

MINI-REVIEW

Diverse Influences of Dietary Factors on Cancer in Asia

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Abstract

The major environmental risk factors for cancer are carcinogen and co-carcinogen exposure in tobacco, insufficient exercise and above all an unhealthy diet. What we eat or do not eat is exceedingly important in determining what cancers or other chronic disease we may suffer from. Carcinogens may be integral contaminants of the diet, like nitrosamines in some situations and aflatoxins, or may be generated by cooking processes, as is known to be the case for heterocyclic amine pyrolysis products. Examples of co-carcinogenic agents may include grit in bread products, salt in pickles or betel in chewing quids. Dietary insufficiencies, for example of zinc, may also act to increase sensitivity to genetic damage, for example. Influence on metabolism of carcinogens, like induction of phase II enzymes like glutathione S transferases, further directly impacts on carcinogenicity. Antioxidants in fruits and vegetables are typical examples of protective agents acting in this way. In addition we have dietary fibre which can decrease carcinogen exposure through accelerating passage of faeces through the gut. Other types of fibre, the soluble forms, can act to decrease uptake of glucose and thus suppress insulin exposure, an important factor for colon cancer. Natural anti-inflammatory agents like N-3 fatty acids in fish offer another example of preventive factors in the diet. Individual dietary components, like isoflavones in soy products, can interfere with hormone function to exert a beneficial action, as on the breast. Other compounds may act via stimulation of the immune system like lactoferrin and betaglacans. Perhaps the most important influence of diet on cancer, however, in a world of increasing comfort and ease of access to foodstuffs, is through over-eating and consequent obesity. Given the importance of diet to all our lives, we need to focus on all possible interactive effects in providing an evidence base to guide our choices regarding what we should eat in Asia.

Key Words: Cancer development - dietary factors - constituents - contaminants

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Introduction

The complexity of dietary influences on cancer development is a reflection of the very variety that characterizes human consumption of foodstuffs. In addition to included fats, carbohydrates and proteins as major constituents, fibre and antioxidants from vegetables, isoflavones from soy products, trace metals and vitamins, there may be other materials present as contaminants, like grit and carcinogens. Physical characteristics like bulk and temperature can also play roles.

Since there are basically only two aetiological factors responsible for neoplastic development, carcinogen exposure and proliferative stimuli, interacting mechanistically to bring about 'initiation' of carcinogenesis and second stage 'modulation' of tumour growth and then 'progression' (see Figure 1), we can classify dietary influence on this basis (see Figure 2).

Carcinogens in the diet, like arsenic and other chemicals from well water, aflatoxins from fungal contamination and heterocyclic amines generated by broiling, can clearly make major contributions by directly forming adducts in tissues. Dilution of carcinogens by drinking large quantities of water or other liquids, or bulky

foods in the gut, may therefore be protective.

Conversely, any factor causing elevated levels of proliferation, whether through damage and regenerative processes or by metabolic stimuli, will then naturally enhance the fixation of such genetic lesions thought to be involved in the first step of neoplasia. Physical agents like grit in food and very hot materials are examples. They can also provide a stimulus to second stage growth and therefore act as promotion factors. Zinc and other metals impact on tissue repair and therefore may be important for initiation. Inflammatory processes due to viral, bacterial and parasite infections provide a very strong

