Natural Safflower Oil And The Oil Partially Hydrogenated

Effect on Lipids of Human Serum

Ethel M. Thompson

Recently there has been a great upsurge of interest and debate on man's need for dietary fats popularly referred to as "polyunsaturates."

These fats, liquid at room temperature, have been characterized as such because of the presence of double bonds at two or more locations in their fatty acid chains which, instead of single bonds, link carbon atoms. These double bonds appear in fats of growing plants because the carbon atoms take on less than their full potential of hydrogen atoms.

It is now commonly accepted that, by virtue of the presence of two or more double bonds, these fats lower, in blood, not only cholesterol *per se* but also at least one of five cholesterol-fatty acid-bearing lipoprotein complexes (the beta fraction). Although relatively high concentrations of these blood constituents (lipids) often occur in apparently normal individuals, there is growing evidence that they occur most frequently in association with heart disease.

Believing that lower levels are beneficial to health, investigators now pursue the testing of various fats to this end, not only in abnormal individuals but in laboratory animals. However, study of the abnormal has led to neglect of better understanding of the normal; of animals, to conflicting data due to differences in response among species.

Research With Humans

Data of genuine significance to man must come from man. However, difficulties exist in conducting such studies and hence they are sharply limited in number. Long-term studies are needed because of relatively large individual variability of blood lipids from day to day. Hence, identification of his characteristic level cannot be made by a single test or even a short series of tests.

A long-term investigation of healthy women has been made in the School of Home Economics. Fats tested were the polyunsaturated oil of the safflower plant, and the same oil after partial hydrogenation to margarine consistency.

In this process most of the two and three double bond fatty acids, namely, linoleic and linolenic, comprising 78 per cent of the oil, are changed to the fatty acid known as elaidic which has one double bond. This acid, which does not occur in nature, has a special conformation in sharp contrast to that of the acids from which it is derived. In this hydrogenation process total fatty acid chain length remained unchanged. These factors, all of which pertain to the chemical make-up of the fat, significantly influence lipid utilization.

Conditions of the Study

Three young graduate women students consumed an adequate, weighed, diet over two 8-week periods. Forty per cent of the calories was derived from fat, three-fourths of which was, in turn, safflower oil and the same oil partially hydrogenated. Body weight was kept constant by establishing calorie need in a preliminary study. The oil diet had a polyunsaturated to saturated fatty acid ratio of 4.2 to 1; the hydrogenated, 0.2 to 1. Serum from finger-tip blood, taken before breakfast, was analyzed for total cholesterol and five fractions of lipoproteins. (For a full discussion of this investigation including other blood constituents the reader is referred to the M.S. thesis by M. Rodriguez, titled, "Effects of Natural and Partially Hydrogenated Safflower Oil on Lipid and Protein Constituents of Human Serum," 1963.

Natural Safflower Oil vs. Hydrogenated

As shown below, cholesterol diminished in the three subjects during the oil period. Beta lipoprotein levels were directly related to initial cholesterol levels, i.e., the highest (or lowest) beta fraction occurring with the highest (or lowest) cholesterol.

During the hydrogenated fat period, subjects one and three diminished in serum cholesterol, but subject two showed no change. All subjects had higher beta levels than during the oil period.

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MICRO SAMPLES OF serum to be read in the spectro-photometer for cholesterol content.

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Serum Total Cholesterol Concentrations, mg. per 100 ml.

Subject No.	*Initial Conc.*[1]	*Weeks of Change*	*Weekly Mean After Drop*	*Total Drop %*	*Variability*[2]
		Natural Oil Period			
1	257	3	202	21	3
2	230	4	204	11	5
3	160	4	149	7	1
		Hydrogenated Oil Period			
1	268	4	218	19	3
2	233[3]	—	—	—	—
3	193	7	181	6	2

[1]Mean of 3 tests, first week.

[2]Weekly, + or − of mean after drop.

[3]No change.

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Biological Application

Elaidic acid, "man-made" in the hydrogenation process, served as a source of energy, apparently equivalent in calories, weight for weight, to the polyunsaturated fatty acids originally present in the natural oil.

A biological change in pattern of utilization of lipids was demonstrated. Criteria were diminished levels of serum cholesterol and increased levels of beta lipoprotein. It was apparent that elaidic acid is capable of diminishing serum cholesterol, although affecting a different pathway of lipid utilization as evidenced by increased beta lipoprotein.

