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With kind regards
from 484
the author

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NEW METHODOLOGICAL CONCEPTS FOR THE SENSORY EVALUATION OF MEAT PRODUCTS

by

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S u m m a r y

Sensory quality evaluations are always the ultimate criterion in assessments and the base for establishing correlations with instrumental results. Four fundamental requirements should be fullfilled in developing a rational scoring scale. Instead of the arbitrary assignement of importance of different quality components in the over-all quality of a product, quality contribution coefficients are now weighted objectively. Reference standarts for visual and kinesthethic characteristics should be used more extensively to improve the accuracy and consistency of the sensory analyst. Intensity standards should supercede ambiguous quantitative definitions and may be based upon the dilution index. For flavour characteristics the flavour dilution profile technique permits a precise comparison of different flavour profiles.

All food products are ultimately jugded by our senses and the various attributes of quality are measured on the basis of sensory evaluation. The trend to introduce instrumental methods for quality evaluation and control is rational but sensory quality scores are always the ultimate criterion for establishing correlations by any proposed instrumental method, either chemical, physical or microbiological.

If the correlation coefficient is sufficiently high and the instrumental procedures are as rapid, simple and inexpensive as the sensory evaluation, instrumental methods can readily replace the human senses. Recently such instrumental quality measurments are becoming available but these are still few and they are incomplete because far too little research is done in this field. We have therefore to continue to rely upon sensory evaluations as the main key to quality scoring, grading and control.

Inadequacies

The inadequacies of our sensory instruments due to very complex psycho-physiological reasons are well know to specialists although they are not generelly recognized. They involve such factors as individual differences in sensitivity, influence of psychic unrest or stress, state of health, environmental conditions, conscious or subconscious bias, changeability of mental quality standards due to lack of absolute reference standards, inconsistency i.e. lack of precision in dublicating results and other factors.

Instrumental methods may, of course, suffer also due to low precision and accuracy and may show variations of individual instruments and procedural technique. Both sensorial and instrumental methods always require proper calibration of the respective instruments involved.

Ranking by Scores

This most employed method of quality assessment assignes the product a numerical rating as a quantitative notation for different degress of quality attributes such as color, tenderness, juiciness, aroma, flavour and others. The actual score reflect the judge's personal impression of the product at the time of scoring. A further advantage is that a number of samples can be compared and tests made at different times can be, to a certain extent, compared with each other.

There are, however, several distinct disadvantages to the ranking method by scores (1). Scoring systems are usually based upon some arbitrary scale of values with too many points and a unsymetrically constructed scale. The judges have not always a precise concept of the quality associated with each point of the scale and use an ambiguous terminology due to an insufficient definition of the quality component involved.

Four Fundamental Requirements

The four fundamental requirements (2) which should be observed in developing a rational scoring scale are the following:

1. Limitation of scale - a limited number of points- preferably a 5 point scale, and only for very specific purposes a 9 point scale should be used. It is certain that even very experienced specialists cannot differentiate a greater range of quality levels than nine and generally a 5 point scale is sufficient.

2. Symetric construction of scale - each quality component should have a similar symetric scaling of quality levels.

3. Distinct differentiation of each point of the scale pertaining to precisely detectable quality levels with precise tolerances and upper and lower control limits (difference threshold) so as to leave a small margin of indecision to the judge,

4. Clear defintion of each quality level of the scale preferably anchored to distinct reference standards.

Quality Contribution Coefficients

It may be taken for granted that some quality components are more important and some are less characteristic for the economic value and over-all quality of the product. Therefore in accordance with the assumed importance of the quality component the respective score is multiplied by a contribution coefficient. But who is to say that, of a total score, color, tenderness, juiciness or flavour should have a larger percentage value than other quality components?

Such quality contribution coefficients have been assigned hitherto arbitrarily on the basis of the experience and judgment of the originator of the respective scoring system.

Important methodological progress has changed this arbitrary approach and the relative weights for the different quality components can now be calculated statistically (3,4).

The integration of separate quality characteristics into an over-all quality by assigning relative contribution coefficients to each of the quality components is done objectively by the use of multiple correlations.

The individual sensory scores for the different quality components are being correlated against the over-all score established for the given product by a qualified sensory panel. This panel scores the quality differences and preference (difference-preference panel).

The contribution coefficients are calculated statistically from the above correlations and regression equations and a sequence of importance of the quality components is objectively obtained for the given product.

For canned ham the over-all quality score established objectively by the above method shows the following weighted sequential importance as valid for Polish assessments (3):

1. Flavour	48.7 %
2. Odour	19.1
3. Juiciness	12.9
4. Fatness (leanness)	11.0
5. Saltiness	6.4
6. Colour	1.2
7. Tenderness	0.5
8. Sliceability	0.2
Over-all quality	100.0 %

Current research in the Meat Quality Laboratory of the Polish Meat Institute (5) showed that for comminuted sausages of the Wiener type the interdependence of 15 different quality components and their influence upon the over-all quality of the product may be divided into three groups. To the first group containing main quality contribution factors belong flavour, colour and consistency. These three components show a high statistical significance and contribute approx. 68% to the over-all quality. Then there are quality factors of medium contribution and the third group exerts a negligible influence upon the over-all quality of the product.

