Susceptibility of Types of Peanuts to Rancidity Development[1,2]

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UPON examining some raw and processed peanut oils several years ago somewhat higher peroxide values were found in the Spanish than in the Runner or Virginia types. Since Spanish accounts for about 40% of the harvested Georgia peanut crop, it was desirable to determine whether this result was merely a chance occurrence due to adverse conditions during harvesting, curing, or storage. Therefore a large number of samples from the crops of 1945 through 1950 were examined for rancidity development.

Experimental

Most of the peanuts used in this study were grown under the supervision of the Botany Department of the Georgia Experiment Station so that a background knowledge of cultural practices, harvesting, curing, and storage conditions was available. In addition, nuts were obtained in the open market. Only No. 1 peanuts having less than one or two milliequivalents of peroxides per kilogram of oil were used.

Rancidity was induced in cold pressed oils by aeration and heating as in the active oxygen method (1). It was also found possible to induce rancidity in raw or roasted peanuts by a variation of this procedure, namely, aeration and heating the nuts at 98°C. in an Erlenmeyer flask. Further trials showed that the test worked equally well when the nuts were stored in open jars. In either case peanuts were removed at intervals, the oil expressed, and peroxides (2) determined. Peroxide formation in the oil was quite slow when whole peanuts were heated so that heating raw peanuts for 24 hours was roughly comparable to direct treatment of the oil for one hour. In addition to accelerating rancidity development by storing at 98°C., roasted nuts were also kept in tightly capped jars at room temperature in both light and dark, samples being removed at weekly intervals.

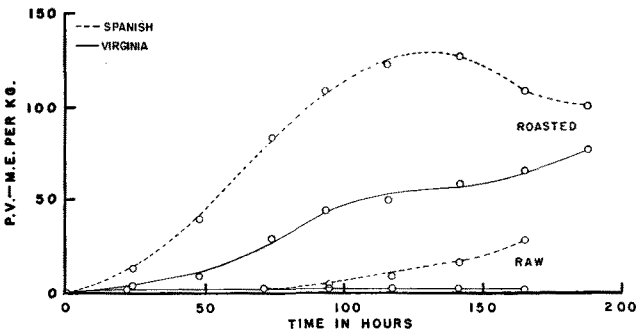

FIG. 1. Peroxide values of oils from raw and roasted peanuts stored at 98°C.

The results illustrated in Figure 1 are typical of those obtained in a great many trials over a six-year period. In this case peroxides developed more rapidly in Spanish than in Virginias. Similar results in other trials also showed that Spanish were more susceptible than the Runner type. As was expected, cold pressed oils from nuts roasted at the usual commercial temperature (about 150°C.) and then held at 98°C. became rancid more quickly than oils from raw nuts stored likewise. In several trials the peroxide values reached a peak and then decreased as shown in the curve for Spanish. This characteristic is a fairly common occurrence in the active oxygen method; however oil in whole shelled peanuts developed lower peaks than did the free oil itself.

Although the great majority of trials indicated that Spanish were more susceptible to rancidity than either Runners or Virginias, in occasional cases the results for all types were unaccountably irregular. The means of all the trials involving the two treatments on raw and roasted nuts are summarized in Figure 2. Even though there was a large yearly variation probably caused by several factors such as length of storage before test, curing conditions, moisture content, etc., the oils from Spanish were more susceptible than from either Runners or Virginias for several consecutive crops.

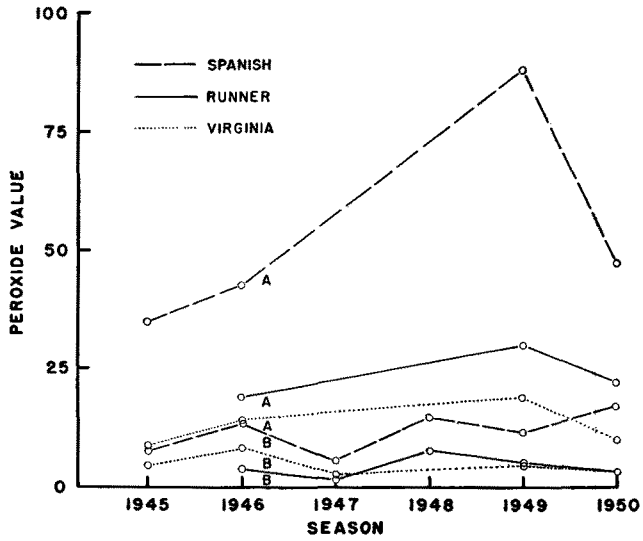

FIG. 2. Average peroxide values of peaunt oils—1945-1950.
A = Roasted peanuts held at 98°C. for 50 hrs.
B = Raw peanuts held at 98°C. for 150 hrs.

Shelled Spanish usually weigh 80 to 90 to the ounce while Runners ordinarily run 50 to 60. Besides comparing oils from common size roasted Spanish and Runners, trials were made, using Spanish 40 to 50 to the ounce and Runners 80 to 90. In both cases (Figure 3) the Spanish oil was more susceptible than the Runners to rancidity. Apparently size of peanuts did not account for the difference in susceptibility of the two types.

Besides keeping peanuts at 98°C. as in previously mentioned trials, roasted nuts were held at room temperature in tightly capped jars. The oils from Spanish (Figure 4) were higher in peroxides than oils from Runners throughout storage in darkness for 7 weeks. Similar results were obtained from other trials on all three types of nuts held in light and in darkness.

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[2] Contribution of the Ga. Expt. Sta. Journal Series Paper No. 213.

