Ecological Study of the Role of Highly Processed Milk, Meat and Vegetable Oil in Prostate Cancer Causation

by

Carl Hans Norgauer

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By

Carl Norgauer

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Approved by:

Janice E. Martin, Ed.D., N.D. — 4/6/04
Committee Chairperson — Date

Committee Member — Date 3/29/04

Committee Member — Date 4/6/04

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Abstract

The transition from locally-produced, whole foods to distant-produced, fractioned foods marks food consumption patterns in the United States and other developed nations. Chief risk factors for prostate cancer - milk, meat and vegetable oils – were examined to determine how modern processing of these foods has impacted the incidence of prostate cancer. Food consumption patterns in six nations with consistently low prostate cancer mortality were compared with seven nations with consistently high cancer mortality. Several of the low prostate cancer mortality nations included in this study have primitive food processing technology while all the high prostate cancer mortality nations have advanced refining and food fractionating technology. World Health Organization (WHO) mortality data for 1980-1995 were correlated with Food and Agricultural Organization (FAO) food consumption data for 1995. Milk consumption statistics are weakly supportive of the hypothesis that the effect of milk processing is important in prostate cancer etiology ($p < 0.06$). Supportive of this hypothesis is the fact that the low mortality nations, Turkmenistan and Uzbekistan, are big consumers of milk but their milk processing technology is primitive. Consumption patterns of the unstable oils - soybean and canola - strongly support the hypothesis that the formation of *trans* fats and oxidized fats by modern processing raises the risk of prostate cancer ($p < 0.05$). The correlation of meat consumption and prostate cancer mortality is consistent with the food processing hypothesis ($p < 0.03$) and potential mechanisms are suggested. The formation of reactive oxygen species (ROS) resulting from milk homogenization is suggested as a source of toxic lipid peroxides and aldehydes that form in the body causing antioxidant depletion. The formation of *trans* fats by

vegetable oil hydrogenization is linked to the formation of abnormal spermatozoa. Defective spermatozoa are proposed as a mechanism for prostate cancer initiation. The formation of ROS by activated neutrophils and spermatozoa is a source of oxidative stress in prostatic tissue that promotes tumor development. Future research is recommended into gut absorption of dietary lipid peroxides and aldehydes, the role of iron as a catalyst for lipid peroxidation in prostate cancer etiology and the possible correlation of prostate cancer and male infertility.

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Abbreviations

bST: bovine somatotropin, a growth hormone.

DHA: docosahexaenoic acid, a long chain omega-3 fatty acid, having six double bonds.

DNA: deoxyribonucleic acid, the genetic material of life.

EPA: eicosapentaenoic acid, a long chain omega-3 fatty acid having five double bonds.

GPX: glutathione peroxidase, an enzymatic antioxidant.

HNE: trans-4-hydroxy-2-nonenal, a 9-carbon aldehyde breakdown product of lipid peroxidation.

HTST: high temperature, short time pasteurization.

IGF-1: insulin-like growth factor 1.

LA: linoleic acid, an omega-6 essential fatty acid, having two double bonds.

LNA: alpha-linolenic acid, an omega-3 essential fatty acid, having three double bonds.

NPN: non-protein nitrogen, used as animal food source.

OR: odds ratio.

ROS: reactive oxygen species.

RR: relative risk.

SOD: superoxide dismutase, an enzymatic antioxidant that neutralizes the superoxide radical.

UHT: ultra-high temperature milk pasteurization.

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Introduction, Statement of Problem, Background and History, Research Questions, Hypotheses, Significance of Study and Definition of Terms

Introduction

Prostate cancer is the second most common malignancy among men in the United States. Deaths from prostate cancer in the United States have tripled between 1961 and 1996, from 11,000 to over 34,000 per year (World Health Organization, 2003). By comparison, while the age-specific rate of prostate cancer in the United States was 13.7 deaths per 100,000 in 1961, the rate in several Asian nations, including Japan, Hong Kong and Thailand was about one-tenth that of the United States (World Health Organization, 2003). However, incidence and mortality rates for prostate cancer are increasing in all developing nations. Furthermore, as migration occurs from nations of low prostate cancer incidence to nations with a high rate, mortality for immigrants soon approaches that of the indigenous people.

