:	Actual

# **Ethics review**

Approved WMO	
Date:	27-10-2015
Application type:	First submission
Review commission:	METC Wageningen Universiteit (Wageningen)

# **Study registrations**

### Followed up by the following (possibly more current) registration

No registrations found.

### Other (possibly less up-to-date) registrations in this register

ID: 20230

8 - The effects of mastication and oro-sensory exposure on satiation 15-06-2025

Source: Nationaal Trial Register Title:

# In other registers

Register	ID
ССМО	NL54634.081.15
OMON	NL-OMON20230