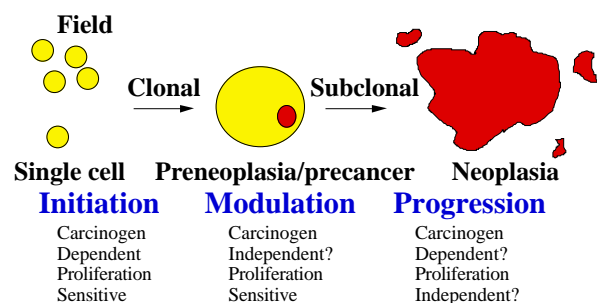


Figure 1. Processes and Factors in Neoplasia

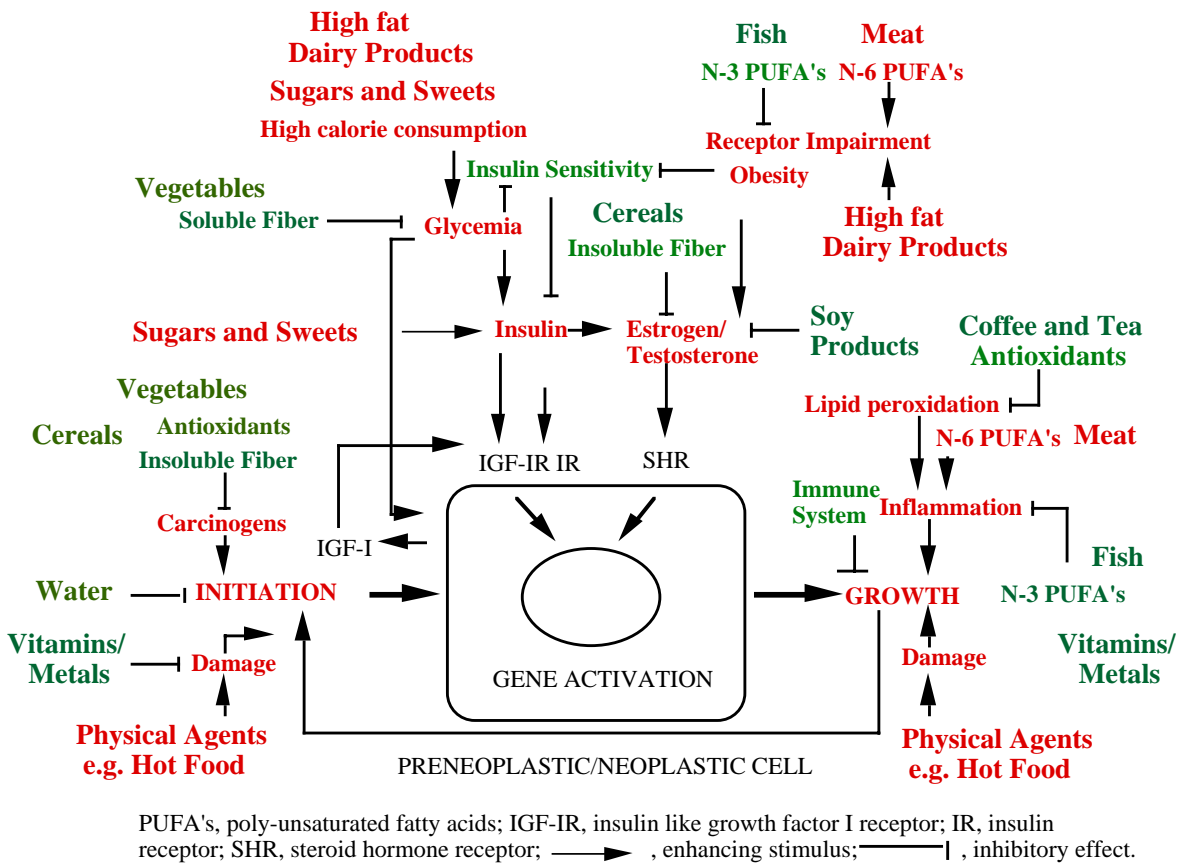


Figure 2. Risk and Beneficial Dietary Factors Impacting on Neoplasia by Influencing Initiation and Growth

promoting influence because of chronically elevated cell proliferation, and may also involve generation of carcinogens, thus acting in both initiation and subsequent modulation stages. Infection may be by the dietary route, at least with hepatitis viruses, certain bacteria and liver flukes. Inflammation through lipid peroxidation and other metabolic imbalance can clearly play a role and therefore any dietary factors which protect against superoxide radicals, like N-3 fatty acids and antioxidants.

Since antioxidants also influence the balance between activation and detoxification of carcinogens, they are important protective factors against initiation, under most circumstances, and this underlies some of the benefits generally accruing from vegetable intake. Vegetables further are sources of soluble fiber which can reduce metabolic exposure to insulin which acts as a growth factor. Cereals, on the other hand, supply insoluble types of fibre, which may impact by binding carcinogens or accelerating passage of faeces.

