

SOCIAL TOXICANTS AND NUTRITIONAL STATUS

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If a man will be sensible and, one fine morning, while lying in bed, count on his fingertips how many things in life truly give him enjoyment, invariably he will find food to be the first.
Chinese Proverb

Throughout history man has been prepared to take some risk with the things he ingests since they have been to him more than nutrition: pleasure, communication, curiosity, and creativity. The functions of food and beverages are several (Table I) (Mead, 1955; Lowenberg *et al.*, 1979; Schack, 1978; Turner 1980). It is the ratio of risk to total benefit that must be borne in mind by nutritionists.

To the nutritionist a social toxicant may represent either a social factor that can adversely affect nutritional status, or an item ingested primarily for social rather than nutritional reasons and that may lead to harm.

NUTRITIONALLY ADVERSE SOCIAL FACTORS

Ethnic Background

The way in which cultural diversity is associated with variation in nutritional status is particularly evident in North America and Australasia where immigrant European, Asian, and African as well as indigenous cultures are found together. The hunter-gatherer life-style of Australian Aborigines (Hetzel and Frith, 1978; Wahlqvist, 1980, 1981) and the semiagriculturalist practice of the American Indians (Lowenberg *et al.*, 1979) were interfered with and, for urban fringe dwellers of these ethnic groups, nutritional prob-

TABLE I
Social Functions of Food and Beverages

Mood alteration
Providing security
Symbolic
Establishing roles and status
Socializing
Celebration
Religious or philosophical expression
Art form (food preparation, viniculture)
Economic

lems are frequently seen. These problems reflect not simply a change in the food system, but extensive societal change for the ethnic group concerned.

In general, minority food cultures tend to move toward the majority food culture. This is already evident in those from southern Europe who migrated to Australia after the Second World War (Hopkins *et al.*, 1980; Kosmidis *et al.*, 1980), and appears to be reflected in an increase in the diseases associated with affluent societies such as colorectal cancer (McMichael *et al.*, 1979).

Traditional food culture is also lost as urbanization occurs, and with the loss appear health problems more characteristic of industrialized society. Such changes are under way in many underdeveloped countries. In the Pacific Island of Nauru, prosperous through phosphate exports, abundant imported foodstuffs are overeaten and obesity and maturity-onset diabetes have emerged (Ringrose and Zimmet, 1979). For Orang Asli or indigenous people of peninsular Malaysia, the more contact they have with the general population, the greater their coronary disease risk by way of serum lipids and blood pressure (Chong, 1976; Chong and Pang, 1978). Urban Ethiopian men also show higher blood lipids when their diets become more westernized (Ostwald and Gebre-Medhin, 1978).

Socioeconomic Status

The marked differences in prevalence of protein energy malnutrition (PEM) between developed and underdeveloped countries clearly demonstrate the importance of socioeconomic factors in achieving adequate nutritional status. The further pressures within an industrialized society of economic influences on food choice have been demonstrated by McKenzie in the U.K. (1980). In Australia, there is evidence that children from lower socioeconomic groups are more likely to have inadequate or no breakfasts (Storey, 1979), with implications for physiologic and scholastic performance (Tuttle *et al.*, 1954). The way in which smoking affects body weight also appears to depend on social class (Ashwell *et al.*, 1978).

Family Relationships

Food purchase, preparation and consumption are most often family matters so that problems within the unit can adversely affect nutritional status. In Western society, an increasing number of family units have only one parent or two working parents, so that ready-to-eat food is more in demand (Krupinski and Stoller, 1978). In this situation, the family has less control over and probably less knowledge of the components of the food it eats. The food outlet has, through its contribution, decreased the working knowledge of food that the family used to have. The education system will presumably be required to help with this change in consumer knowledge, so that the potentially adverse effects of a rapidly changing food system can be minimized.

Not only does the child pattern food behavior after the parent, but the child with information obtained from school, the media, or peers can in turn influence the parent. Close parent-child nutrient-intake interrelationships have been observed insofar as factors affecting serum lipids are concerned (Laskarzewski *et al.*, 1980).

Accommodation

Food storage and preparation facilities can affect nutritional status and these vary greatly according to the kind of accommodation an individual has.

Whether a household has a designated place for eating or encourages eating in a number of venues can also be important as far as the restraint of food consumption is concerned.

Occupation

The workplace has become for some, through related health services, a place for identification of nutritionally related problems (Kornitzer *et al.*, 1980; Rose *et al.*, 1980; Stewart *et al.*, 1980). When provision of food by the employer becomes a benefit of employment, the relative contribution of the canteen to daily needs tends to increase. There is, therefore, a growing need for nutritionists to be involved in assessment of food supply at the place of employment.

