APPLICATION OF THE RIDGELIMETER FOR TESTING THE CONSISTENCY OF JAM*

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Consistency is an important consideration in the evaluation of the quality of foods. Consistency has not been clearly defined and the realitonship between the various factors, commonly thought to be related to this quality, has not been fully understood [1]. Consistency is related to the sensory property often described as "mouth feel" and is influenced by the amount, size, and shape of the insoluble solids as well as by the viscosity of the juiciness etc. Mesaurement of "gross viscosity" is most frequently used as an index of the consistence of various food products, and methods appropriate for measuring the viscosity of Newtonian fluids have been applied. Fruit jams, however, do not behave like Newtonian fluids. They are rather an elastic or pseudoelastic body.

The consistency of jam is determined by various factors in connection with consumer preference in the individual countries. Under jam we generally undestand a jelly from fruit, pectin, sugar and other foodstuffs. Its consistency is characterized generally by a medium softness, evenness of the passing condition of uniform apportionment of the fruit fragments. Jams must not contain other undesirable components, for instance stone particles, flowercups, etc., and juice must not segregate.

At present the consistency of jams is only sensor tested by skilled panel groups. Several properties of consistency affect appearance and taste. The sensory results for consistency are open to debate. Obviously, any single test can at best provide an empirical measurement of certain related properties. In selecting an instrument to measure the consistency of jam, the following requirements were considered. The instrument should correlate with the sensory properties generally associated with consistency. It should have maximum sensitivity in the particular range of consistencies of most concern in evaluating these products. It should be simple in design, easy to operate, and suitable to standardization. The ridgelimeter, developed by COX and HIGBY [2] and converted to the metric system [3], is a suitable instru-

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ment for the measurement of consistency. It is used for testing jelly strength of pectin, starch hydrolysis products, gelatine and agar-agar [4, 5].

The principle of measurement of jelly strength (one main property of consistence) with the ridgelimeter is based on the slump of a standard jelly body under its dead weight, expressed as slump percentage referred to the original standard height of 80 mm.

Our investigations applied the ridgelimeter for testing consistency, especially jelly strength of jams. Simultaneously, a scoring system for the sensory evaluation of consistency and jelly strength of jams has been elaborated.

Score	Decariptive terms for consistency	Jelly strength
5	uniform soft jelly, pulpy, well-spreadable, with no undersirable components and separation of juice	soft jelly
4	not perfectly uniform, rather soft or compact jelly, pulpy, well-spreadable, with no undersirable components, some separation of juice	rather soft rather compact
3	not uniform, rather too soft or compact jelly, just spreadable, with no undersirable components, medium separation of juice	rather too soft rather too compact
2	too soft or compact jelly, hardly spreadable, with some undesirable components, strong separation of juice	too soft too compact
1	liquid or dry, not jelly, with many undersirable components, strong phase separation	liquid dry

The sensory evaluation involved 5 skilled experts. The averages were calculated from the 5 judge-scores.

The sampling for instrumental testing immediately followed production. The warm jams were bottled in standard cups adding 2 ml 48% citric acid and preserved in a room at about 25°. After 24 hours the samples were clumped on a glass plate and tested. An exact measurement requires a smooth surface, a different condition for jams with fruit fragments. The results were averages from double tests.

In our investigations the following jams were tested both sensorily and instrumentally:

strawberry 19 jams; 15 diabetic cherry jams;

black currant 12 jams; 6 strawberry and apple jams;

3 diabetic jams from cherry and apple; and 2 apricot jams.

There are in total 57 sensory results for consistency (jelly strength) and slump percentage each.

The results were interpreted by simple correlation and regression [6]. The interpretation of the results was controlled by two principles:

1. The relationship between the consistency of jam and slump percentage is other than simply linear. The consistency of jam is undesirable, if