These historical trends have led to a focus on environmental factors as the major cause of prostate cancer. Starting in the 1970s, many case-control and cohort studies were undertaken to examine numerous socioeconomic, genetic and dietary factors in an attempt to better understand the causes of prostate cancer. One of the first findings was that developed nations, which commonly enjoyed diets higher in fat than did less developed nations, had higher rates of prostate cancer. Therefore, much research has focused on the effects of diets high in animal and vegetable fat.

Unfortunately, the results obtained in these studies have been inconsistent. Several studies have found a high risk associated with increased intake of animal fat, while others have failed to confirm these findings. Similarly, some studies have found increased risk associated with high retinol or beta-carotene intake while others have not. The same inconsistent pattern emerges when the intake of other macro- or micronutrients have been investigated.

Statement of the Problem

A review of the scientific literature indicates that research into prostate cancer causation has been frustratingly inconsistent or contradictory. It is proposed by this author, that new ways of looking at the results of previous studies are needed. A new paradigm is called for.

Much previous research has focused on measuring intake of traditional nutrients such as saturated, monounsaturated and polyunsaturated fats, carbohydrates, proteins, specific vitamins and minerals. Some research has looked not only at different nutrients but has also examined the impact of specific foods, e.g., meat, milk, mayonnaise and salad dressing. The latter studies are significant but, in this author's view, they do not go far enough.

No studies have been found by this author which have considered the effect of food processing on the quality and toxicity of specific foods. This is a major oversight in view of the fact that the overarching diet and health development of the 20th century has been the transition from home, family and local food production to the consumption of highly processed and modified food, loaded with preservatives and pesticides, produced far from home by multinational companies organized for profit. This author suggests that this monumental shift in the way food is produced is at the root of the problem of prostate cancer and will help to explain the inconsistent and contradictory research findings. This perspective, furthermore, will also help explain the rise of other degenerative diseases occurring in industrialized societies.

Industrialization not only affects the quality of food, it introduces into the food many toxic products through air, water and soil pollution. All these by-products of industrialization contribute to disease causation. These effects of technology are virtually unavoidable and in countless studies have been shown to cause damage and to result in lower levels of health and vitality.

Background and History

Two overarching developments have marked food production in the United States. The first major development has been the shift from family and local food production to factory and distant production. The second major development is an outgrowth of factory production: the development of technology for altering and fractionating foods.

Traditional diets have predominantly involved home and local food production. During the seventeenth, eighteenth and nineteenth centuries, as the United States was being settled, a family's food needs were predominantly met through killing wild game and by production on the family farm where cows, pigs, sheep, chickens, fruit and vegetables were raised for family use. Only a few items such as sugar and salt were not available locally and were imported.

As immigration to the United States increased, more and more people settled in towns, and these individuals began to engage in activities not dedicated to food production. Until the early twentieth century, however, these town-dwellers, who did not continue to produce their own food, primarily depended on locally grown food to meet their family's needs.

The trend away from home food production is highlighted by the decline in the number of farmers over the last two centuries. At the founding of the United States most families worked their own farms but by 1860, less than one hundred years after the founding, farmers made up only 58% of Americans. By 1910, the number of farming families had dropped to 31%, and by 1970, only 5% of families gained their livelihood through farming (Agricultural Research Service, 2003). However, even as the number of full time farmers dropped, food supplies were still predominantly obtained locally and many families supplemented their food intake with home-grown produce and animal products.

Data are presented below on the historical development of the production of the foods most often associated with prostate cancer: milk, meat, fats and oils. These foods are often associated with other degenerative diseases as well. Two patterns will be described relating to the production of these foods. First is the transition from local to distant production. Second is the transition, during the twentieth century in the United States, from consumption of whole foods to the consumption of fractionated and altered foods.

