RESEARCH ARTICLE

Meat Consumption, Animal Products, and the Risk of Bladder Cancer: A Case-Control Study in Uruguayan Men

Alvaro Luis Ronco[1], Maria Mendilaharsu[2], Paolo Boffetta[3], Hugo Deneo-Pellegrini[2], Eduardo De Stefani[2]*

Abstract

In the time period 1996-2004, all incident cases of bladder cancer were included in a case-control study in order to study the role of meat consumption and product animals in the etiology of urothelial cancer. The study included 225 cases and 1,510 hospitalized controls with non-neoplastic conditions, not related to smoking and alcohol drinking. Relative risks, approximated by the odds ratios, were calculated in order to clarify the effect of meat consumption in the etiology of urothelial cancer. Total meat consumption (OR 1.47, 95% CI 1.02-2.11), total processed meat (OR 1.57, 95% CI 1.08-2.27), frankfurters (hot dogs) (OR 2.03, 95% CI 1.28-3.21), ham (OR 1.79, 95% CI 1.21-2.67) and salted meat (OR 2.73, 95% CI 1.78-4.18) were positively associated with risk of bladder cancer. Animal products, like cheese, whole milk, and total eggs were also associated with bladder cancer risk (OR for eggs 4.05, 95% CI 2.68-6.12). In conclusion, total meat, processed meat, and eggs could play an important role in the etiology of bladder cancer in Uruguay.

Keywords: Bladder cancer - meat consumption - red meat - processed meat - eggs - cholesterol - Uruguay

Asian Pac J Cancer Prev, **15 (14)**, 5805-5809

Introduction

Urinary bladder carcinoma (mainly transitional carcinoma) is a frequent malignancy among the male Uruguayan population (age-standardized incidence rate 23.4 per 100,000 men) (Barrios et al., 2010). According to the recent monograph by the World Cancer Research Fund/American Institute for Cancer Research (World Cancer Research Fund, 2007) there is limited evidence suggesting that milk and calcium protect against bladder cancer and that arsenic in drinking water is a cause of this malignancy. Moreover, according to this monograph (World Cancer Research Fund, 2007) meat intake is not a convincing cause of bladder cancer. Studies conducted in Iran (Rohani-Rasaf et al., 2013) and in the Pacific Islands (Moore et al., 2009) showed lower incidence rates of bladder cancer.

Conversely, a multisite case-control conducted in Uruguay (De Stefani et al., 2012) reported an increased risk of bladder cancer associated with processed meat intake. Also, the study by Tavani et al. (2000) showed an increased risk of bladder cancer associated with red meat consumption. Therefore, the relationship between red and processed meat consumption and bladder cancer deserves to be studied further.

For this reason we decided to conduct a case-control study in Uruguay, in order to explore the relationship between meat consumption and risk of bladder cancer in a high risk country like Uruguay.

Materials and Methods

Selection of cases

In the time period 1996-2005, all newly diagnosed and microscopically validated cases of transitional-cell carcinoma of the urinary bladder occurring in men were considered eligible for this study. A total of 230 male cases were approached for a possible interview and five patients refused, leaving 225 cases for inclusion in the study (response rate 97.8%). All the cases were drawn from the four major public health hospitals in Montevideo, Uruguay.

Selection of controls

In the same time period and in the same hospitals, all men afflicted with non neoplastic conditions not related to smoking and alcohol drinking were considered eligible for the study. A total of 1,555 potential controls were approached for possible interview, and 45 patients refused, leaving a final total of 1,510 controls, which were included in the study (response rate 97.1%). These controls presented the following diseases: eye disorders (382 patients, 25.3%), abdominal hernia (337, 22.3%), fractures (158, 10.5%), injuries (122, 8.1%), diseases of the skin

*[1]Department of Epidemiology, School of Medicine IUCLAEH, Maldonado, [2]Epidemiology Group, Department of Pathology, School of Medicine, Uruguay, [3]The Tisch Cancer Institute, Mount Sinai School of Medicine, New York, USA *For correspondence: edestefani@gmail.com*

(112, 7.4%), acute appendicitis (91, 6.0%), varicose veins (80, 5.3%), hydatid cyst (66, 4.4%), urinary stones (56, 3.7%), blood disorders (52, 3.4%), prostate hypertrophy (33, 2.2%), and diseases of the bone (21, 1.4%).

