MILK-ED

MODERN AND INNOVATIVE ONLINE-BASED
KNOW-HOW ON EUROPEAN DAIRY PROCESSING

SENSORY EVALUATION OF DAIRY PRODUCTS

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SENSORY EVALUATION OF DAIRY PRODUCTS

Most consumers are interested in **the quality of the dairy products** they buy, which they usually determine primarily through their senses, i.e. sensory evaluation. This is something that dairy producers should be aware of. It is therefore advisable to sensorically evaluate each batch of dairy products before they reach the market. It is also useful to check the quality of other producers' dairy products from time to time. Only such a comparison provides a good basis for objectively evaluating the quality of one's products.

Sensory evaluation is carried out **for various purposes**. Let us highlight a few of the most important ones:
- to assess the characteristics of finished products,
- to control the quality of the raw materials,
- to design and develop new products,
- to monitor the influence of raw materials and additives on product quality, - to check the shelf life of products during storage, - to evaluate competing products.

General on sensory evaluation

Sensory evaluation is the oldest way of checking the quality of dairy products and involves evaluating their characteristics using the five basic **senses** (sight, smell, taste, touch, and hearing). The properties of foodstuffs that are perceived by the senses are described in terms of the appropriate **terms.** In sensory evaluation, we focus on each sensory property of the food under investigation in the following sequence:

- **visual appearance** by sight,
- **sme**ll by olfaction,
- **consistency** by touch,
- **sound** by hearing,
- **taste** by flavour.

The correct sequence of evaluation

The first consideration is **the appearance** of the dairy product, as this is the first information or first impression of the product. The size, shape, colour, surface appearance, etc., are observed and described by the assessors using the appropriate agreed terms specific to each group of dairy products. Some examples to describe a sample of a dairy product:

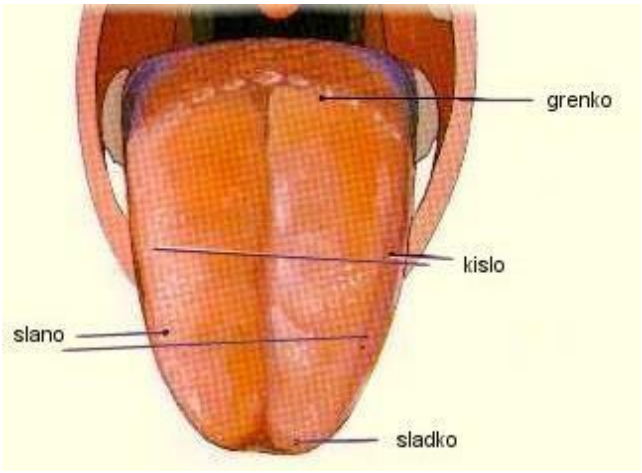
- **size:** too large, too small, typical size, still meets the requirements;
- **shape:** convex, inflated, too low, nicely rounded, deformed;
- **colour**: characteristic colour, discoloured, streaked, marbled,no-sheen;
- **surface appearance:** smooth, wrinkled, cracked, damaged cover, mouldy, etc.

This is followed by an evaluation of **the odour** of the dairy product, which is formed by the volatile substances contained therein. The volatiles are detected by the sensory organs in the nasal cavity. The intensity of the odour depends on the temperature of the sample, as more volatiles are released at higher temperatures. Therefore, when preparing the sample, the temperature range that is normal for the consumption of the dairy product in question must be taken into account. The odour is described by the following terms: characteristic, intense, bland, repulsive, faint, floral, musty, rancid, impure, chemical, burnt, sour, fruity, yeasty, honey-like, etc.

This is followed by **the consistency** of the dairy product, which is defined by the type of sensory cells, which are most concentrated at the fingertips, but also on the gums, tongue, and palate, which can only be assessed by tasting. The consistency of a dairy product can be described in the following terms: soft, hard, granular, smooth, sticky, floury, pasty, stringy, crumbly, brittle, coarse, oily, etc.