Local to distant food production

The following developments in the dairy industry, recorded in “Landmarks in the U.S. Dairy Industry” (Weimer & Blayley, 1994), illustrate the early prevalence of local food consumption in the United States. Tank trucks were first used to transport milk in 1914, but up to the early 1930’s the universal way of hauling milk to market was in 40-quart cans. By 1925 some milk deliveries were by milk trucks, but prior to this, the most common form of delivery was the stop-and-go horse-driven milk wagon. Electricity was first brought to the farm in 1906 but by 1920 few dairy farms had refrigeration. It was not until the 1950’s that a large proportion of dairy farms had refrigeration. Therefore, before widespread electrification, distribution of milk products had a limited range.

The pattern was very much the same with regard to meat production. Without refrigeration, meat distribution and consumption was limited to locally raised animals. Beef and dairy cattle were grass-fed on pasture during spring, summer and fall and then brought into barns in the winter, where they were fed locally grown hay, silage or grain. It was not until the 1950's in the United States that large numbers of beef cattle were shipped to feed lots where hundreds of thousands of cows were packed together and grain-fed to fatten them before slaughter. Starting in the 1950's a large quantity of feed-lot fed meat was distributed to the national market. Later in the twentieth century meat from these feed lots supplied the world market and meat was also imported from numerous foreign countries.

The historical development of fat and oil production is similar. The main fats used for cooking prior to the twentieth century in the United States were lard, tallow and butter. These fats were obtained either from wild game or locally raised cows and pigs. A popular American cookbook published in 1895 included only lard, tallow and butter for cooking and frying. Recipes using vegetable oils were not mentioned in the cookbook and their presence in American cooking before the 1890's was rare. Shortening was made predominantly from lard and tallow. It was not until 1935 that margarine was invented and by the late twentieth century its use became widespread.

Whole to fractionated foods

The second major development in food production, i.e. fractionation and alteration of food started in the American dairy industry in 1856 when a patent for condensation of milk was issued to Gail Borden and he subsequently started several factories for milk condensation. In 1872 a patent was issued for the process of atomizing fluids which could later be applied to milk pasteurization. In 1884, the first factory to produce evaporated milk was established, and in 1895 commercial milk pasteurization machines were introduced. In 1905, a milk-drying plant was built and in 1919 homogenization of milk was introduced. By 1926 processed cheese was widely used and by 1925 nonfat dry milk manufacturing using spray processing was becoming widely used. During the years between 1930 and 1950, high-temperature, short-time continuous flow pasteurization began replacing vat pasteurization. In 1940, the Borden milk company started adding vitamin D to milk and between 1940 and 1950 homogenized and vitamin D-fortified milk products became widely used. In 1946 vacuum pasteurization was perfected and in 1948 ultra high-temperature pasteurization was introduced. During the latter part of the twentieth century low-fat milk products were promoted to the public as health foods. Also in those years the dairy industry developed the process of blending evaporated milk with skim milk to produce fluid milk with different fat content, e.g., 1% and 2% milk.

The process of fractionating and altering food has become universal in the commercial production of animal feed. During the 1930's Purina Milling Company began research on its total mixed rations (Weimar & Blayney, 1994). In the following years, urea, which is a nonprotein source of nitrogen (NPN), was introduced as a partial replacement of forage and grain protein in cattle rations. During the next seventy-five years, many industrial waste products such as ammoniated molasses, ammoniated citrus pulp and ammoniated beet pulp were used as components in animal feed (Stanton, 1998). Meat and bone meal from slaughtered cattle, pigs, poultry and fish have became widely used in feed for cattle, pigs, poultry and fish (Miles & Jacob, 1998). Soybean meal and hulls, by-products of commercial soybean oil processing, are used as a primary source of protein in livestock feeding. Bakery byproducts are also processed for animal feed in order to provide a cheaper source of protein. Indeed, the waste products from many industries have been introduced into animal feeds in an attempt by multinational companies to reduce the cost of manufacturing meat products for the highly competitive national and international markets. Recent research has led to the use of chemicals for protein replacement. In 1998 the Oklahoma Agricultural Experimental Station studied the effectiveness of the chemicals diammonium phosphate and monoammonium phosphate as a source of NPN and phosphorus for cattle and sheep.