Time Management

Food consumption patterns appear to be influenced by both under- and overutilization of time. Both the bored and those with little time to spare may overeat, the latter because they eat too fast or without planning. The extent to which leisure time is used for physical activity and the extent to which work tasks expend physical energy will also affect energy balance.

Physical Activity

Appetite control is optimal when regular exercise is undertaken (Åstrand and Rodahl, 1970). With a greater energy requirement, a wider choice of food items is possible inasmuch as more of the energy-dense items can be incorporated. The basic nutritional principle that the wider the variety of foods the more likely is nutrient intake to be adequate and the less likely any toxic effect, is also better served with a greater energy requirement.

Education

To some extent it is difficult to separate education from socioeconomic factors affecting nutritional status. The down-turn in mortality from ischemic heart disease in North America may have occurred because of reduced exposure to risk factors (Stallones, 1980). Whether the down-turn actually represents better access to information about risk factors, more ability to respond to recommendations, more resources to accomplish change in risk, greater access to medical care, or a combination of these is difficult to assess.

However, knowledge of nutritional needs or problems may not be enough to effect behavioral change. Motivation, techniques for change, and problem-solving skills are also required (Caliendo, 1979).

The print and electronic media can be used to affect food habits in underdeveloped (Wood-Bradley *et al.*, 1980) as well as developed countries (Senate Standing Committee on Education and the Arts, 1978). Food advertisers, if not nutritionists, are convinced about the media possibilities. In the Australian summer of 1978–1979, owing to a concerted advertising campaign, flavored sweetened milk displaced carbonated sweetened beverages as the principal drink purchased by Melbourne children. In the Australian capital, Canberra, a survey showed that the percentage of advertisement time devoted to fast-foods, (i.e., biscuits, sweets, and drinks) was 44% during 4:00–6:00 PM, compared with only 6% during 6:00–7:00 PM (Senate Standing Committee on Education and the Arts, 1978).

Transportation

Although road, rail, water, and air transport contribute to the movement of food from grower to processor to user, the user himself may not always be well-served by modern transport systems.

In many ways, the automobile serves as a model for an examination of some of the contemporary factors adversely affecting nutrition in the West. In the first place, it reduces the level of physical activity. Next, it allows an increase in the range of places in which it is possible to eat and thereby some of the constraints on overconsumption are reduced. It allows the purchase of food in larger quantities because transport of the food is easier. It also allows access to ready-to-eat food outlets which are beyond ordinary walking

distance from home or employment and often not related to a public transport system. The car itself provides a relatively private place for food consumption and driving may encourage chewing to stay awake, to avoid tension, or to counter boredom. The car adds to the risks of alcohol abuse. The automobile illustrates how an apparently unrelated technological change can affect the food system and nutritional status.

The Food System

The mode of food production, processing, marketing, and pricing can all affect nutritional status (Abelson, 1975; Caliendo, 1979).

Personal Habits

The adverse effects of cigarette smoking on vitamin C status are now recognized (Pelletier, 1975). The magnitude of effect of cigarette smoking on vitamin C is related to the number of cigarettes smoked. For those who persist with cigarette smoking, it may be necessary to recommend a higher vitamin C intake than for nonsmokers. Smoking may have a more general effect on nutritional status by impairment of taste and smell.

There is also evidence that those who ingest more than 80 g ethanol daily have low plasma and platelet vitamin C concentrations (Strauss *et al.*, 1981). The effect may in part be due to reduced vitamin C absorption (Fazio *et al.*, 1981). Often, alcohol abusers are also cigarette smokers and the effect of both on vitamin C status may be additive.

The wide-ranging nutritional consequences of alcohol abuse are reviewed elsewhere (Thomson, 1978; Hurt *et al.*, 1979). As far as cardiovascular disease is concerned, it would appear that alcohol induces competing risk phenomena (Kozararevic, *et al.*, 1980). Less than one standard drink a day is associated with more ischemic heart disease, perhaps because high-density lipoprotein cholesterol is lower. For all alcoholic beverages except beer their use is associated with higher blood pressure and therefore probably more death from stroke.

Health Care System

The inadequate training of health-care professionals in nutrition is one of the ways in which the health-care system itself can adversely affect nutritional status (Wahlqvist, 1981). The health-care system requires facilities for prevention, identification, and management of nutritional problems. Even in the practice of clinical nutrition and dietetics, the consideration of nutritional problems in isolation from other health problems and of a particular nutrient rather than intact food or food patterns can present problems (Wahlqvist *et al.*, 1981). Where management of medical problems is drug oriented, drug-nutrient interactions may be seen (Mueller, 1980).

RISK OF SYMBOLIC FOODS

In food cultures, a particular item may symbolize food as a whole. In the Greek meal it is bread (Mead, 1955); for most Chinese it is rice; for Papua New Guineans it is the sweet potato. The potential problem with the dominance of one food item is that it diminishes the likelihood of variety in the diet and makes the community vulnerable should the symbolic food be unavailable.