Sound is a characteristic that is **not assessed** in most dairy products. Exceptions are the wafery quality of ice creams and the crunchiness of various additives such as crispies, nuts, extruded rice, etc. This characteristic is described by the following terms: crunchy, effervescent, crackling, crepitating, not pronounced enough, etc.
Tasting is **the final assessment** of a dairy product, as we must know for certain that we are looking at a dairy product that is fit to eat, just by using the senses listed above. If in doubt, do not taste the product, as doing so may be dangerous to your health.

Taste is the most important characteristic of any dairy product and has a decisive influence on sensory evaluation. We perceive the intensity of the following basic tastes: sweet, sour, salty, and bitter, as well as electric, soapy or metallic taste. The sensory organs for each of the basic tastes are located throughout the oral cavity but are concentrated on a specific part of the tongue, as indicated in the following figure.



grenko - bitter
kislo - sour
slano - salty
sladko – sweet

Common terms used to describe the taste are: sweet, sour, fruity, astringent, rotten, harmonious, spicy, pronounced, yeasty, pungent, loose, zesty, burnt, etc.

Sensory representation in sensory evaluation.

Feature	SENSE ORGANS					
	eyes	nose	tongue	mouth	fingers, mouth	ear
appearance	X					
smell		X				
taste			X			
consistency			X	X	X	
sound						X

Basic conditions for official sensory evaluation

The sensory evaluation of milk and milk products shall relate only to their sensory characteristics. Objective sensory evaluation and thus reliable assessments of the characteristics of the dairy products concerned can be achieved if **the following conditions** are ensured:

- a sensory evaluation **room**
- a sensory evaluation **panel**,
- **the minimum quantities** of samples required for sensory evaluation,
- proper **storage** of the samples,
- properly **prepared** and **labeled samples** of dairy products,
- the correct **order** of the dairy product samples for sensory evaluation,
- **the evaluation sheets**.

The evaluation of milk and milk products shall be carried out only in **suitable premises** with appropriate equipment and suitable climatic conditions. A suitably decorated room shall be properly lit, have light cream-coloured walls, a room temperature between 18 and 20 °C, relative humidity of 60 to 70 %, adequate ventilation, be free from foreign or strong odours, and be protected from noise.

The evaluation panel shall be composed of **experts** or **experts with a good knowledge** of dairy production who also have experience in sensory evaluation. The assessors shall be qualified to evaluate the sensory characteristics of dairy products objectively and reliably and shall be able to describe them adequately and accurately.

The evaluation panel shall have at least 3 evaluators. One of the assessors shall be designated as chairman of the assessment panel. The assessment panel shall be responsible solely for the professional assessment of the sensory quality of the dairy products by the criteria set out in the assessment sheets. The evaluators shall score to the nearest 0,5 points. If the individual assessors' assessment of a sensory attribute differs by only one point, either downwards or upwards, the average value determined by the panel shall apply. If the difference between the individual scores is greater, they must repeat the evaluation of that attribute.

Each member of the jury writes his/her mark on **the evaluation sheet** and signs it. The final marks of all the panel members for each sample are added together and divided by the number of assessors. This gives the average and final score of the milk and milk products samples. A maximum of 50 samples may be assessed per day.

Evaluators shall not smoke, drink coffee or strong alcoholic beverages, or consume food with a sharp taste, 1-2 hours before the start of the evaluation. They shall not use intensive cosmetic products such as toothpaste, mouthwash, deodorant, perfume, aftershave, etc. before the sensory analysis.

The following minimum **quantities of samples** or number of packaging units are required for the assessment of the sensory characteristics of milk and milk products:
- pasteurised milk: 2 packing units
- fermented milk: 2 packaging units
- sweet/sour cream: 2 packaging units
- kaymak: 2 packing units
- raw/melted butter: 2 packaging units
- **cheeses (hard, semi-hard, soft):** 1 whole cheese
- **fresh cheeses**: 2 packing units

The storage conditions for milk and milk product samples pending sensory evaluation are as follows:
- pasteurised and fermented milk, cream, kaymak at a temperature of 4 to 8 °C;
- raw butter at a temperature of 4 to 8 °C;
- fresh cheeses at a temperature of 4 to 8 °C;
- other cheeses at a temperature of 4 to 10 °C;
- other dairy products at the temperature indicated on the declaration.

