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Testing Schemes for the Evaluation of Sensory Quality of Meat Products on a 5-Point-Scale

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Introduction

Chemical, physical, serological, histological and/or microbiological measuring processes have, up to now, been either completely or at least partially inadequate for the testing and evaluation of the total sensory quality of a foodstuff.

The "enjoyment value", the "sensory quality", which, first and foremost, make a consumer decide whether a product is worth purchasing and consuming, cannot be dealt with adequately by means of these processes (4).

Using sensory analysis, it is possible to objectify subjectively received impressions through the senses - smell, taste, sight, touch and hearing - and so to obtain findings which can be reproduced (1). Scientifically produced and practically tested product-specific testing schemes must be placed at the disposal of the sensory expert, as "tools".

Previously, the quality tests of the German Agricultural Society (DLG) has been carried out on a 20-point scheme; this has now been replaced with a new 5-point testing scheme. For the sensory analysis of meat products, ready-to-serve meals and delicatessen, the German Agricultural Society, together with the Institute for Food Hygiene of the Free University of Berlin and the Federal Centre for Meat Research, has revised the 12 existing product-specific testing schemes, transferred them into the 5-point system and tested them.

In order to come closer to the aim of continuous quality improvement the testing schemes were oriented towards specific considerations.

The testing schemes must satisfy the following requirements:

1. They must be suitably set out, clear, easy to remember and easy to learn for the tester from economic, scientific, nutritional research and trained consumer circles, in order that they can be applied confidently and without difficulty after a short learning period

2. The descriptions of quality and product (testing criteria and product characteristics) must be technically accurate and easy to understand.
3. The levels of rating must be perceptible to the senses and correspond to actual quality levels.
4. The testing schemes must be able to accommodate continuously additions and extensions, so that they can be adapted to changed production techniques and developments and also to changed patterns of consumption.
5. Suggestions for improvement of the product must be visible in specific descriptions of characteristics, or must be derivable from them.

For these reasons, descriptive and at the same time rative testing tables were devised and combined with a testing scale.

The specific testing schemes were set up and perfected during 4 years' work, under scientific control, with experts from the butchery trade, meat products industry and ancilliary industries. A total of 730 trials were made in special "sensory seminars" (training courses for testers) and testing sessions. Theoretical conversions from the 20-point scheme to the 5-point testing scheme were made with 14,000 testers' results (table 1). These conversions were necessary in order to achieve realistic weighting factors and prize-classes.

The new DLG testing schemes are divided up into four areas (table 2):

The 5-point scale is the basic component; other parts are the rating table and the ranges of rating and evaluation.

1. The 5-Point-Scale

The points on the 5-point-scale correspond to a range of marks (table 3).

The points are assigned to:

- verbal quality descriptions, from "very good" to "insufficient", and
- general descriptions of characteristics, from "expectation of quality fully met" to "not valuable".

The 5-point scale with descriptions is the non-specific rating scheme.

The positive description of "very good" = "expectations of quality fully met" corresponds to 5 points; although a score of 4 points means "good", the quality it denotes is only slightly less than that denoted by 5.

The 0 = "insufficient" denotes exclusion from the test - e.g. if samples are spoiled.

The reasons for exclusion or non-valuability should always be given under "Remarks" in the testing scheme.

2. The Rating Table

The rating table contains:

- the testing criteria (sensory sub-qualities)
- the specific product characteristics

This is the specific rating scheme.

2.1. The Testing Criteria

The total sensory quality of a meat product is sub-divided into sub-qualities = testing criteria: e.g. for raw sausage - external appearance (form, colour, colour retention), appearance (colour, colour retention, composition in section), consistency, smell and taste.

Smell and taste have been deliberately combined into one testing criterion, for all meat product schemes. Clear distinction between and designation of impressions of smell and taste would therefore lead to the danger of double rating -i.e. the duplication of the same defect - e.g. "yeasty" - which would work against practical product improvement.