At times, the desire for a culturally characteristic food or beverage may override a knowledge of possible death. This happens, for example, with pufferfish—potentially contaminated with tetrodotoxin—yet eaten by Chinese and Japanese (Committee on Food Protection, 1973), and with the fermented Javanese food bongkrek, which may be contaminated with *Pseudomonas cocovenenans* (Winarno, 1979).

BEVERAGES

Like food, beverages are used as a means of communication, entertaining others, and for mood alteration. Where a water supply is safe microbiologically and toxicologically, water itself would generally be the nutritionally preferred drink to quench thirst. Yet it occurs less and less to children and adults in affluent societies to drink water, sweetened carbonated beverages being preferred by children and caffeinated or alcoholic beverages by adults.

The potential hazard or hazardous component in commonly used beverages as well as the possible nutritional benefits are shown in Table II (Zar-embski and Hodgkinson, 1962; Graham, 1978; Siegel, 1979). Caffeine occurs in tea, coffee, guarana, maté, kola nuts, and cocoa beans. Guarana yields beans for roasting, and maté provides tealike leaves used to make stimulating beverages in South America. The kola nut is used in the manufacture of the cola group of soft drinks. The average caffeine contents of common beverages are (Burg, 1975; Bunker and McWilliams, 1979);

1. Brewed Coffee, 85 mg/150 ml cup
2. Instant Coffee, 60 mg/150 ml cup
3. Decaffeinated Coffee, 3 mg/150 ml cup
4. Black Tea, 50 mg/150 ml cup
5. Green Tea, 30 mg/150 ml cup
6. Cocoa Drinks, 6–42 mg/150 ml cup
7. Cola Drinks, 22–65 mg/360 ml container

The effects of caffeine need to be considered on a dose per kg basis which means that effects in children will be relatively greater for a given ingested amount. The lethal dose for adult men is probably in excess of 10 g (Timson, 1978; Graham, 1978). The various potential adverse effects of caffeine are

TABLE II
Orally Ingested Items That Usually Serve Little Nutritional Purpose

Item	Potential hazard or hazardous component	Possible nutritional benefit
<i>Beverages</i>		
Tea	Caffeine, oxalate, tannin	Fluoride source; vehicle for water ingestion; added milk and sugar as protein and energy sources
Coffee	Caffeine, tannin	Potassium; nicotinic acid; vehicle for water; added milk and sugar
Cocoa	Theobromine, caffeine, tannin	—
Alcohol	Ethanol, amines, aldehydes, ethers, fusel oils	Local noncommercial beverages may contribute vitamins and minerals; energy source; accompany and encourage use of food
Carbonated, sweetened	Dental caries	Energy source; fluid replacement
Ginseng	Saponin glycosides	—
<i>Confectionery</i>	Dental caries, coloring agents	Energy source
<i>Chewables</i>		
Gums	Dental caries if sweetened	Dental and oral hygiene
Betel nut	Psychotropic factor	Stimulates salivary flow; medicinal
Tobacco	Oral cancer, abnormal fetal development	—

summarized in Table III (Anonymous, 1979, 1980; Cohen, 1980; Greden *et al.*, 1980). Of most concern has been its possible mutagenicity and teratogenicity (Mau and Netter, 1974; Weathersbee *et al.*, 1977; Borlee *et al.*, 1978).

Animal studies indicate the threshold of caffeine for no fetal effect is about 50 mg/kg as a single dose. This would be about 25–40 cups for man. At this stage it is probable prudent for pregnant women to reduce caffeinated beverage intake (Goyan, 1980).

A recent case-control study by MacMahon *et al.* (1981) in Boston has shown an association between drinking coffee and cancer of the pancreas, such that the relative risk associated with up to 2 cups per day was 1.8 after adjustment for cigarette smoking. Whether or not the relationship is causal will depend on further investigation.

TABLE III
Putative Adverse Effects of Caffeine

Symptoms	Grades of evidence ^a
<i>Cardiovascular</i>	
ischemic heart disease	3
arrhythmias	2
lipoprotein	1
<i>Central Nervous System</i>	
adenosine antagonist	2
behavioral changes	1
withdrawal headache	2
<i>Mutagenic</i>	3
<i>Teratogenic</i>	3
<i>Breast</i>	
fibrocystic breast disease	3
<i>Gastrointestinal</i>	
heartburn	3

^a Evidence for effects has been graded on a scale of 1 to 3. Assignment of 1 indicates good, 2 fair, and 3 weak evidence that effects might be seen in man.