Most dairy products are assessed at a temperature of between 16 and 18 °C; for fermented milk and milk drinks, a lower temperature of 11 to 13 °C is recommended.

Samples of dairy products shall be **properly prepared** and **labeled** by first removing or covering all labels, markings, and declarations from the original packaging from which the assessors could determine the origin or the name of the manufacturer of the product. Only then shall the samples be coded. The code list is inaccessible to the assessors.

The correct order of evaluation means that the evaluators are given the samples with less pronounced and milder flavours to evaluate first, as evaluating spicy products at the beginning of the evaluation would make it difficult, if not impossible, to evaluate dairy products with less pronounced flavours. During the evaluation, the evaluators have water, apple pieces, and white bread to neutralise the taste in the mouth.

For sensory evaluation, the evaluators have the same **evaluation sheets** that are used in official dairy evaluations in Slovenia. **The evaluation sheets** are an integral part of the sensory evaluation of the quality of milk and milk products. Each sensory attribute of a dairy product is defined by a certain number of points. Where individual defects are found, the points are deducted. A maximum of 20 points may be scored for a single product.

The sensory attributes of milk and milk products are determined based on **the number of points** scored. On theBased overall assessment of the sensory characteristics of the product, the products shall be classified in the following **quality classes**:

Quality class	**Number of points**
Extra quality class	20.0 – 19.0 points
Quality Class I	18.9 – 17.0 points
Quality Class II	16.9 – 15.0 points

However, the following awards may be given to the products examined at the official **evaluations**:
19.0 to 20.0 points = gold award
18.0 to 18.9 points = silver award
17.0 to 17.9 points = bronze award

For sensory evaluation, we can use **the evaluation sheets** that are also used in official dairy evaluations in Slovenia. The following are the evaluation criteria and scoring sheets that are also used in official dairy evaluations. In addition, the causes of the most common errors are presented for each group of dairy products.

Assessment criteria and scoring grid for PASTEURISED MILK

Feature	**Maximum number of points**	**Points achieved**	**Note**
appearance	3		
colour	2		
smell	3		
taste	12		
total	20		

Errors	Causes
Elevated acid levels	This is a very common fault, especially in summer. When the acidity level is greatly increased, irreversible (irreversible) damage is done to the milk proteins, which are eviscerated during heat treatment. This defect is caused by lactic acid bacteria and coliform bacteria (Escherichia coli, Enterobacter aerogenes).
Sweet curdled	It is caused by the action of micro-organisms that secrete proteolytic enzymes that break down milk proteins. Heat treatment eviscerates the damaged proteins.
Rancid-salty milk	This is the result of the action of lipases or the presence of microorganisms that secrete lipases.
Pulling or slimy	Milk is more viscous and 'pulls at the threads'. This is caused by bacteria forming sheaths or capsules.
Abnormally coloured	The bluish colour is due to the action of bacteria in the genus *Chromobacter*; Reddish discolouration is due to infection by *Serratia marcescens*

Evaluation criteria and scoring system for FERMENTED0 MILK (fermented milk products): sour milk, yoghurt, Greek yoghurt, kefir without additives

Feature	Maximum number of points	Points achieved	Note
appearance	1		
colour	1		
consistency	4		
odour	2		
taste	12		
total	20		

Faults of fermented milk (sour milk, yoghurt)