Interviews and questionnaire

All the participants (cases and controls) were administered a structured questionnaire by two trained social workers shortly after admittance to the hospitals. All the interviews were performed face-to-face and proxy interviews were not allowed. The questionnaire included the following sections: sociodemographics (last name, first name, age, residence, education, monthly income, identification number), self-reported height and weight five years before the date of interview, family history of bladder cancer among first-degree relatives, a complete occupational history based on the last four jobs and their duration, a complete history of smoking (age at start, age at quit, number of cigarettes smoked per day, type of tobacco, type of cigarette, inhalation practices), a complete alcohol drinking history (age at start, age at quit, number of glasses per day or week, type of alcoholic beverage), a complete history of non-alcoholic beverages (mate, coffee, coffee with milk, tea, tea with milk, soft drinks), and a food frequency questionnaire (FFQ) on 64 food items. The FFQ recorded the consumption of foods in servings/years and the corresponding portion size per food. Therefore, we managed the consumption of foods in grams per day. The nutrients were calculated following a Table of chemical consumption of the foods. This FFQ allowed the estimation of total energy intake and was considered representative of the Uruguayan diet. Although it was not validated, it was tested for reproducibility with good results (Ronco et al., 2006).

Foods and nutrients included into the study

The following items were included in the study: total meat (beef, lamb, poultry, fish, liver, processed meat), red meat (beef, lamb), poultry, fish, total processed meat (bacon, sausage, mortadella, salami, saucisson, hot dog, ham, salted meat), liver, total vegetables and fruits, boiled eggs, fried eggs, total eggs, cheese, butter, whole milk, dietary cholesterol, sodium, nitrite, nitrate, nitroso compounds. All the food and nutrients were energy adjusted using the residuals method (Willett, 1998).

Statistical analysis

Relative risks of bladder cancer, approximated by the odds ratios, were estimated by unconditional multiple logistic regression (Rothman et al., 2008). We fitted the following model: age (continuous), residence (ordinal), education (categorical), tobacco smoking in pack years (categorical), alcohol drinking (categorical), mate consumption (categorical), total energy intake (continuous), total vegetables and fruits (continuous). This basic model further included several terms of risk factors for the study (meat intake, dairy foods, total eggs, and selected nutrients). All the estimates were two-sided and P value was considered as significant as alpha of 95%. All the calculations were estimated using the statistical software Stata, release 13.1 (Stata Corp, 2013).

Results

Distribution of cases and controls by sociodemographics and selected risk factors are shown in Table 1. Age, residence, education, and monthly income were rather similar among both groups of participants. Smoking and mate consumption showed significantly higher percentages among cases compared with controls.

Odds ratios of bladder cancer for types of meat are shown in Table 2. Odds ratios for the higher tertile versus the first tertile were positively associated with bladder cancer risk for total meat (OR 1.47, 95% CI 1.02-2.11), processed meat (OR 1.55, 95% CI 1.07-2.24), hot dog (OR 2.16, 95% CI 1.45-3.23), ham (OR 1.83, 95% CI 1.26-2.65), and salted meat (OR 2.37, 95% CI 1.57-3.57). Red meat, poultry, fish, liver, bacon, sausage, saucisson, mortadella, and salami were not associated with risk of bladder cancer.

The ORs of red meat for cooking methods are shown in Table 3. Barbecued red meat was positively associated with risk of bladder carcinoma (OR 1.96, 95% CI 1.34-2.87). Boiled red meat was also positively associated with bladder cancer (OR 1.52, 95% CI 1.06-2.19). Fried red meat was not associated with bladder cancer (OR 1.04, 95% 0.71-1.53).

The effect of animal products is shown in Table 4. Cheese consumption was protective (OR 0.60, 95% CI 0.41-0.86, P value for trend = 0.006) and whole milk was positively associated with bladder cancer (OR 1.45, 95% 1.01-2.08, P value for trend = 0.04). Eggs consumption (boiled eggs, fried eggs, and total eggs) displayed a high

Table 1. Distribution of Cases and Controls by Sociodemographics and Selected Risk Factors

Variable	Category	Cases		Controls		Global
		No	%	No	%	p value
Age	30-39	2	0.9	10	0.7	
(years)	40-49	11	4.9	64	4.2	
	50-59	35	15.6	256	16.9	
	60-69	77	34.2	585	38.7	
	70-79	78	34.7	495	32.8	
	80-89	22	9.8	100	6.6	0.47
Residence	Urban	168	74.7	1137	75.3	
	Rural	57	25.3	373	24.7	0.84
Education	0-2	53	23.6	424	28.1	
(yrs)	3-5	92	40.9	574	38.0	
	6+	80	35.5	512	33.9	0.36
Monthly	≤145	80	35.6	592	39.2	
income	146+	100	44.4	575	38.1	
(US dollars)	Missing values	45	20.0	343	22.7	0.19
Smoking	Never smokers	33	14.7	306	20.3	
(pack years)	1-29	39	17.3	364	24.1	
	30-39	55	24.4	305	20.2	
	40-49	53	23.6	303	20.1	
	50+	45	20.0	232	15.4	0.01
Alcohol	Never drinkers	77	34.2	423	28.0	
drinking	1-60	54	24.0	423	28.0	
(ml/ethanol)	61-120	40	17.8	295	19.5	
	121-240	30	13.3	206	13.6	
	241+	24	10.7	163	10.8	0.39
Mate	Never drinkers	15	6.6	198	13.1	
consumption	0.1-0.9	26	11.6	331	21.9	
(liters/day)	1.0-1.9	112	49.8	743	49.2	
	2.0+	72	32.0	238	15.8	<0.0001
No patients		225	100.0	1510	100.0	

