Leading article

Dietary essential fatty acids and the decline in peptic ulcer disease – a hypothesis

The incidence and virulence of peptic ulcer disease have been declining for the past few decades. Hospital admissions due to duodenal or gastric ulcer have been declining in the United States and in England and Wales for the past 20 years. In parallel, the number of surgical operations for peptic ulcer disease has also declined, even before the introduction of cimetidine. Most importantly, the age-sex-specific death rates due to peptic ulcer disease have also been declining during the past few decades. For example, the death rate due to duodenal ulcer disease in men in their fifth decade declined from 154 per million in 1930 to 24 per million in 1976 in Scotland. Similar figures from England show a decline in death rate from 109 per million in 1930 to 16 per million in 1976. In the United States the decline in death rates in the fifth decade of life was from 40 per million in 1921 to seven per million in 1976. A similar decrease in the mortality rate has been recorded in gastric ulcer disease and in peptic ulcer disease in women.

What are the factors which would account for the decreased incidence, severity and mortality of peptic ulcer disease? Many hypotheses have been advanced to account for this phenomenon. One factor that has not been considered is the increased consumption of, and interaction between, dietary essential fatty acids and the natural defence mechanisms of the gastroduodenal mucosa.

Evidence is accumulating that a major factor in the intrinsic defence against ulceration is the endogenous elaboration of prostaglandins, mainly of the E group, by the gastroduodenal mucosa. These prostaglandins administered exogenously, or synthesised endogenously, can prevent the formation of mucosal ulceration induced experimentally by aspirin, alcohol, bile acids, and even boiling water. Prostaglandins are synthesised by the gastroduodenal mucosa from arachidonic or linoleic acids. Both of these fatty acids are dietary essential fatty acids of the polyunsaturated type. When these acids are administered intragastrically, the concentration of prostaglandins in the stomach rises a few thousand-fold within a matter of minutes, promoting mucosal protection and accelerating the repair of mucosal ulceration.

Vegetable oil is the major dietary source of polyunsaturated fatty acids. The ingestion of vegetable oils in western countries has been increasing since the beginning of this century. For example, the daily intake of vegetable oils in the United States in 1909–1913 was 21 g per day per person. In contrast, in 1980, the United States consumption of vegetable oils increased to 68 g per day per person (Fig. 1). Data from the United Kingdom indicate similar trends. As the fatty acids precursor of
prostaglandins are predominantly from vegetable sources, these data show a greatly increased dietary supply of these fatty acids during the recent decades. Linoleic acid, the most common dietary essential fatty acid, is predominantly found in vegetable oils. It is, therefore, not surprising that the dietary availability of linoleic acid has increased by 200% since 1909 (Fig. 2). During the same time span the availability of saturated fatty acids decreased slightly and that of oleic acid increased to a small extent.

The increased consumption of vegetable oils has occurred for two reasons. Firstly, vegetable oils are cheaper than most animal oils to the consumer and to the manufacturer of oil derived products such as margarine, salad oils, and baked goods. The switch from animal to vegetable fats has also been encouraged by physicians, nutritionists, and governmental agencies in order to decrease the incidence of cardiovascular disease. For commercial and public health reasons, western societies' dietary intake of polyunsaturated fatty acids has increased markedly during the last three to five decades. Recent research indicates that these fatty acids stimulate the synthesis of protective prostaglandins by the gastroduodenal mucosa. Therefore we propose that the 200% increase in intake of essential fatty acids could account in part for the concomitant decrease in incidence and virulence of peptic ulcer disease.

In summary, the decline in incidence and virulence of peptic ulcer disease has occurred during the same time span as a 200% increase in the dietary availability of essential fatty acids. Recent studies have shown that dietary essential fatty acids can be rapidly converted to prostaglandins of the E group by the gastroduodenal mucosa. These fatty acid derived prostaglandins are able to protect the gastroduodenal mucosa against injury by alcohol, aspirin, and bile acids. We propose that the marked increase in the dietary availability of essential fatty acids could be
Dietary essential fatty acids and decline in peptic ulcer disease – a hypothesis

Fig. 2. Changes in the dietary availability of the essential fatty acid – linoleic acid, compared with oleic acid and saturated fatty acids. Data are expressed as a per cent change from the 1909–1913 figures which are taken as 100%. Data were derived from reference 19.

responsible at least in part for the marked decrease in the incidence and virulence of peptic ulcer disease.

D Hollander and A Tarnawski

Department of Human Anatomy, Oxford University, and Department of Medicine, University of California, Irvine

Supported by Senior International Fellowship number F06-TW00875-01 from the Fogarty International Center, and grant AM 32865 from the National Institutes of Health, Bethesda, Maryland, USA.

Address for correspondence: Department of Medicine, C-340 Medical Science I, University of California, Irvine, California 92717, USA.

References