Soy products like genistein primarily make a positive

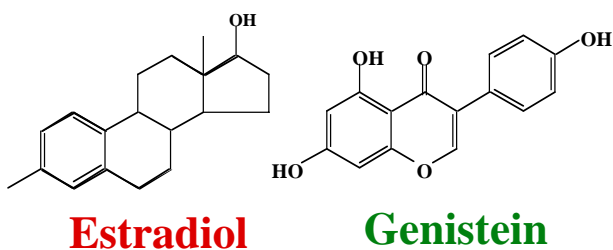


Figure 3. Chemical Structures of Estradiol and Genistein

contribution by interfering with the action of estrogen through their similar structures and potential for binding to estrogen receptors (see Figure 3).

Overeating and the resultant obesity may now constitute overall the most iniquitous harmful influence of the diet, given the preponderance of lifestyle-related adenocarcinomas of the breast, colorectum, prostate and other body sites which are generally on the increase throughout Asia. The present mini-review was undertaken to summarize the findings for dietary influence for the various body sites documented in a series of

Table 1. Asian Evidence for Modifying Factors for the Oral Cavity

	NW	SW	S	SEM	SEI	Pac	NE	World*
Prevalence	L	L-M	H	L-M	L	L-H	L	NA
Lifestyle								
Tobacco	++	++	+++	+	ND	++	++	NA
Reverse smoking								
Alcohol	+/-	ND	-	-	ND	-	++	+++
Betel	ND	ND	+++	+++	+	++	+	NA
Diet								
Hot Drinks	ND	ND	ND	ND	ND	ND	ND	+
Vegetables	ND	ND	ND	ND	ND	ND	ND	--#
Fruits	ND	ND	ND	ND	ND	ND	ND	--
Coffee	ND	ND	ND	ND	ND	ND	-	+/-

*World Cancer Research Fund, American Institute for Cancer Research 2007; NW, North-West, SW, South-West, S, South; SEM, South-East Mainland; SEI, South-East Island; Pac, Pacific; NE, North-East; L, low; M, medium; H, high; NA, not applicable; ND, no data; +/-, slight/weak protection, +/+, no effect, +/+/+/+, slight, weak, strong risk #Carotenoids

Table 2. Asian Evidence for Modifying Factors for the Oesophagus

	NW	SW	S	SEM	SEI	Pac	NE	World*
Prevalence	L-H	L	M	L-M	L	L-H	L	NA
Lifestyle								
Carcinogens	ND	ND	ND	ND	ND	ND	+	NA
Tobacco	++	++	+++	+	ND	ND	++	NA
Alcohol	+/-	ND	-	+	ND	ND	++	+++
Betel	ND	ND	++	+	ND	ND	+	NA
Obesity	ND	ND	ND	ND	ND	ND	+#	+++ [#]
Diet								
Deficiency	++	ND	+	ND	ND	ND	++	+
Hot Drinks	++	ND	ND	ND	ND	ND	+	+
Vegetables	ND	ND	-	ND	ND	ND	--	--
Fruits	ND	ND	-	ND	ND	ND	-	--
Meat	ND	ND	ND	ND	ND	ND	ND	+
Salt	+	ND	ND	ND	ND	ND	+	+/-
Tea	ND	ND	ND	ND	ND	ND	-	+/-

*World Cancer Research Fund, American Institute for Cancer Research 2007; NW, North-West, SW, South-West, S, South; SEM, South-East Mainland; SEI, South-East Island; Pac, Pacific; NE, North-East; L, low; M, medium; H, high; NA, not applicable; ND, no data; +/-, slight/weak protection, +/+, no effect, +/+/+/+, slight, weak, strong risk; # for adenocarcinomas

epidemiological reviews of cancer in the different regions of Asia: North-western and Central (Moore et al., 2010a); South-western (Salim et al., 2010); Southern (Moore et al., 2010b); South-eastern mainland (Moore et al., 2010c); South-eastern peninsular and island (Moore et al., 2010d); Pacific region (Moore et al., 2010e); and North-east (Long et al., 2010). For comparison, the overall results of the major survey carried out by the World Cancer Research Fund/American Institute for Cancer Research (2007) are referenced in the series of Tables (from Moore and Sobue, 2010) given below.