Errors	Causes
whey curdling	too low milk heat treatment temperature milk dry matter content too low ripening temperature too high shaking or violent movement of the yoghurt during incubation and storage
acidity rising too slowly	milk faults the presence of inhibiting substances old, inactive cultures cooling during ripening
thin, runny consistency	too low heat treatment temperature of the milk ripening temperature too low inactive microbiological cultures milk dry matter content too low
grainy, lumpy yoghurt	slow acidification starter culture too low
inadequate acidification, harsh, sour, musty, unclean taste	processing of milk with high initial contamination (inadequate cleaning of milking facilities, milk cooled too slowly, stored for too long, and/or stored at too high temperatures) addition of old and/or inactive microbiological culture prevalence of technologically harmful micro-organisms
loose, empty taste	uncharacteristic microbiological culture ripening temperature too low
floury, gritty taste	too much milk powder added the added milk powder has not dissolved completely
too high acidity	too long ripening time over-ripening and/or storage temperature subsequent souring
too tender, not acidic enough taste	premature interruption of ripening insufficient acid-forming microbiological culture
a hint of yeasty taste, taste	yeast contamination from the air and/or from the surfaces of work equipment due to inadequate cleaning and disinfection of equipment use of contaminated microbiological cultures
shelf life too short	microbiological contamination from the air and/or from the surface of work equipment contaminated microbiological culture the cold chain broke in storage storage temperature too high microbiologically contaminated packaging poorly sealed packaging

GREEK YOGURT

Errors	Causes
whey curdling	too low heat treatment temperature of the milk insufficient draining subsequent acidification during storage
acidity rises too slowly	milk defects or presence of inhibiting substances old, inactive cultures, cooling during ripening too short a time for acid formation
thin, tough texture	The too low temperature of heat treatment of milk incubation temperature too low insufficient fat in the milk inactive cultures
short shelf-life	contamination through utensils, equipment, utensils, air infected cultures broken, cold chain storage at too high a temperature microbiologically contaminated packaging packaging not well sealed
inadequate acidification, harsh, sour, musty, unclean taste	milk processing with high initial contamination (inadequate cleaning of milking facilities, milk cooled too slowly, storage for too, long and storage at too high temperatures) old, inactive cultures
too high acidity	too long incubation time too long incubation storage temperature too high, acidification afterwardspredolg
yeasty taste	yeast infestation due to inadequate cleaning and disinfection of equipment use of contaminated cultures secondary contamination from the air

KEFIR

Errors	Causes
over-fermentation	too many kefir grains added yeast predominance in kefir grains
kefir tastes too sour	too many streptococci in kefir grains fermentation should take place at lower temperatures
uncharacteristic taste, vinegary, rotten, etc.	contamination with unwanted micro-organisms, moulds, and coliforms important hygiene maintenance and rinsing of kefir grains

Assessment criteria and scoring grid for SWEET CREAM

Feature	Maximum number of points	Points achieved	Note
appearance	2		
consistency	3		
colour	1		
odour	2		
taste	12		
Total	20		

SWEET CREAM

Errors	Causes
inhomogeneous appearance	too high-fat content storage for too long
mould on the surface of the product	poorly sealed, contaminated, or damaged packaging
a musty and undefined odour and taste	inadequate heat treatment of cream subsequent microbiological contamination of the cream excessive storage temperature of the cream
a musty smell and taste of fodder	fodder with unsuitable odour contaminated fodder spoiled silage

Assessment criteria and scoring grid for SOUR CREAM

Feature	Maximum number of points	Points achieved	Note
appearance	2		
consistency	4		
colour	1		
odour	3		
taste	10		
total	20		

SOUR CREAM

Errors	Causes
inhomogeneous appearance	the fat has separated from the sour milk too long storage
too sour taste	improper fermentation of the cream due to excessive addition of microbiological culture too high a temperature and/or too long a duration of fermentation
too tender, empty, not sufficiently aromatic odour and taste	slowing down the activity of micro-organisms insufficient acid-forming or flavour-forming microbiological culture fermentation temperature too low fermentation is completed too quickly and the required acidity level of the sour cream is not achieved
musty smell and taste of fodder	fodder with unsuitable odour contaminated fodder spoiled silage
mouldiness on the surface of the product	poorly sealed, contaminated, and/or damaged packaging
musty and undefined smell and taste	inadequate heat treatment of cream subsequent microbiological contamination of sour cream storage temperature of sour cream too high

Assessment criteria and scoring grid for KAYMAK

Feature	Maximum number of points	Points achieved	Note
appearance	2		
colour	2		
consistency	3		
odour	3		
taste	10		
total	20		