In the production of fats and oils, two major developments have occurred in the United States during the twentieth century: 1) animal fats and tropical oils, which were almost universally used for cooking, baking and food preparation, were replaced by vegetable oils as the main added dietary fat and 2) processes for the production of highly refined vegetable oils were introduced. The production of refined oils from seeds such as cottonseed, safflower, sunflower, peanut, soybean and rapeseed (Canola) is a multistage process in which the oil is subjected to high temperature, pressure and oxidation. At almost every stage of this process nutrients are destroyed or removed and toxic products introduced.

Research Question

Many studies have associated high intakes of animal fats such as milk and meat and high intakes of alpha-linolenic acid as found in such foods as mayonnaise and salad dressing, with increased risk of prostate cancer. Is this association really due to the saturated, monounsaturated or polyunsaturated fat content of the latter foods, as suggested by the prevailing nutritionist paradigm?

It is here proposed that the increased rate of prostate cancer is actually due to the prevalence of factory-type food production, involving high-levels of processing and refining, that alters animal and vegetable fats and destroys valuable nutrients and, in addition, generates toxic products detrimental to health. Can the adulteration of milk, meat and vegetable oil account for the modern high incidence of prostate cancer and also account for the inconsistent prostate cancer research results?

Hypotheses

Toxic milk

Commercial dairy cows are not pasture-fed and are permanently confined to barns, producing milk that is deficient in vitamin A and D. The typical cow is now forced through a lactation period lasting about 600 days. The cow is then slaughtered. Under these forced conditions, mastitis is a very common ailment and the pus and other products of that disease enter the milk. Cows are fed growth hormones and antibiotics which also enter the milk and contribute to its pathogenicity. Milk from these diseased cows is pasteurized, a process that results in the partial or total loss of numerous enzymes, such as phosphatase, that are required for mineral absorption. Milk is also commonly homogenized. This is a high temperature and high pressure process that alters the size of the milk fat globules and causes oxidation of the valuable anti-cancer conjugated linoleic acid (Campbell, Drake & Larick, 2003). The oxidative products of homogenization may lead to the formation of disease-causing free radicals in the individuals who consume milk products and result in the depletion of antioxidants such as vitamin E. One percent and two percent milks are made by combining skim milk with powdered milk. Powdered milk contains oxidized cholesterol, a product that further contributes to the oxidative stress in those who consume the milk.

Toxic meat

Cattle, chicken and pig rations are made from industrial by-products and chemicals. These feeds are not normal and contribute to disease. Furthermore, to stimulate growth, animals are fed growth hormones such as bovine samatotropin (bST). Meat containing bST results in higher levels of insulin-like growth factor (IGF-1) in men who consume the meat. A higher level of IGF-1 in turn, has been associated with increased prostate cancer risk. The diet of cattle in feedlots is high in grains, a diet unnatural to ruminants whose normal diet is forage. The high grain feedlot diet produces beef that is unbalanced in type of fat, being high in the omega-6 fatty acid, linoleic acid, and low in the omega-3 fatty acid, alpha-linolenic acid. The living conditions for cattle in feedlots and chickens in factory buildings are unhygienic and stressful. The animals are packed together to such a high density that they are constantly breathing fecal dust.

Toxic vegetable oil

Modern oil refining is a multistage process that results in a lifeless end-product. The process begins with the mashing and heating of the seeds to an average temperature of 248° F. This begins the exposure of the oil to oxygen and the development of rancidity. The oil is extracted either by a mechanical expeller which generates high pressure and temperature or it is extracted chemically by mixing a solvent such as hexane with the cooked mash. Traces of hexane, which have a deleterious effect on health, may remain with the extracted oil after the solvent is distilled away at a temperature of 302° F.