Organ Sites

Oral Cancer

Conclusions regarding risk factors for oral cancer are summarized in Table 1. The major dietary factor is betel chewing in its multiple forms, often mixed with tobacco. In the Yemen an equivalent influence may be exerted by Qat. While alcohol is a major contributor in the West, the findings for Asia are equivocal.

Oesophageal Cancer

Through Iran and all of Central Asia and a band through China, oesophageal cancer is of major importance and has attracted a great deal of research interest. Thermal irritation and coarse food (physical damage to the mucosal lining of the esophagus) are culprit risk factors, presumably interacting with low socioeconomic status and hygienic conditions, and a poor nutritional diet, as well as contaminated well water and low intake of fresh fruits and vegetables (see Table 2).

Stomach Cancer

Stomach cancer is prevalent in Iran and the Central Asian republics and well as China and especially Korea and Japan. While *Helicobacter pylori* infection is the major factor, being rare in low incidence Malay

Table 3. Asian Evidence for Modifying Factors for the Stomach

	NW	SW	S	SEM	SEI	Pac	NE	World*
Prevalence	L-H	L	L	L-M	L	L-H	L	NA
Lifestyle								
<i>Helicobacter</i>	++	ND	+	ND	++	ND	++	NA
Tobacco	ND	ND	+/-	ND	+	ND	++	NA
Alcohol	ND	ND	+/-	ND	ND	ND	+	+/-
Obesity	ND	ND	ND	ND	ND	ND	+	+/-
Exercise	ND	ND	ND	ND	ND	ND	-	+/-
Diet								
Vegetables	ND	ND	-	-	--	ND	--	--
Fruits	ND	ND	-	-	-	ND	-	--
Meat	ND	ND	ND	ND	ND	ND	ND	+
Fish	ND	ND	ND	ND	ND	ND	--	+
Smoked food	ND	ND	ND	ND	ND	ND	+	+
Salt	ND	ND	ND	++	++	ND	++	++
Coffee	ND	ND	ND	ND	ND	ND	-	+/-

*World Cancer Research Fund, American Institute for Cancer Research 2007; NW, North-West, SW, South-West, S, South; SEM, South-East Mainland; SEI, South-East Island; Pac, Pacific; NE, North-East; L, low; M, medium; H, high; NA, not applicable; ND, no data; +/-, slight/weak protection, +/+, no effect, +/+/+/+, slight, weak, strong risk

populations, there must be other influences, given the low prevalence in Indians in Malaysia who have high rates of bacterial infection. *H. pylori* infection may interact with consumption of salt, especially as pickles and sa-um or smoked dried meat or soda (alkali), used as a food additive and dried fish (see Table 3). Established protective factors include intake of fruits and vegetables, and fish at least in populations like Japan with very high intake.

Colorectal Cancer

Colorectal cancers are now very frequent in Japan, and although relatively rare in many countries of Asia are generally on the increase. Risk factors (see Table 4) include meat consumption while vegetables and fruits are

Table 4. Asian Evidence for Modifying Factors for the Colorectum

	NW	SW	S	SEM	SEI	Pac	NE	World*
Prevalence	L-M	L-H	L	L-M	M	L-H	L	NA
Lifestyle								
Carcinogens	ND	+	ND	ND	+	ND	+	NA
Tobacco	ND	ND	ND	ND	+	ND	+	NA
Alcohol	ND	ND	ND	ND	ND	ND	+	+++
Obesity	ND	ND	ND	ND	ND	ND	+	+++
Exercise	ND	ND	ND	ND	ND	ND	--	---
Diet								
Vegetables	ND	-	ND	-	--	ND	--	--
Fruits	ND	-	ND	-	-	ND	-	-
Fat	ND	ND	ND	ND	ND	ND	++	+
Sugar	ND	ND	ND	ND	ND	ND	ND	+
Meat	ND	ND	ND	+	+	ND	+	+++
Fish	ND	ND	ND	ND	ND	ND	--	-
Milk	ND	ND	ND	ND	ND	ND	ND	--
Tea	ND	ND	ND	ND	ND	ND	-	NA