Subdivision into further testing criteria is always possible, e.g. for scientific investigations. For this, practical tests with a sufficient quantity of samples must be made. According to our experience at least 200 individual results from different samples should be evaluated in order to establish weighting factors for the testing criteria and thus their relative importance.

Equally, the test can be confined to a single criterion; e.g. where, in the case of a certain criterion, particularly serious production defects are revealed, or where the criterion is to be modified.

2.2. The Specific Product Characteristics

Individual product characteristics can be added or removed. They can be adapted to changes, so that advanced technologies and/or changed patterns of consumption can be assimilated into the rating tables.

The list of characteristics is intended to help the tester to classify and describe his sensory impressions; it thus helps to ensure uniformity in the report. The uniform designation of characteristics also contributes to uniformity in the formulation and description of concepts.

An "other defects" designation has been placed under each testing criterion for characteristics which occur only infrequently or are new. These always require special explanation under "Remarks". The rating table contains negative descriptions for all meat products. The aim is to obtain, through expert evaluation, guidelines for the improvement of the product; attention should be directed to quality reserves, so that these can be exploited.

3. The Rating Range and the Evaluation Range

The 5-point scale serves

- the rating of the specific product characteristics
- the rating of the testing criteria (sensory sub-qualities) and
- the rating of the total sensory quality, expressed in the "quality number".

3.1. The Rating Range

3.1.1. The Rating of the Product Characteristics

The product characteristics are listed with the appropriate rating points (according to the 5-point scale) for each. The product characteristics and the rating points provide the tester with a kind of "guide-line"; he can, however, also use the points' scale further, provided the exclusion of particular points is not indicated by a dash: e.g., under the testing

criterion "smell/taste", 4 and 3 points may not be awarded for "mouldy/musty", as this is a serious defect.

3.1.2. The Rating of the Testing Criteria

- The lowest point given to the product characteristics serves as a basis for evaluation, as the most serious defect has the greatest negative influence on quality.
- If a point is awarded twice or more, the next lowest point-score is taken, e.g. 4 + 4 = 3. Practical tests showed that several minor deviations or defects accumulate to produce a substantial loss of quality.

3.2 The Evaluation Range

3.2.1. The Weighting Factors

The rating in points of a testing criterion, the testing criterion result, is multiplied by the specific weighting factor given to it, producing the "weighted rating of a testing criterion".

The weighting factors, therefore, accentuate or diminish the importance of the testing criteria (table 4), so that these have a greater or less influence on the final evaluation of the total sensory quality, on the quality number.

3.2.2. The Evaluation of the Total Sensory Quality

All the weighted ratings of the testing criteria are added together to give the "total weighted rating"; this is divided by the sum of the weighting factors to give the "quality number", which can also be measured on the 5-point scale.

The total sensory quality of the product is expressed with the quality number.

$$\frac{\sum (T \times W)}{\sum W} = Q = \frac{\text{Sum of (Testing Criterion Result x Weighting Factor)}}{\text{Sum of Weighting Factors}} = \begin{array}{l} \text{Quality} \\ \text{Number} \\ \text{=====} \end{array}$$

3.2.3. Prerequisites for prizes

If prizes are to be awarded as incentives either within or outside a firm, we suggest the following prize limit and prize classes:

- 1st Prize : 5.00 points
- 2nd Prize : 4.50 to 4.99 points
- 3rd Prize : 4.00 to 4.49 points
- No prize : less than 4.00 points

The following condition was agreed for the awarding of a prize:

So that samples which display obvious defects in testing criteria which have a low weighting are not awarded a prize, each testing criterion must have an unweighted score of at least 3 points.

Advantages and Effects of the new Testing Schemes:

- Weighting of the individual testing criteria (sensory subqualities) is close to what consumers consider important, i.e. the testing criterion "external appearance" is less heavily weighted than the "smell, taste" testing criterion which is of prime importance in the expectations of consumers.

In this way the producer is encouraged to concentrate on improving smell and taste.