Any possible effect of coffee on ischemic heart disease might be through its interaction with smoking on lipoprotein cholesterol (Heyden *et al.*, 1979; Anonymous, 1981).

It must be remembered that not all effects of coffee may be mediated by caffeine and this appears to be the case as far as heartburn is concerned (Cohen, 1980).

Teas made from a variety of plant sources are currently popular in the west amongst those who are interested in 'health foods'. These are not all as safe as might be thought (Editorial, 1979). For example, teas made from juniper berries can cause gastrointestinal irritation; those from shave grass or horsetail plants, adverse effects may result from the nicotine and the thiaminase that they contain; those from buckthorn bark, senna leaves, dockroots and aloe leaves are cathartics; teas from catnip, juniper, hydrangea, lobelia, jimson weed and wormwood are anticholinergic, can produce euphoria and hallucinations; nutmeg is hallucinogenic and hepatotoxic; chamomile can cause sensitivity reactions; licorice root can cause sodium and water retention; pennyroyal oil and devil's claw foot contain oxytocics; sassafras root bark is hepatotoxic and carcinogenic; Indian tobacco contains lobelline which can cause paralysis and hypothermia; mistletoe contains phytotoxins with muscle depolarizing properties; apricot kernels contain the cyanogenetic glycoside amygdalin.

Ginseng, used for a long time in oriental medicine, is now used in a variety of forms including teas in the West. The active constituents, saponin glycosides, have now been reported to cause the ginseng abuse syndrome (GAS) (Siegel, 1979). GAS includes mood alteration, anorexia, hypertension and hypotension, edema, amenorrhea, diarrhea, and skin eruptions.

CONFECTIONERY

The adverse effects of confectionery relate chiefly to the increased likelihood of dental caries (Newbrun, 1979; Lee, 1981). There may also be a problem where energy needs have been met, but all nutrient needs have not. Nevertheless, the role of confectionery use in childhood and adult life requires better description. An Oxford study indicates that confectionery plays an important part in creating a children's world separate from that of the adult (James, 1979).

CHEWABLES

Man has long chewed for nonnutritional reasons (Table II). Oral satisfaction is considered a basic psychological need. For oral hygiene, chewing sticks were used by the Greeks and Romans; and the counterpart to the modern toothbrush is thought to have been devised by the Chinese in the fifteenth century (Lewis and Elvin-Lewis, 1976).

Although the use of chewing gum (chicle latex from *Achras zapota*) and bubble gum (latex from *Mimusops dalata*) are regarded as North American practices, gums, latex, and resins have long been used by indigenous peoples for chewing (Lewis and Elvin-Lewis, 1976). With added sugar, gums may promote dental caries.

In Arabia, the leaves and young shoots of the shrub *Catha edulis*, called kat or khat, are chewed for their stimulant properties.

Betelnut (*Areca catechu*) and lime is used widely as a chewable throughout Asia and Papua New Guinea (Wood-Bradley *et al.*, 1980). It appears to have mood-modifying properties. Additionally, where food supply is short, it may be used to stave off hunger and, indeed, when used by children who could otherwise be nibbling food, may contribute to malnutrition.

Tobacco does not have to be smoked to cause harm (Darby, 1979). Not only smoking (Simpson, 1957) but also the chewing of tobacco by pregnant women has been shown to lead to low birth weight (Krishna, 1978). Krishna also observed in Maharashtra that tobacco chewing led to an increased still-birth rate and a low male : female infant sex ratio.

LIFESTYLE

From the Edinburgh–Stockholm comparison of risk factors for ischemic heart disease, it can be seen that several factors were more prevalent in Edinburgh, which has the higher mortality rates (Logan *et al.*, 1978). Edinburgh men were shorter and fatter, had higher blood pressures, smoked more cigarettes, drank more alcohol, had more electrocardiograph abnormalities, lower exercise tolerance, higher serum insulins, higher serum triglyceride

concentrations, lower concentrations of serum high-density lipoprotein cholesterol, and lower contents of serum triglyceride and cholesterol ester linoleic acid. It is likely that at least some of these risk factors operate independently of each other. Yet they have occurred together more frequently in one place than another. This clustering of risks suggests that there may be a basic lifestyle problem.

Lifestyles with different components were examined for relationships to nutrient intake and laboratory indices of nutritional status by Baird and Schutz (1980). The study indicates that as the general quality of life improves, so the nutritional status of the population could be expected to improve.

The recognition of a particular lifestyle, which may alter several nutritional and other health-related variables, may be of considerable importance in preventive medicine (Turner, 1980). A checklist of the many components of lifestyle is available (Stanley *et al.*, 1978). Although pathogenetic mechanisms are important to understand inasmuch as they may allow the chain of events leading from cause to effect to be broken, it may sometimes be more effective overall to alter a lifestyle.

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