*World Cancer Research Fund, American Institute for Cancer Research 2007; NW, North-West, SW, South-West, S, South; SEM, South-East Mainland; SEI, South-East Island; Pac, Pacific; NE, North-East; L, low; M, medium; H, high; NA, not applicable; ND, no data; +/-, slight/weak protection, +/+, no effect, +/+/+/+, slight, weak, strong risk

Table 5. Asian Evidence for Modifying Factors for the Liver

	NW	SW	S	SEM	SEI	Pac	NE	World*
Prevalence	L-M	L-M	L	M-H	M-H	L-H	H	NA
Lifestyle								
Viruses	++	++	++	++	++	++	+++	NA
Parasites [#]	ND	ND	ND	+++	ND	ND	+	NA
Carcinogens	ND	+	ND	ND	ND	ND	++	+++
Tobacco	ND	ND	ND	ND	ND	ND	++	NA
Alcohol	+	ND	ND	ND	ND	ND	++	++
Obesity	+	ND	+	ND	ND	ND	+	+/-
Exercise	ND	ND	ND	ND	ND	ND	--	+/-
Diet								
Vegetables	ND	ND	ND	ND	ND	ND	--	+/-
Fruits	ND	ND	ND	ND	ND	ND	-	-
Fat	ND	ND	ND	ND	ND	ND	++	+/-
Fish	ND	ND	ND	ND	ND	ND	-	+/-
Soy	ND	ND	ND	ND	ND	ND	-	+/-
Coffee	ND	ND	ND	ND	ND	ND	-	NA

*World Cancer Research Fund, American Institute for Cancer Research 2007; NW, North-West, SW, South-West, S, South; SEM, South-East Mainland; SEI, South-East Island; Pac, Pacific; NE, North-East; L, low; M, medium; H, high; NA, not applicable; ND, no data; +/-, slight/weak protection, +/+, no effect, +/+/+/+, slight, weak, strong risk; for cholangiocellular liver cancers

protective, as well as fish in Japan. Hyperinsulinemia is now generally considered to play a major role in colorectal carcinogenesis and the amount of diet consumed overall may be a prime factor since there have been many reports of associations with the body mass index (BMI).

Liver Cancer

While the main causal factor for hepatocellular carcinomas is clearly viral, the recently documented increase in non-alcoholic steatohepatitis in the region might indicate an elevated risk of high calorific diet-dependent liver cancer in the future (see Table 5). Some role for alcohol could be implicated in this, as well as being a direct cause of damage and cirrhosis.

The direct link between dietary exposure to eggs of the liver fluke and cholangiocarcinoma, for example in Thailand is very well documented. There may also be

Table 6. Asian Evidence for Modifying Factors for the Pancreas

	NW	SW	S	SEM	SEI	Pac	NE	World*
Prevalence	L-M	L-M	L	L-M	L-M	M-H	L-H	NA
Lifestyle								
Carcinogens	ND	+	ND	ND	ND	ND	ND	+/-
Tobacco	++	++	ND	ND	ND	ND	++	NA
Alcohol	ND	ND	ND	ND	ND	ND	++	++
Obesity	ND	+	ND	ND	ND	ND	++	+++
Exercise	ND	ND	ND	ND	ND	ND	ND	-
Diet								
Vegetables	ND	ND	ND	ND	ND	ND	--	--
Fruits	ND	ND	ND	ND	ND	ND	-	-
Meat	ND	ND	ND	ND	ND	ND	ND	+
Coffee	ND	ND	ND	ND	ND	ND	-	+/-

*World Cancer Research Fund, American Institute for Cancer Research 2007; NW, North-West, SW, South-West, S, South; SEM, South-East Mainland; SEI, South-East Island; Pac, Pacific; NE, North-East; L, low; M, medium; H, high; NA, not applicable; ND, no data; +/-, slight/weak protection, +/+, no effect, +/+/+/+, slight, weak, strong risk

contributions of dietary carcinogens like aflatoxin and nitrosamines in both types of liver cancer.

Gallbladder Cancer

In females in the North-east of India gallbladder cancers are relatively frequent. Risk factors are gallstones, and vitamin A intake, high fat intake, prolonged fasting, a habit of missing dinner and tobacco chewing as prime causes.

