Note on the Linoleic Acid-Tocopherol Relationship in Fats and Oils[1]

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THERE appears to be a rough proportionality between linoleic acid and tocopherol contents of most fats and oils (5); however the significance and statistical precision of this relationship has not been explored.

Twenty-two fats, 15 of vegetable origin and 7 from animal sources, are listed in Table I, showing their linoleic acid and tocopherol content. These are the only fats for which both linoleic acid and tocopherol values are currently known.

It is interesting that with two exceptions all the fats in the table are derived from egg, milk, or plant seeds, items which are important for nourishing the very young organism. Also of interest and possible significance is the fact that human milk fat is about three times richer than the fat of cows' milk in both linoleic acid and tocopherol. Other fats should be analyzed for linoleic acid and tocopherol content to permit extension of the list in Table I.

TABLE I

The Linoleic Acid and Tocopherol Content of Fats

Fat or Oil	Linoleic Acid (%)[a]	Total Tocopherol (mg.%)[b]
Cod liver	0	0
Cow milk	3	3
Ewe milk	4	5 (6)
Lard	8	3 (3)
Human milk	8	10 (3)
Sow milk	15	18 (6)
Chicken egg	16	20 (3)
Coconut	2	3
Olive	6	7 (3)
Linseed	18	23
Almond	19	40
Peanut	24	36
Pecan	25	42
Okra seed	27	74
Oat germ	31	60
Rice bran	37	91
Sesame	41	18
Corn	44	110
Cottonseed	49	110
Wheat germ	50	270
Soybean	58	180
Sunflower seed	63	70

[a] All values for linoleic acid concentration were obtained from Hilditch (4).

[b] Values for tocopherol content, not otherwise indicated, were obtained from Baxter (1).

Statistically the linoleic acid values and the tocopherol concentrations (Table I) show a highly significant degree of correlation. The value obtained for the correlation coefficient *(r)* is +0.79 (7). In such a comparison with 20 degrees of freedom an r value of only +0.537 represents a significant correlation at a 1% confidence level. Thus, for those fats and oils to which the data refer, high concentrations of tocopherols coincide with high concentrations of linoleic acid. Furthermore this relationship compared on the basis of log. values for both linoleic acid and tocopherol concentrations is essentially linear (Figure 1).

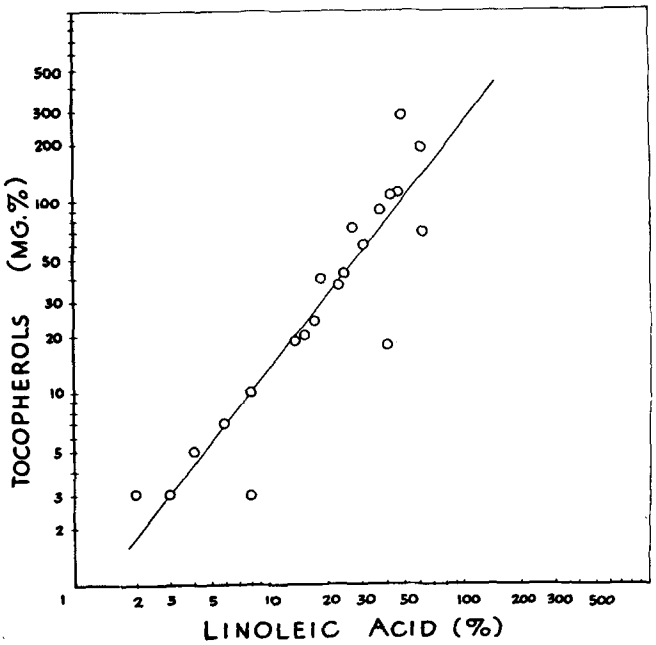

FIG. 1. Relationship between tocopherol and linoleic acid content of various fats and oils.

The values in the table are unselected, representing all the data currently available. Samples from all parts of the world are included, and analytical procedures of many different kinds were used. It may be however that the correlation found involves one individual tocopherol rather than total tocopherol. Or the correct correlation may be with the total antioxidant content of the fat. This would explain the deviation shown by the values for sesame oil. This oil is out of line because of a low tocopherol level which may be accounted for by the presence in the oil of the antioxidant sesamol (2). The linoleic acid values used in most instances actually represent octadecadienoic acids, but, for all practical purposes and to the extent of our present knowledge, the designation "linoleic acid" is satisfactory. It might be pointed out that the linoleic acid values are not a measure of, and do not parallel, the degree of unsaturation of the fat.

Conclusions. The linoleic acid and total tocopherol content of animal and vegetable oils, for which these characteristics are known, are correlated with a high degree of significance; $r = +0.79$.

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