KAYMAK

Errors	Causes
inhomogeneous appearance	draining for too long insufficiently mixed product
too sour taste	intensive lactic acid fermentation insufficiently drained product
musty smell and taste of fodder	the cream was not properly heat-treated because the heat treatment was carried out at too low a temperature
product	poorly sealed, contaminated, and/or damaged packaging
a musty and undefined smell and taste	subsequent microbiological contamination storage temperature too high
bitter taste	protein degradation due to subsequent contamination of the product by proteolytic micro-organisms storage temperature too high

Assessment criteria and scoring grid for RAW BUTTER

Feature	Maximum number of points	Points achieved	Note
appearance	1		
colour	1		
consistency	2		
production	4		
odour	2		
taste	10		
total	20		

RAW BUTTER

Errors	Causes
mouldy butter	infection from the environment inadequately sealed packaging
malty taste	microbiological infection with *Lactococcus lactis spp. lactis biovar maltigene* contamination of milk or cream with bacteriophages
taste of fodder	inadequate or spoilt fodder
yeasty taste	yeast contamination of milk or cream
hard and crumbly butter	incorrect preparation of the cream for churning, which depends in particular on the fodder, which influences the composition of the milk fat at different times of the year

Assessment criteria and scoring grid for HEATED or COOKED BUTTER (GHEE BUTTER)

Feature	Maximum number of points	Points achieved	Note
appearance	2		
colour	2		
consistency	4		
odour	2		
taste	10		
total	20		

HEATED or COOKED BUTTER (GHEE BUTTER)

Errors	Causes
sediments	the heated butter has not been well strained holes in the strainer/draining cloth too large
a layer of liquid at the bottom of the container	not enough evaporated water
burnt taste	overheating temperature

Assessment criteria and scoring grid for HARD CHEESE, SEMI-HARD CHEESE, AND SOFT CHEESE

Feature	Maximum number of points	Points achieved	Note
appearance	2		
colour	1		
consistency	2		
Cross-section / cheese eyes	3		
odour	2		
taste	10		
total	20		

Evaluation of the characteristics of the cheeses according to the following criteria in the following order:

- the **external appearance of the cheese**: the appearance must be typical of the type of cheese being assessed, the cheese must be of the correct dimensions, the rind must be typical of the type of cheese being assessed;
- **the colour of the cheese**: it must be uniform and characteristic of the type of cheese being assessed; **- consistency**: it must correspond to the type of cheese being assessed; it may be described as spreadable, cohesive, compact, elastic;
- **cross-section**: the cheese eyes are observed to be correctly arranged, of the correct size and shape for the type of cheese ;
- **smell of the cheese**: the smell is characteristic and clean, without any foreign odours;
- **taste**: it must be characteristic of the type of cheese, without any foreign flavour, and suitably salty.

Defects in the shape of the cheese: too low, too high, inflated, irregularly shaped, concave, convex, slanted.
Defects in the rind or surface of the cheese: thick, thin, rough, cracked, abnormal, dry, moist, oily, greasy, wrinkled, mottled, mouldy, too much red spread, too little red spread, too little noble mould, damaged coating, mould under the coating or the foil, red spread under the coating or the foil.
Colour defects of the cheese: colourless, two-tone, streaky, mottled, marbled, pale, no sheen.
Cheese consistency defects: hard, firm, lumpy, coarse-grained, crumbly, gritty, chalky, crumbly, chalky, brittle, tough, sticky, elastic, smooth, soft, pasty, spreadable, water-repellent, spongy, layered, uneven, not firm enough, etc.
Defects in the cross-section of the cheese: no eyes, few eyes, many eyes, small eyes, muscular eyes, large eyes, torn eyes, atypical eyes, distorted eyes, too fine eyes, unevenly distributed eyes, cracks in the cross-section, mould on the edges, foreign mould, foreign particles, etc.
Odour defects: unclean, foreign, atypical, loose, soapy, rotten, ammoniacal,
Taste defects: pungent, sweet, sour, bitter, astringent, metallic, chemical, sulphurous, rancid, loose, empty, burnt, musty, yeasty, etc.

