

A Sample Bias in the Evaluation of Smoked Frankfurters by the Triangle Test

SUMMARY—A taste panel was able to determine the difference between smoked and unsmoked frankfurters, at a statistically significant level, only when the smoked frankfurter was the "odd" sample; non-significant selections were made with the unsmoked frankfurter as the "odd" sample. Positional differences of the "odd" sample in tasting the three samples did not affect its selection. Determination of difference between two food products by the triangle taste panel test can be affected by the choice of sample for the "odd" sample.

INTRODUCTION

THE DIFFERENCE between two samples of a food product can be evaluated through use of the triangle test procedure in which a sample of one product is compared with duplicate samples of the second product. Theoretically, in the absence of any differences, random selection should result in each sample being identified as the odd sample in one-third of the tests. Harrison *et al.* (1950), however, have shown that there is a significant tendency under these conditions to choose the middle sample as the "odd" one. This was confirmed by Harries (1956) who extended this positional bias to the tendency toward pairing of the first and last samples in a series of five. This bias may not exist when actual differences between the samples are present. Trolle (1964), while studying the evaluation of the taste of beer by the triangle test, observed that the "odd" sample had a higher percentage of correct selections than each of the two identical samples, all six position combinations of presentation taken into consideration.

Recently Grim *et al.* (1965) reported an interesting phenomenon that occurred in the testing of irradiated whole egg magma. Panel members were less able to identify correctly the non-irradiated control material than the irradiated egg magma when each was presented as the odd sample. We have observed a similar response in the detection of differences in flavor between smoked and unsmoked frankfurters.

EXPERIMENTAL

THREE SETS OF frankfurters, prepared in our laboratory from a standard formulation, were cooked in an air-conditioned, temperature and humidity controlled smokehouse using a standardized program of temperature and humidity changes over a period of 90 min. Smoked frankfurters were exposed to hickory smoke for the entire 90 min cooking time.

For the taste panel test, frankfurters were dropped into boiling water for 2 min, cut into approximately $\frac{3}{4}$ in. pieces, and held in a steam table. Pieces of frankfurters were served to the trained panel in randomly coded portion cups. The panel consisted of 30 members of the laboratory, most of whom were available for each test. The panelist was requested to select the "odd" sample on the basis of taste from the three presented. Unlimited sampling was permitted, with no time limit. Water was available for use between samples if desired. Two groups of panel tests were done with each set of frankfurters, one in the morning and one in the afternoon. In one group the "odd" sample was the smoked frankfurter; in the second the "odd" sample was the unsmoked frank. The order of presentation was not the same for each set of franks. The data were analyzed for degree of significance using the tables of Roessler *et al.* (1948).

The results of the tests for recognition of smokiness in three preparations of frankfurters by selection of the "odd" sample in a triangle test are shown in Table 1. The number of correct selections when the "odd" sample was the *smoked* frankfurter is significant; however when the *un-smoked* frankfurter was the "odd" sample the number of correct selections was not significant.

In the initial series of tests (Experiment 1) the panelists received the samples, and presumably tasted them, in random order. However, to eliminate the possibility that the panelists themselves arranged the cups in alphabetical or numerical order and that this in some way affected the

Table 1. Detection of the difference between smoked and unsmoked frankfurters by the triangle test.

Experiment No.	"Odd" sample	
	Smoked	Unsmoked
1	24/40 ¹ ***	11/27
2	18/31 **	12/29
3	19/21 ***	11/22

¹ Number of correct selections/number of judges.

** Significant at P = 0.01; *** Significant at P = 0.001.

selection, the samples in the next two experiments were presented in approximately equal numbers of all six possible position combinations with panelists requested to taste samples in the order indicated. Experiments 2 and 3 showed no difference as a result of sample position—the selection of the smoked "odd" samples was statistically significant whereas the selection of the unsmoked "odd"

Table 2. Effect of the position of the "odd" sample on the correct selection of smoked and unsmoked frankfurters.

	Sample position		
	Left	Center	Right
<u>Experiment 2¹</u>			
"Odd" sample smoked	5/11 ²	6/10	6/10
"Odd" sample unsmoked	5/10	4/10	3/9
<u>Experiment 3</u>			
"Odd" sample smoked	5/7	7/7	7/7
"Odd" sample unsmoked	4/7	3/6	3/7

¹ Experiment numbers correspond with those in Table 1.

² Number correct selections/number of judges.

samples was not. The details of the distribution of the "odd" samples in the various positions and the results obtained are shown in Table 2.

For the third experiment (Table 1) the intensity of smoke to which the frankfurters were exposed was greatly increased. Nineteen of 21 panelists correctly identified the smoked frank when it was the "odd" sample, by far the largest number correctly identifying the sample. However, even though the number identifying the unsmoked "odd" sample increased, proportionately, with the heavily smoked samples it was still short of statistical significance.

No explanations are available at this time for these observations, and it is not known whether similar effects have been observed in testing other foods. However, since it has been reported by Grim *et al.* (1965) and now in our studies, this discrepancy in selection of "odd" samples may become a factor in planning triangle tests. By implication, it may be possible to dismiss as not significant a true difference between products as a result of using the wrong "odd" sample.

REFERENCES

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