The next step in the refinement process is degumming, which is carried out at about 140° F. Degumming removes phospholipids, including lecithin, from the unrefined oil. It also removes chlorophyll, calcium, magnesium, iron and copper. After degumming, the oil is treated with caustic soda (NaOH), at a temperature of about 167° F, to remove free fatty acids. Phospholipids and minerals are also removed in this step. Since the oil still contains pigments such as chlorophyll and carotene, the oil is bleached with acid-treated clays to remove these pigments. Bleaching is done at about 230° F for 15 to 30 minutes. Since air is usually not excluded from the bleaching process, toxic peroxides and conjugated fatty acids are produced. Because of the odor-producing rancidity resulting from the above processes, the oil must then be deodorized by steam distillation under pressure. Deoderization takes placed at 464 to 518° F for 30 to 60 minutes and removes the peroxides produced during the refining and bleaching steps. At temperatures above 302° F, unsaturated fatty acids become mutagenic and above 392° F, substantial amounts of *trans* fatty acids are formed. The refined oil end-product is lacking in vitamins, minerals and is loaded with toxic products. It is the nutritional equivalent of white sugar and white flour with added toxic products.

This author proposes that individuals who consume modern, commercial milk, meat or vegetable oils or foods that are prepared with them are consuming nutrient-deficient and toxic products that contribute to prostate cancer. The toxic food hypothesis asserts that the more that milk, meat and vegetable oil are subjected to unnatural and unhealthful production conditions, the greater will be the risk of prostate cancer in men who consume it.

Significance of study

Prostate cancer is the second most common malignancy in the United States. Incidence is increasing in the United States as well as in most developed nations. Prostate disease is a source of great discomfort, pain and disability. Surgical treatment often produces incontinence, impotence and accompanying physical and psychological stress. Chemotherapy and radiation have major debilitating effects. Clearly, many men could be benefited by a better understanding of the etiology of prostate cancer. It is here asserted that the cause of this disease lies in poor food choices, i.e., a diet dominated by manufactured and highly processed foods. In order to avoid succumbing to this disease, men will have to make significant lifestyle changes. The growing, purchasing and preparing of whole foods is sometimes inconvenient, time-consuming and more expensive. To develop a high level of bodily immunity to prostate cancer men will have to make efforts to locate producers of whole foods or become a producer of whole foods and then learn how to prepare these foods properly at home.

Previous Studies

Milk and prostate cancer

Among several studies that have linked milk consumption and prostate cancer, two are ecological studies (Rose, Boyar & Wynder, 1986; Hebert, Hurley, Olendzki, Teas, Ma & Hampl , 1998); three are case-control (Mettlin, Selenskas, Natarajan & Huben, 1989; La Vecchia, Negri, D'Avanzo, Franceschi, & Boyle, 1991; Talamini, Franceschi, La Vecchia, Serraino, Barra & Negri, 1992) and four are cohort studies (Snowdon, Phillips, & Choi, 1984; Mills, Beeson, Abbey, Fraser, & Phillips, 1988; Le Marchand, Kolonel, Wilkens, Myers & Hirohata, 1994; Veierod, Laake & Thelle, 1997).

In one of the ecological studies, mortality rates during the period 1978 – 1979 for prostate cancer were related to food consumption data published by the United Nations for 26 to 30 countries (Rose et al., 1986). They found a strong positive correlation between milk consumption and prostate cancer. Similarly, in another ecological study, Hebert et al. (1998) found a strong correlation between certain cancers and food consumption. Just as Rose et al. had done about twenty years before, Hebert et al. found a strong positive correlation between milk consumption and prostate cancer.

In a 1989 case-control study at Roswell Park Memorial Institute (RPMI), Buffalo, New York, using 371 prostate cancer patients and comparable control subjects, Mettlin et al. (1989) found that the regular consumption of whole milk raised the relative risk (RR) of prostate cancer to 1.91. Furthermore, drinking three or more glasses of whole milk daily raised the RR to 2.49 when compared to men who never drank whole milk. They found a strong association of prostate