Errors	**Causes**
early inflation of cheese	Infection with coliform bacteria or yeasts
late inflation of cheese	Infection with butyric acid bacteria, mainly *Clostridium butyricum, Clostridium tyrobutyricum*
Exterior defects	
mouldy cheese	*moulds of the genera Penicillium and Aspergillus*
dark (black) **rancid cheese**	*Monillia nigra and Cladosporium herbarum* moulds the yeast *Torulopsis spp.*
white rancid cheese or **dry rot**	*Oospora* mould
The floury rind of cheese	*Penicillium brevicaule* mould
brown spots and **patches** on the rind	*Penicillium casei* mould
yellow rind	*Aspergillus casei* mould
Dough defects	
chalky, crumbly	milk too acidic for cheese
sticky, compacted	The rapid drop in milk temperature in the boiler
cracked	Cheese dough too acidic, milk calcium % too low for cheese, infection with butyric acid bacteria (late bloating)
bumpy	Inadequate microbiological quality of milk, inadequate occupational hygiene, and consequent contamination of milk with coliform bacteria
Odour and taste defects	
sour	Over-acidity of cheese dough due to inadequate management of the coagulum treatment process
too salty taste	Over-salting
bitter	Excessive degradation of protein to amino acids, as a result of too much, added rennet or the presence of proteolytic enzymes

Assessment criteria and scoring grid for FRESH CHEESES (CURDS) AND CHEESE SPREADS

Feature	Maximum number of points	Points achieved	Note
appearance	1		
consistency	4		
colour	2		
odour	3		
taste	10		
total	20		

CURD

Errors	Causes
whey separated in packaging	insufficiently drained curd before filling into packaging
mould on the surface	microbiological contamination from the air or the surfaces of work equipment poorly sealed, contaminated, and/or damaged packaging
overly acid curd	too long lactic acid fermentation fermentation took place at too high a temperature overdose of microbiological culture
unflavoured and insufficiently acid curd	poor milk quality, suspected presence of inhibiting substances incorrect choice of microbiological culture insufficient dose of microbiological culture too low a temperature and/or too short a duration of fermentation
crumbly curd	too intensive lactic acid fermentation (too high temperature or too long duration) too much rennet added heating of the curd coagulum at too high a temperature draining or pressing the curd for too long

bitter curd	inadequate rennet too much rennet added microbiological contamination with proteolytic micro-organisms improper storage at too high a temperature
taste of acetic acid (vinegar)	microbiological infection with yeasts and acetic acid bacteria

MOZZARELLA

Errors	**Causes**
slimy surface	improperly prepared brine (too low salt concentration)
The tough and compact structure of the cheese dough	coagulum acidification too low a temperature of the cheese grains before drawing too low a temperature of the water in which the curd is drawn
over-sour cheese dough	too much acid at curdling
The torn texture of the pieces	microbiological contamination of raw milk with gas-forming microorganisms subsequent contamination of the product with yeasts or coliforms

FRESH and WHITE CHEESE IN BRINE

Errors	Causes
slimy surface	undried surface storing the cheese in a closed container
foxed cross-section	unevenly distributed fat or additives
cheese not firm enough	too little soluble calcium in milk too large cheese grains inadequate processing of cheese grains insufficient pressing of the cheese under its weight
The coarse and crumbly texture of the cheese	excessive coagulation and/or processing temperature of the cheese grains coagulation and/or processing of the cheese grains for too long a period cheese grains are too small too long and/or too intensive pressing of the curd excessive addition of salt
too low acidity	too short a ripening period before coagulation milk ripening temperature too low before coagulation insufficient addition of microbiological culture inactive microbiological culture
too high acidity	too long a period of ripening of the milk before coagulation too high a ripening temperature of the milk before coagulation too much added microbiological culture too high a cheese pressing temperature
finely pitted or torn cheese	infection with coliform micro-organisms
unclean taste and the musty smell of the stable	storing raw milk under inappropriate conditions the prevalence of technologically harmful micro-organisms