Pancreatic Cancer

Pancreatic cancer rates are moderately high in the 'Western' area but otherwise low, and high insulin and C-peptide levels suggest that insulin resistance and obesity may be risk factors, along with alcohol and smoking (see Table 6). Clustering of cases in Egypt possibly is related to water pollution and carcinogen exposure.

Oropharyngeal, Nasopharyngeal and Laryngeal Cancer

The major risk factors for pharyngeal and laryngeal cancer appear to be dust and smoking exposure, as well as alcohol, with vegetables and fruits as protective influences (see Table 7). Intake of salt-preserved meat and fish and herbal medicines may also be particularly important in the nasopharyngeal case.

Lung Cancer

Although tobacco is the prime concern with regard to lung cancer, many dietary influences have also been reported (see Table 8). Cooking oil pollution and food contamination by environmental polycyclic aromatic hydrocarbons may contribute. Fruit and vegetables are protective, while high fat consumption may increase the risk of adenocarcinoma in females.

Kidney Cancer

Obesity is associated with an increased risk of kidney cancer and diabetes mellitus is a risk factor, while reduced risk is generally seen for increasing categories of fruit and vegetable intake (see Table 9).

Table 7. Asian Evidence for Modifying Factors for the Pharynx and Larynx

	NW	SW	S	SEM	SEI	Pac	NE	World*
Prevalence	L-H	L-H	M-H	L-M	L-M	M-H	L-M	NA
Lifestyle								
Tobacco	+	ND	++	ND	++	ND	++	NA
Herbs [#]	ND	ND	ND	ND	+	ND	ND	NA
Alcohol	+	ND	ND	ND	ND	ND	++	+++
Dusts	++	ND	ND	ND	ND	ND	++	NA
Hot drinks	ND	ND	ND	ND	ND	ND	ND	+
Diet								
Vegetables	ND	ND	ND	ND	ND	ND	--	---
Fruits	ND	ND	ND	ND	ND	ND	-	---
Salt [#]	ND	ND	ND	ND	ND	ND	++	+/-
Coffee	ND	ND	ND	ND	ND	ND	-	+/-

*World Cancer Research Fund, American Institute for Cancer Research 2007; NW, North-West, SW, South-West, S, South; SEM, South-East Mainland; SEI, South-East Island; Pac, Pacific; NE, North-East; L, low; M, medium; H, high; NA, not applicable; ND, no data; +/-, slight/weak protection, +/+, no effect, +/+/+/+, slight, weak, strong risk; [#] for the nasopharynx

Table 8. Asian Country Evidence for Modifying Factors for the Lung

	NW	SW	S	SEM	SEI	Pac	NE	World*
Prevalence	L-H	L-M	L-M	L-M	L-H	M-H	M-H	NA
Lifestyle								
Tobacco	+	ND	++	++	++	+	++	NA
Carcinogens	++ [#]	ND	ND	ND	+	+	+	NA
Alcohol	ND	ND	ND	ND	ND	ND	+/-	+/-
Dusts/oils	++	ND	ND	ND	ND	ND	++	NA
Diet								
Vegetables	ND	ND	ND	-	-	ND	--	---
Fruits	ND	ND	ND	-	ND	ND	-	---
Meat	ND	ND	ND	ND	ND	ND	ND	+
Fat	ND	ND	ND	ND	ND	ND	ND	+
Fish	ND	ND	ND	ND	ND	ND	-	+/-

*World Cancer Research Fund, American Institute for Cancer Research 2007; NW, North-West, SW, South-West, S, South; SEM, South-East Mainland; SEI, South-East Island; Pac, Pacific; NE, North-East; L, low; M, medium; H, high; NA, not applicable; ND, no data; +/-, slight/weak protection, +/+, no effect, +/+/+/, slight, weak, strong risk;[#] asbestos and other fibres for mesotheliomas

Bladder Cancer

The established major risk factors for bladder cancer are smoking and parasites (see Table 10) but dietary factors may also play a role. One major influence could be liquid intake, flushing out carcinogens, whether water, coffee or green tea. Fruit and green-yellow vegetable intake may be protective as well as soy. High arsenic and trihalomethane and nitrate levels in drinking water have