Weighting the quality components primarily by the device of the partial regression coefficients we are now able to determine objectively the relative influence of the different quality characteristics on over-all quality and establish genuine quality contribution coefficients for each product.

Reference Standards

Accuracy in sensory quality scoring is much greater if objective standards are established and available to the grader for ready reference. Such unvarying reference standards improve the accuracy and consistency of the sensory analyst and permit easy restandarization of his mental standards derived from his training and experience.

For all visual attributes like size, shape and color illustrative material like photographs, painted models, drawing, color chips etc. are used extensively and are of great help as reference standards.

Kinesthetic characteristics, primarily firmness or softness of sausages or bacon may be measured physically by compression and expressed by suitable reference standards which simulate the sensation which a judge experiences through his finger feel.

Small plastic cylinders whose firmness is measured instrumentally and will not change from one time to another or through repeated testing are good reference standards. A set of five or nine reference standards representing a rating range of "very firm" - "firm" - "slightly soft" - "soft" - and "very soft" permits an easy restandarization by actually compressing them and becoming thoroughly familiar with the stimulus range experienced in assessing the firmness of sausages, f.ex. of the Serdelowa type (45 mm diameter) with a firmness range of 450 - 850 g/cm^2 and of the normal Polish pork sausage type (Zwyczajna) with a 36 mm diameter and with a firmness range of 850 - 1450 g/cm^2 with a difference threshold of 80 g/cm^2 for the different firmness levels (6).

Intensity standards

Odour and flavour components are difficult to evaluate instrumentally. New research tools may lead in the not too distant future to the direct instrumental measurement of these most important quality components.

For the time being the following sensory standardization methods may help in some way to define these important quality components.

The degree of saltiness in a meat product may be expressed by the sensory index of saltiness, i.e. by matching the test sample with one of the reference solutions consisting of a series of NaCl solutions ranging from 0.9 - 2,2% in 0.1% steps. Thus verbal definitions like "very mild", "salty" or "oversalted" can be expressed in objective reference standards (7).

The intensity of odor or flavour components can be measured by the determination of the dilution index i.e. the identification threshold of the extract slurry of the material under study. This odor or flavour dilution index is preferably expressed in percent dilution of the meat product. The index expresses the actual amount of sensory stimulus detected by the sensory apparatus. The greater the odor or flavour intensity of the product, the lower the dilution and the percentage value of the index (8).

F.ex. in examining the influence of ripening upon the increase of flavour in raw fermented sausages of the Cervelat type the dilution index is in the freshly made product around 1.4%, after 2 weeks - 1.3%, after 4 weeks - 1.2%, but after 6 weeks 0.6% and even lower (0.3%).

Flavour Standards

Quality and uniformity of flavour are per se an important requirement in all branches of the food industry. This means also uniformity and acceptability of the olfactory and gustatory components in meat products. Slight differences may result in changes in preference.

At present our only method of distinguishing and controlling flavour quality is by tasting. We know, of course, that sensory judgments of flavour are far from being uniform, consistent and reproducible. Much basic research is needed to establish objective standards for the manifold flavour components (9).

Flavour Dilution Profiles

The flavour dilution profile technique provides us with a simple tool to characterize the complex aroma and flavour behaviour of the tested product in dilution steps between the identification threshold and the standard 33% extract solution of the product. The quality, intensity and range of preception of each single component is recorded.

While examining the varying dilution levels of the extract an interesting sequence of sensations appear and disappear. Since the comminuting and mixing of the sample with water and the extraction and filtration is always done in the same way a direct comparison of the flavour dilution profile is obtained and the sensory properties are characterized in three dimensions i.e. qualitative, quantitative, and sequential.

The meat sample is comminuted by a laboratory grinder with a 4 mm sieve and a second time with a 1.4 mm sieve, mixed with two parts of distilled water (t = 35°C) and one part of ground meat and extracted for 30 minutes on a rotary shaker (80 revolutions per minute). After the volume has been carefully adjusted with distilled water, the slurry is filtered through 5 layers of gauze and the standard extract solution diluted for the determination of the dilution index and the flavour dilution profile. Both are expressed in weight percentage of the meat sample (100%).

The testing is done in booths with the single sample method and the analyst is required to state the quality, intensity and sequence of his sensations.

The results are treated statistically.

Flavour Profilograms

The originally proposed graphic expression of the flavour dilution profile (8) has been further improved.

The dilution levels are shown on the abscissa, the intensity of sensations on the ordinate and their sequence of preception is marked numerically on the plotted components.

The intensity values are based on a 5 point scale - 1 threshold, 2 slight, 3 moderate, 4 strong, 5 very strong.

The duration of perception of one particularly important flavour component may vary at a set dilution level from one product to another of the same type and could be marked off additionally in seconds above the respective dilution flavour or seperately on graphs paper with intensity and time coordinates, intensity values on the y-axis, intervals of time on the x-axis.