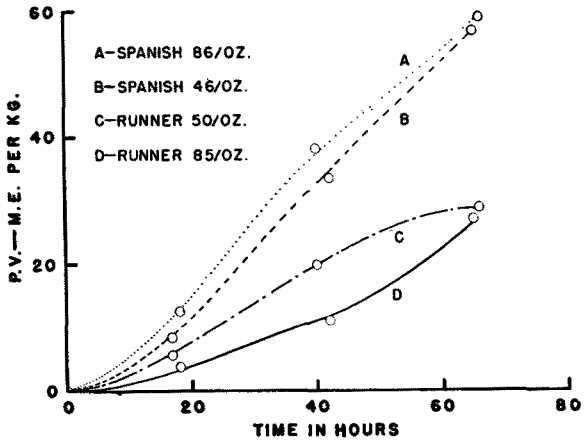

FIG. 3. Effect of size of peanuts on peroxide rancidity development.

When Spanish and Virginia raw cold pressed oils were subjected to aeration and heating at 98°C., there was a considerable percentage difference between the peroxide values of the oils during the first few hours of heating, Spanish being much higher. After 20 hours the peroxide values were about the same. Thus the difference in susceptibility of peanut types may be overlooked unless peroxide determinations are made in the early stages of rancidity development.

Some of the 1949 and 1950 samples were examined by a different procedure. At intervals a counted number of seed was taken from the 98°C. storage chamber, seed coats removed, and one half of each seed tasted by an experienced individual (Table I) and the other half placed either in a sound or rancid group. Half-seeds of a representative number of each group were weighed individually, macerated, blended with chloroform in a semimicro blendor, filtered, and peroxides determined. Not only did the Spanish appear to develop rancidity by the taste test earlier than either the Runners or Virginias but also their peroxide values were higher. When milliequivalents per kg. of rancid seed were multiplied by the number of rancid seed found in the original sample, an index (Table I) was obtained which perhaps shows more clearly the greater susceptibility of Spanish over Runner and Virginia types.

TABLE I

Effect of Heating Raw Peanuts at 98°C.

Days at 98°C.	Rancid seed by taste			No. of rancid seed by taste × M.E./kg. of rancid seed.		
	Sp.	Run.	Va.	Sp.	Run.	Va.
No.	%	%	%			
2	0	0	0	0	0	0
4	11	0	0	40	0	0
6	28	3	2	1,135	30	15
8	35	24	15	1,445	880	315

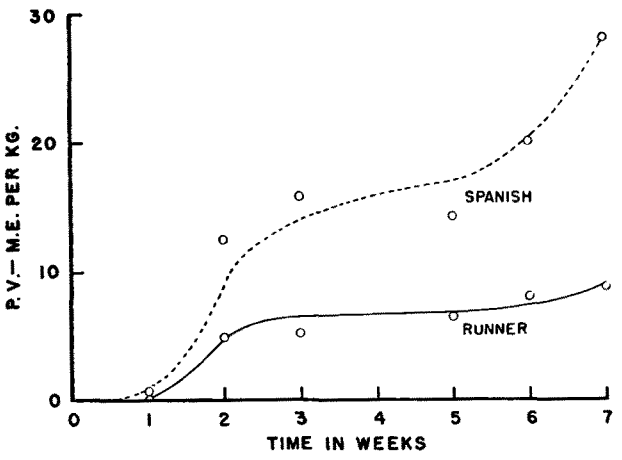

FIG. 4. Roasted peanuts stored at room temperature in darkness.

Discussion

The greater susceptibility of the oil from Spanish type peanuts towards peroxide formation is evident whether the expressed oils are directly aerated and heated or the peanuts are aerated and heated prior to expression. It is also independent of variations in surface area per unit weight due to differences in sizes of the nuts.

Although all three types of peanuts are quite similar in many respects, there are some differences which may be related to this peculiarity of Spanish. All three are types of *Arachis hypogaea*; however Waldron (3) has suggested the possibility that Spanish has a different genetic origin, partly based on marked differences in the histology of the fruit of the erect and prostrate types of plants. Also Spanish peanuts germinate without passing through the lengthy dormant period required by Runners and Virginias. In addition, the Spanish nut seems to have a much softer texture, and the oil appears to flow more readily upon pressing than in either the Runner or Virginia types. This apparent physical difference may allow oxygen to contact the oil in the Spanish more readily and thereby influence rancidity development.

Substances which affect the stability of vegetable oils include tocopherols, other natural antioxidants, pro-oxidants, and enzymes. Some of these substances have been determined in peanut oil, but the amounts in different types of peanuts have not been reported.

Although all peanut oil has approximately the same composition, Jamieson *et al.* (4) noted that Spanish oil contained slightly less oleic and more linoleic glycerides than Virginia oil. They reported the linoleic to be 25% for Spanish and 22% for Virginia. The significance of such a small difference has been studied very little, but it is well known that linoleic esters become rancid much more rapidly than those more saturated.

Conclusions

Based on the data from over 70 trials involving peanuts grown during six consecutive seasons, oil from Spanish peanuts is more susceptible to peroxide rancidity development than that from either the Runner or Virginia types.

Acknowledgment

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REFERENCES

1. King, A. E., Roschen, H. L., and Irwin, W. H., Oil and Soap, *10*, 105 (1933).
2. Riemenschneider, R. W., Turer, J., and Speck, R. M., Oil and Soap, *20*, 169 (1943).
3. Waldron, R. A., Contributions Bot. Lab. U. of Pa., *4*, 302 (1919).
4. Jamieson, G. S., Baughman, W. F., and Brauns, D. H., J. Am. Chem. Soc., *43*, 1372 (1921).

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