Table 9. Asian Evidence for Modifying Factors for the Kidney

	NW	SW	S	SEM	SEI	Pac	NE	World*
Prevalence	L	L-M	L	L	L	L-M	L-M	NA
Lifestyle								
Obesity	ND	ND	ND	ND	ND	ND	++	+++
Diet								
Vegetables	ND	ND	ND	ND	ND	ND	--	+/-
Fruits	ND	ND	ND	ND	ND	ND	-	+/-

*World Cancer Research Fund, American Institute for Cancer Research 2007; NW, North-West, SW, South-West, S, South; SEM, South-East Mainland; SEI, South-East Island; Pac, Pacific; NE, North-East; L, low; M, medium; H, high; NA, not applicable; ND, no data; +/-, slight/weak protection, +/+, no effect, +/+/+/, slight, weak, strong risk

Table 10. Asian Evidence for Modifying Factors for the Ureter and Urinary Bladder

	NW	SW	S	SEM	SEI	Pac	NE	World*
Prevalence	L-M	L-H	L	L	L	L-M	L	NA
Lifestyle								
Parasites	ND	++	ND	ND	ND	ND	ND	NA
Tobacco	++	++	ND	ND	ND	ND	++	NA
Carcinogens	+	ND	ND	ND	ND	ND	++ [#]	+ [#]
Diet								
Vegetables	ND	ND	ND	ND	ND	ND	--	+/-
Fruits	ND	ND	ND	ND	ND	ND	--	+/-
Meat	ND	ND	ND	ND	ND	ND	+	+/-

*World Cancer Research Fund, American Institute for Cancer Research 2007; NW, North-West, SW, South-West, S, South; SEM, South-East Mainland; SEI, South-East Island; Pac, Pacific; NE, North-East; L, low; M, medium; H, high; NA, not applicable; ND, no data; +/-, slight/weak protection, +/+, no effect, +/+/+/, slight, weak, strong risk;[#] arsenic and other environmental carcinogens

been proposed as contributory agents in certain countries of Asia.

Prostate Cancer

Fat and meat intake appear to be determinants of prostate cancer risk, while vegetables/fruits and especially tomatoes are protective (see Table 11). Consumption of dairy products is considered to be important in the West but data for Asia are limited.

Breast Cancer

An elevated BMI is a risk factor for breast cancer, especially in postmenopausal women (see Table 12). However, excessive calorific intake could also interact with reproductive parameters to exert an influence, for

Table 11. Asian Evidence for Modifying Factors for the Prostate

	NW	SW	S	SEM	SEI	Pac	NE	World*
Prevalence	L-M	L-M	L	L	L-M	M-H	L-M	NA
Lifestyle								
Obesity	ND	ND	ND	ND	ND	ND	+	+/-
Exercise	ND	ND	ND	ND	ND	ND	-	+/-
Diet								
Vegetables [#]	-	ND	ND	ND	ND	ND	--	--
Fruits	ND	ND	ND	ND	ND	ND	-	-
Fat	+	+	ND	ND	ND	ND	+	+/-
Meat	+	+	ND	ND	ND	ND	ND	+/-
Dairy food	ND	+	ND	ND	ND	ND	ND	++
Soy food	ND	ND	ND	ND	ND	ND	---	NA

*World Cancer Research Fund, American Institute for Cancer Research 2007; NW, North-West, SW, South-West, S, South; SEM, South-East Mainland; SEI, South-East Island; Pac, Pacific; NE, North-East; L, low; M, medium; H, high; NA, not applicable; ND, no data; +/-, slight/weak protection, +/+, no effect, +/+/+/, slight, weak, strong risk; [#]particular ingredients like lycopene