This additional time-intensity evaluation is particularly valuable in cases where a product has an outstanding or often unpleasant characteristic which has to be in some way controlled. When it is desired to have a prolonged flavour, time-intensity evaluations are most helpful in screening different flavour components to see which is most important. Time-intensity curves may deepen our flavour knowledge and can illustrate additionally a dilution profilogram of a particularly successful product.

Flavour changes due to maturing or the influence of different treatments upon the flavour of meat and meat products can be easily checked on these dilution flavour profilograms.

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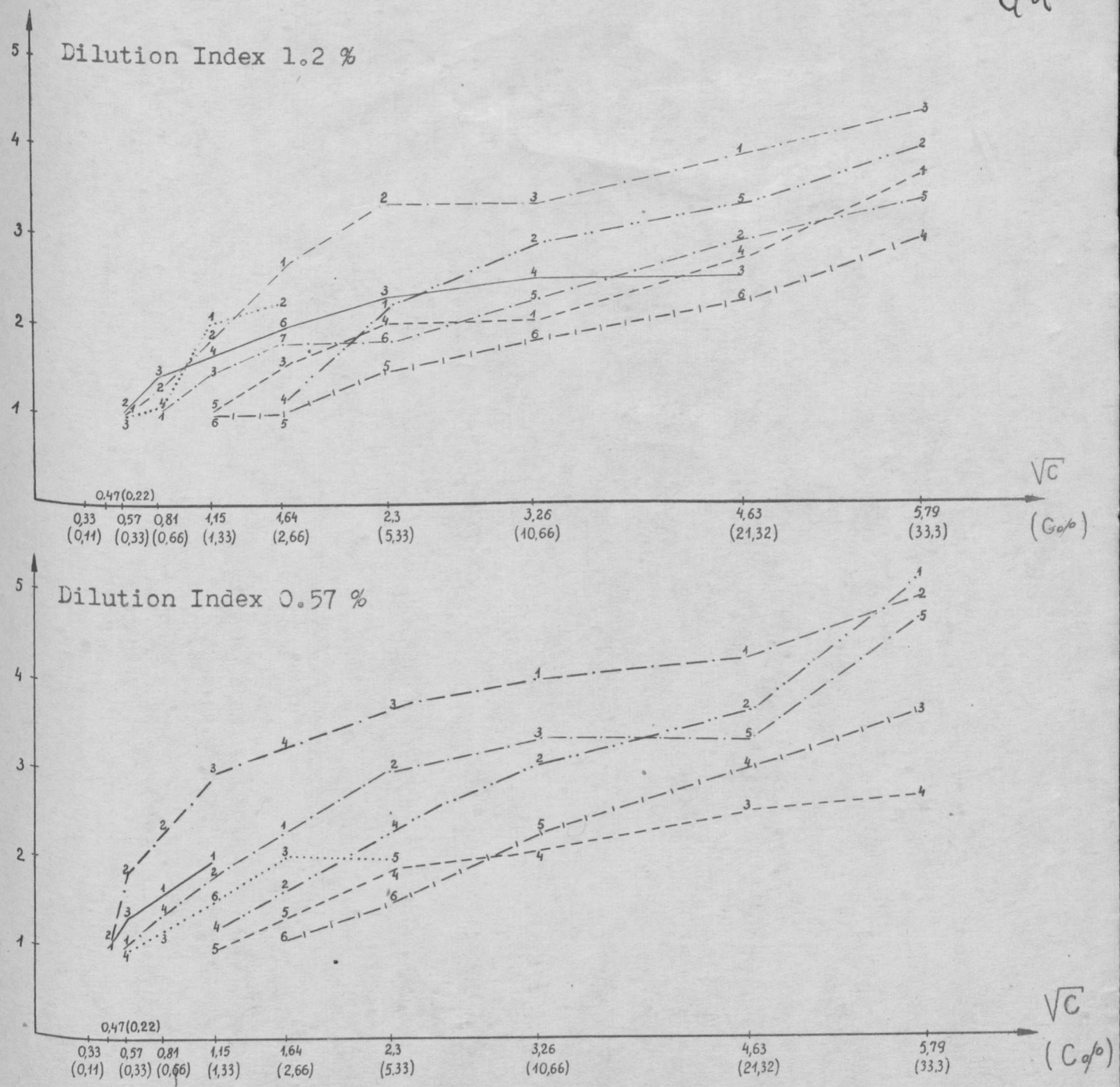

Two dilution flavour profilograms of a Cervelat raw sausage fermented with the Bactofermente starter culture and matured 4 weeks (upper) resp. 6 weeks (lower) at 20°C and 70 % rel.hum.

———	charcoal note	– · – · –	very ripe cured meat
– – – – –	sour	·····	sweet
·– ·– ·– ·–	salty	– · – · – · –	well smoked phenolic
–·–·–·–·	peppery-spicy		

Note the fast disappearance of the charcoal note in the well-matured product already at the 1.33 % dilution level, while after 4 weeks ripening this undesirable flavour note persists to the 21.32 % dilution level.
The very ripe-cured meat note increases distinctly it's intensity while the sour note becomes milder and slower in sequential appearance. The salty note and the peppery-spicy note increase considerably their intensity during ripening and change their sequence of appearance.