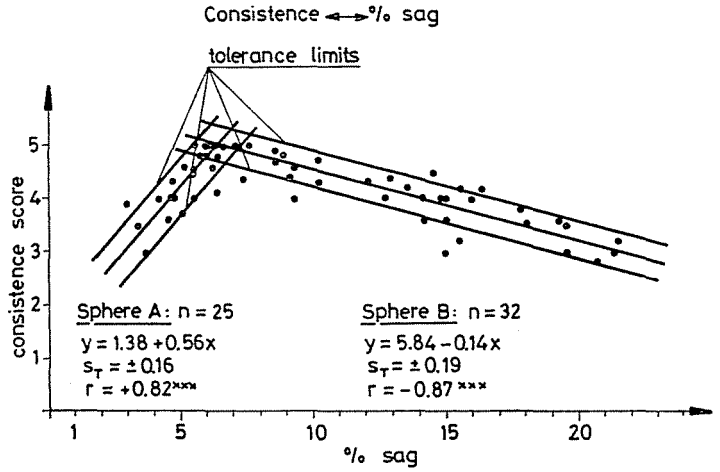

Fig. 1

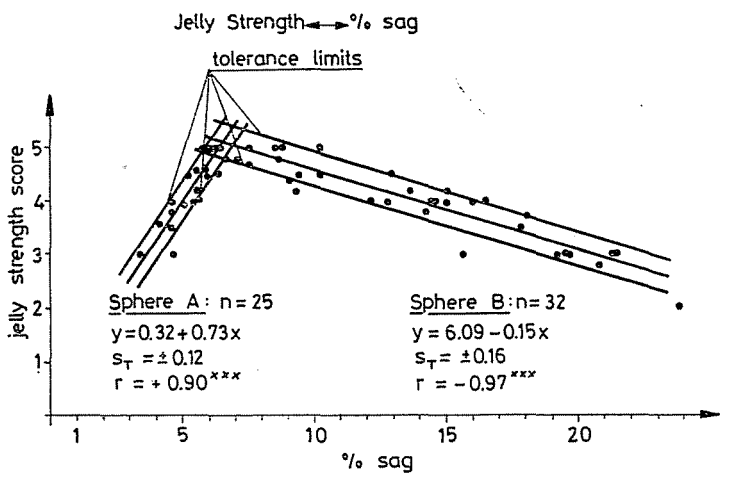

Fig. 2

either too compact or too soft. Other consistency errors support this appearance more or less, which was taken into consideration at the elaboration of the scoring scales.

2. The jelly strength affects the consistency of jam and play a decisive role. The correlation and regression between ether consistency and slump percentage, or between jelly strength and slump percentage have to be calculated separately. The relationship between consistency and jelly strength is interesting, too.

The calculated results are shown in Figs 1, 2 and 3.

The correlations of +0.79 to 0.97 and —0.87 to —0.98 show close relationship between the investigated properties of jams. The correlation between jelly strength and slump percentage was by +0.90 and —0.98 higher

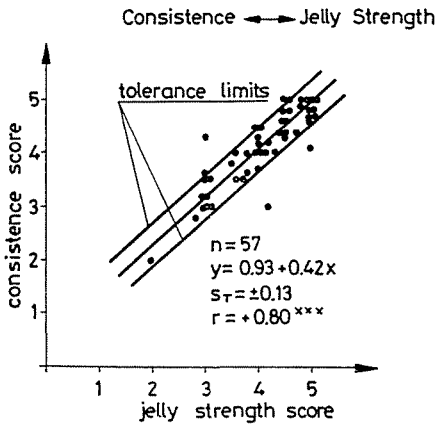

Fig. 3

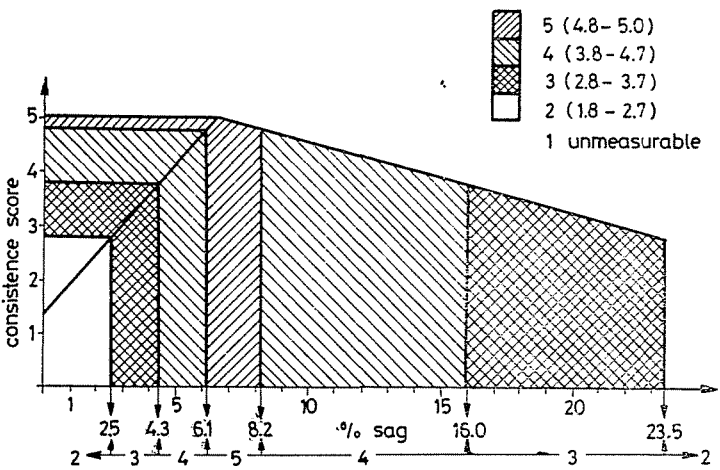

Fig. 4

than that expected between consistency and by +0.82 and —0.87, because the consistency involved some other properties and sensory factors. The calculated correlation coefficients are very significant. The consistency determined by jelly strength is about 64% (r = + 0.80).

The ridgelimeter-values with an average error of about 1% are suitable for supporting sensory scores for consistency of jams. One aim of the investigation has been realized, and in the near future jelly strength will be tested

mainly by ridgelimeter rather than sensorily. The other properties affecting consistency can further be evaluated sensorily and supported by ridgelimeter tests. Relationships between consistency score and slump percentage will be tabulated. Fig. 4 indicates the theoretical conception for this table and proposals for the slump percentage limits. For the total quality evaluation of jams it is very important to restrain the somehow uncertain sensory quality tests and to extend instrumental tests.

Summary

The consistency of 57 samples of different jams produced in factories of the GDR was investigated using the ridgelimeter (Cox and Higby [2] and by sensory evaluation. The mathematical-statistical evaluation of the results showed a good correlation between the ridgelimeter values and the sensory quality. This fact gives a possibility to extend the use of instrumental methods in the quality determination of jams.

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