- If there is an alteration in consumer behaviour, or reorganisation of production, the individual weighting factor can be increased or decreased accordingly.

The relative values of the individual testing criteria are thus altered. Concrete statements can therefore be made with specific aims for practical use.

- The testing scheme can also always be adjusted
 - . in the rating table (alteration, inclusion of new categories, or deletion) and
 - . in the testing criteria (inclusion, deletion or scrutiny of individual criteria)to new products or changed production techniques and/or changed consumer behaviour, without a fundamental alteration of the scheme being necessary.
- The testing process is separate from the mathematical evaluation.

It is intended for the tester to concentrate only on the rating table and the rating of the testing criteria, and thus on the rating of the product.

The evaluation of the total sensory quality, expressed in the "quality number", is independent of the actual testing process.

The test is therefore objective to a very great extent.

- The tester has to come to a clear decision by means of the 5-point scale; the tester can also be given "guide-points" for the rating of product characteristics.
- The points' scale is also intelligible and meaningful for the non-expert, for the consumer, thanks to the verbal descriptions of quality from "very good" to "insufficient".
- The "quality number", which is on the 5-point-scale, makes possible a comparison of quality with other foodstuffs judged by the same principle, also in other areas of the food industry.

References

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Summary

Testing Schemes for the Evaluation of Sensory Quality of Meat Products on a 5-Point-Scale
Sinell, Weber, Hauptmann

Chemical, physical, serological, histological or microbiological investigations register sensory quality characteristics very inadequately or not at all.

For the sensory analysis of meat products 12 product-specific testing schemes were therefore developed and tried on over 700 products.

The testing schemes compries

- the 5-point scale with descriptions of the rating points;
- the rating table, sub-divided into testing criteria (sub-qualitites), under which specific product characteristics are listed;
- the range of rating, with fixed rating conditions;
- the range of evaluation, with weighting factors which are assigned to the testing criteria, and the prerequisites for prizes.

The sum of the weighted testing criteria result is divided by the sum of the weighting factors. The result is termed the quality number

$$\frac{\sum (T \times W)}{\sum W} = Q = \frac{\text{Sum of (Testing Criterion Result x Weighting Factor)}}{\text{Sum of Weighting Factors}} = \begin{array}{l} \text{Quality} \\ \text{Number} \\ \text{=====} \end{array}$$

Table 1: Empirical and Theoretical Bases for the Determination of Weighting Factors.
Period 1980 - 1983.

Type of Test

Meat Products

Samples

Testers

5-point special groups
(4 to 5 persons per test group)

150

30

All test groups for DLG tests
(3 to 5 persons per test group)

400

1,600

Individual tests at sensory seminars
(Tester training)

180

540

Total

730

2,170

Theoretical conversions from the
20-points system to the 5-point system 14,000

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Table 2:

5-Point Testing Scheme

Non-specific
Rating Scheme
5-Point-Scale

- Quality Descriptions
- General Characteristics

Specific
Rating Scheme
Rating Table

- Testing Criteria
- Product Characteristics

Rating Range

Description of the Product Characteristics
Range of marks

Evaluation Range

Determination of Result

- Testing Criterion Result
- Weighting
- Quality Number

Prerequisites for Prizes

- Minimum Value of Testing Criteria
- Minimum Value of Quality Numbers

Table 3: Non-Specific Rating Scheme

Points	Quality Descriptions	General Characteristics
5	Very Good	Expectations of quality fully met
4	Good	Minimal deviation
3	Satisfactory	Noticable deviation
2	Less satisfactory	Obvious defect
1	Unsatisfactory	Bad defect
0	Insufficient	Not valuable

Table 4: Survey of the Testing Criteria and their Weighting Factors
Meat Products

Meat Products

Testing Criteria	Weighting Factors
1. External appearance	1 (10 %)
2. Appearance, colour, colour retention, composition	3 (30 %)
3. Consistency	2 (20 %)
4. Smell and taste	4 (40 %)