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NON-SAPONIFIABLES FROM DEEP-FRY FATS

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The non-saponifiable fraction of various animal and vegetable fats used in deep-frying is largely composed of sterols related to the sitosterols. Since the preparation of deep-fried foods is carried out under oxidative high-temperature conditions, it is not inconceivable that these sterols might be dehydrogenated to aromatic polycyclic compounds related to the cholanthrenes which are known to be carcinogenic. With this in mind, a number of fats used in deep-frying were saponified with alcoholic potassium hydroxide solution, and the non-saponifiable fractions were extracted with benzene from the water-soluble soaps for preliminary biological screening.

Materials

The fats were selected from several local restaurants and had been used in the deep-frying of the various foods indicated below. The composition of each fat, insofar as it was known, together with conditions of usage, are recorded as follows:

Fat 1.—A hydrogenated vegetable oil used to deep-fry meat, fish and potatoes at 150-200° C. for at least six months. Fresh oil was added as it was needed and occasionally the oil was filtered.

Fat 2.—A homogenized shortening of animal and vegetable oils in which shrimp and fish were deep-fried at 175-180° C., 17 hrs. per day for 10 days.

Fat 3.—A hydrogenated animal fat and vegetable oil used at 175° C. for chicken, potatoes and fish, 11 hrs. per day for 6 days.

Fat 4.—A homogenized shortening made from animal and vegetable oils in which shrimp was deep-fried at 175-180° C., 17 hrs. per day for 10 days.

Fat 5.—Same as No. 4 used for one month (17 hours/day) to deep-fry chicken and fish.

Fat 6.—Same as No. 4, used for one month (17 hours/day) to deep-fry potatoes.

Fat 7.—A cottonseed oil heated with aeration in our laboratory at 175° C. for 11 days, 24 hrs. per day. This product was exceedingly gummy and apparently had polymerized.

Fat 8.—An untreated corn oil used for control purposes. Crystalline sitosterols were obtained from this fat using the procedure outlined below.

TABLE 1.—Yields and Sterol Tests on Non-Saponifiable Extracts from Deep-Fry Fats.

Fat no.	Per-cent yield of non-saponifiable fraction	Lieberman-Burchard test
1.....	0.3	slightly positive
2.....	0.7	slightly positive
3.....	0.8	negative
4.....	1.2	slightly positive
5.....	0.7	slightly positive
6.....	0.6	slightly positive
7.....	1.3	negative
8.....	1.5	strongly positive

SAPONIFICATION AND ISOLATION PROCEDURE

Each sample of used fat (250 gms.) was refluxed with 500 ml. of 20% alcoholic potassium hydroxide solution for 5 hours. A portion of the alcohol was removed by distillation and the residual soap was diluted with three volumes of water. The solution was extracted 3 times with 500-ml. portions of benzene and the combined benzene extracts were washed with distilled water to remove traces of soap. The benzene was removed by distillation and the non-saponifiable concentrate was weighed and tested qualitatively for sterol content by the Lieberman-Burchard reaction. The yields of non-saponifiable material as well as the sterol tests are listed in Table 1.

SUMMARY

A variety of fats, commonly used in the deep-frying of foods such as potatoes, fish, and chicken, were saponified and the non-saponifiable fractions were isolated. From their non-crystalline appearance and the weakly positive Lieberman-Burchard tests it was apparent that the sterols present in the original fats had been altered during the deep-frying process. These non-saponifiable fractions are being screened for possible carcinogenic activity by Dr. Arthur Furst at Stanford University School of Medicine.