Table 11. Asian Evidence for Modifying Factors for the Breast

	NW	SW	S	SEM	SEI	Pac	NE	World*
Prevalence	L-H	L-M	L-H	L-M	M-H	M-H	L-M	NA
Lifestyle								
Tobacco	+	ND	+	ND	ND	ND	+	NA
Alcohol	ND	ND	ND	+	ND	ND	ND	+++
Obesity	+	++	++	ND	ND	ND	++	++ [#]
Exercise	ND	--	ND	ND	ND	ND	--	--
Reproductive Factors								
Menarche	+	ND	ND	ND	+	ND	++	NA
Menopause	+	ND	ND	ND	+	ND	++	NA
Hormones	ND	+	ND	+/-	+	ND	+	NA
Pregnancy	-	ND	ND	-	ND	ND	--	NA
Lactation	--	--	ND	ND	--	ND	--	---
Diet								
Vegetables [#]	ND	-	-	ND	-	ND	-	+/-
Fat	ND	+	ND	ND	ND	ND	+	+ [#]
Sugar	ND	+	ND	ND	ND	ND	+	+/-
Fish	ND	ND	ND	ND	ND	ND	--	+/-
Soy food	ND	ND	ND	ND	--	ND	---	NA

*World Cancer Research Fund, American Institute for Cancer Research 2007; NW, North-West, SW, South-West, S, South; SEM, South-East Mainland; SEI, South-East Island; Pac, Pacific; NE, North-East; L, low; M, medium; H, high; NA, not applicable; ND, no data; +/-, slight/weak protection, +/+, no effect, +/+/+/, slight, weak, strong risk; [#]postmenopausal

Table 12. Asian Evidence for Modifying Factors for the Uterine Cervix

	NW	SW	S	SEM	SEI	Pac	NE	World*
Prevalence	L-H	L-M	L-H	M-H	M-H	M-H	L-M	NA
Lifestyle								
HPV	+++	+++	+++	+++	+++	+++	+++	NA
Tobacco	ND	ND	ND	++	++	ND	++	NA
Reproductive Factors								
Pregnancy	ND	ND	ND	+	ND	ND	+	NA
Early Sex	ND	ND	+	ND	ND	ND	+	NA
VD	ND	ND	ND	+	+	ND	++	NA
Diet								
Vegetables	ND	ND	ND	-	ND	ND	ND	-
Fruit	ND	ND	ND	-	ND	ND	-	+/-
Fish	ND	ND	ND	-	ND	ND	-	+/-

*World Cancer Research Fund, American Institute for Cancer Research 2007; NW, North-West, SW, South-West, S, South; SEM, South-East Mainland; SEI, South-East Island; Pac, Pacific; NE, North-East; L, low; M, medium; H, high; NA, not applicable; ND, no data; +/-, slight/weak protection, +/+, no effect, +/+/+/, slight, weak, strong risk

example on age at menarche. Frequent consumption of carbohydrate, sweets, animal fat, and vegetable oil (margarine) with low intake of fresh vegetables and olive oil is of general significance. Particularly in the North-east region of Asia and in Chinese populations elsewhere, soy products could clearly be playing a role and intake is significantly associated with decrease in plasma estrogen levels as well as percentage mammographic density. High levels of dietary n-3 fatty acids from fish/shellfish have also been found to be associated with a lower risk of breast cancer.

Ovarian and Corpus Uteri Cancers

In the cases of ovarian and endometrial cancers, obesity is an independent risk factor. Consumption of foods low in fat but high in fibre, carotene and vitamins appears to be protective.

Cervix uteri

The over-riding well established cause of cervical cancer is persistent infection with a high risk form of human papilloma virus but smoking and any other influence on the immune system can exert an influence (see Table 12). Increasing intake of foods rich in total vitamin A, and particularly high-retinol foods, may reduce risk of *in-situ* cervical cancer.

Brain cancer

Risk of brain cancer increases with consumption of liquor, salted vegetables and salted fish, while vegetables and fruit and vitamin E and calcium may be protective.

Thyroid cancer

Menstrual and reproductive parameters with excess body weight, especially with onset during early adulthood, may be the most important risk factors for thyroid cancer but iodine intake in the diet presumably can play a role.

Conclusions

From the present mini-review, it is abundantly clear

that, as in the other parts of the world, diet plays a major role in determining risk of cancer development in all major organ sites in Asia. However, the relative dearth of information available for many regions also needs to be stressed and future research should be focused on trying to identify particular food habits which may be of importance, both for elevating risk and for prevention in populations with very low incidences of particular cancers.

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