Asks Irrigation Research Be Increased

Of particular interest to us in Arizona is the recommendation that more research is needed to cut down losses of irrigation water through seepage, evaporation, and wasteful runoff. The suggestion comes from the USDA's Soils, Water, and Fertilizer Research Advisory Committee.

New principles, practices, and equipment should be developed to reduce water losses, develop new water sources, and recharge ground water, the committee reported. Expanded research is needed on low-cost soil stabilizers and sealers to decrease losses of irrigation water during conveyance, and to develop satisfactory methods for spreading chemicals that prevent evaporation from water surfaces.

The committee recommended that USDA consider priorities for soil and water research, to assure that work is done in prime agricultural areas of the country that now, and in the future, will produce most of our food and fiber.

More research on watershed area problems, including management of storm runoff, reduction of flood runoff, and control of erosion and sedimentation, was recommended. Increased cooperation between the Forest Service, Agricultural Research Service, and other public and private groups on problems of crop, forest, and range lands should complement these studies, according to the committee.

The committee also urged expanded economic research to guide planning of programs by soil conservation districts, the Bureau of Land Management, and other groups. This research would compare the success of conservation practices by regions, different physical conditions, and types of farming.

Improved technology, including higher yielding crops and increased application of commercial fertilizers, serves to emphasize the need for more research to define precisely the seedbed requirements for various crops in different areas of the country. These studies should deal with depth of cover, size of soil particles, degree of soil compaction, soil surface profile, and row spacing, the committee said.

Dewhirst Heads UA Agric. Men's Club

New officers of the Agricultural College Men's Club, made up of staff members in this college, are Dr. Leonard W. Dewhirst, animal pathology, president; Dr. George Gries, plant pathology, president-elect; Dr. Jimmye Hillman, agricultural economics, program chairman; and Dr. K. C. Hamilton, agronomy, secretary-treasurer. The new officers will man the club through the 1963-64 school year, starting next September.

1962 Cotton Crop Sets Yield Record

Arizona's cotton production last season set a new state record, while the state's average short staple yield may have set a national mark.

These figures and others were reviewed at a mid-May meeting of the High Yield Club at Phoenix. Honored by the group were farmers who grew the most cotton per acre in Arizona during the 1962-63 season.

Top honors went to John Buxton and Jack C. Hart of Royal Packing Co., who grew an amazing 4.98 bales per acre on 141 acres in the Harquahala Valley. Power Brothers, in the Queen Creek area, was second with 3.547 bales per acre.

Others in the top production group are Franklin B. Cox, Stanfield; E. A. Robert, Bernard J. Erskine, Red Mountain Ranches, of the Scottsdale area; Raymond Cook of Glendale; Jaybe Tschudy, Kyrene; Glenn Kempton and Robert Snediger of Tempe; G. D. Isabell of Deer Valley; and Don Wiechens of Cashion.

Arizona, which consistently leads the nation in yield per acre, produced 942,000 bales of cotton in the 1962-63 season, the 300 persons at the award banquet were told.

The average yield of 1,162 pounds of short staple cotton last season set a new state record. The Crop & Livestock Reporting Service, with only preliminary figures available from other states, believes this 1,162 pounds may set a national record.

Arizona's all-cotton yield (short staple plus long staple) was 1,112 pounds per acre, falling behind California's 1,132.

But California grows only about 600 acres of comparatively low-yielding long staple, while Arizona's all-cotton average was diluted by 41,000 acres of long staple, half the nation's production.

Long-staple yield in Arizona rose from an average 518 pounds per acre the previous year to 665 pounds in 1962-63.

Seton Ross, Memphis, editor and publisher of the Cotton Trade Journal, said in a banquet address that research is the answer to cotton's biggest problem, the cost of production.

He called for "greatly accelerated progress in basic and applied cotton research if our industry is not to sink to the level of a specialty crop."

Orange production in Arizona for the 1962-63 crop year is forecast at 1,050,000 boxes compared with the 1961-62 crop of 1,440,000 boxes. Grapefruit production was 1,900,000 boxes compared with the 1961-62 crop of 2,270,000 boxes. The 1962-63 lemon production is estimated at 500,000 boxes, less than one-third of the 1,540,000 boxes produced in 1961-62.