Table 2. Odds Ratios of Bladder Cancer for Meat Consumption[ab]

Type of meat	Tertiles I OR (reference)	II OR (95% CI)	III OR (95% CI)	p value trend
Total meat	[b]60/503	74/504	91/503	
	1.0	1.18 (0.81-1.72)	1.47 (1.02-2.11)	0.036
Red meat	71/503	64/504	90/503	
	1.0	0.78 (0.53-1.15)	1.18 (0.83-1.69)	0.33
Poultry	74/503	68/504	83/503	
	1.0	0.92 (0.64-1.32)	1.16 (0.81-1.66)	0.41
Fish	68/503	80/504	77/503	
	1.0	1.22 (0.85-1.75)	1.24 (0.86-1.78)	0.25
	59/503	76/504	90/503	
Processed meat				
	1.0	1.30 (0.89-1.89)	1.55 (1.07-2.24)	0.018
	69/503	94/504	62/503	
Bacon, sausage *mortadella*				
	1.0	1.37 (0.96-1.95)	0.91 (0.62-1.35)	0.64
	140/925	37/248	48/337	
Salami	1.0	1.05 (0.70-1.57)	0.99 (0.69-1.44)	0.97
	136/1085	45/237	44/188	
Hot dog	1.0	1.76 (1.19-2.61)	2.16 (1.45-3.23)	<0.0001
	148/1086	26/190	51/234	
Ham	1.0	1.43 (0.86-2.39)	1.83 (1.26-2.65)	0.002
	174/1313	10/69	41/128	
Salted meat	1.0	1.34 (0.63-2.83)	2.37 (1.57-3.57)	0.0001
	69/503	92/504	65/503	
Liver	1.0	1.29 (0.82-2.03)	0.95 (0.61-1.50)	0.61

[a]Multivariate ORs adjusted for age, residence, education, body mass index, smoking, alcohol drinking, *mate* consumption, total energy, and total vegetables and fruits intakes. [b]Number of cases and controls by tertiles

Table 3. Odds Ratios of Bladder Cancer for Cooked Red Meat[ab]

Meat cooking	Tertiles I OR (reference)	II OR (95% CI)	III OR (95% CI)	p value trend
Fried meat	[b]73/503	78/504	74/503	
	1.0	1.04 (0.72-1.52)	1.04 (0.71-1.53)	0.91
Barbecued meat				
	58/503	60/504	107/503	
	1.0	1.07 (0.72-1.59)	1.96 (1.34-2.87)	0.0004
Boiled meat	65/503	62/504	98/503	
	1.0	0.92 (0.62-1.35)	1.52 (1.06-2.19)	0.03

[a]Multivariate ORs adjusted for age, residence, education, body mass index, smoking, alcohol drinking, *mate* consumption, total energy, and total vegetables and fruits intakes; [b]Number of cases and controls by tertiles

Table 4. Odds Ratios of Bladder Cancer for Animal Products[ab]

Food	Tertiles I OR (reference)	II OR (95% CI)	III OR (95% CI)	p value trend
Cheese	[b]92/503	78/504	55/503	
	1.0	0.85 (0.60-1.20)	0.60 (0.41-0.86)	0.006
Butter	80/503	58/504	87/503	
	1.0	0.64 (0.43-0.96)	1.06 (0.75-1.49)	0.70
Whole milk	62/503	73/504	90/503	
	1.0	1.26 (0.86-1.85)	1.45 (1.01-2.08)	0.04
Boiled eggs	45/503	59/504	121/503	
	1.0	1.31 (0.84-2.05)	2.76 (1.85-4.13)	<0.0001
Fried eggs	43/503	57/504	125/503	
	1.0	1.28 (0.82-2.00)	2.79 (1.88-4.13)	<0.0001
Total eggs	33/503	61/504	131/503	
	1.0	1.92 (1.21-3.04)	4.05 (2.68-6.12)	<0.0001

[a]Multivariate ORs adjusted for age, residence, education, body mass index, smoking, alcohol drinking, *mate* consumption, total energy, and total vegetables and fruits intakes; [b]Number of cases and controls by tertiles

Table 5. Odds Ratios of Bladder Cancer for Dietary Cholesterol, Sodium, Nitrite, Nitrate, and NOC Compounds[a]

Nutrients	Tertiles I OR (reference)	II OR (95% CI)	III OR (95% CI)	p value trend
Cholesterol	1.0	2.22 (1.38-3.55)	4.84 (3.11-7.52)	<0.0001
Sodium	1.0	1.49 (1.01-2.21)	2.07 (1.41-3.02)	0.0001
Nitrite	1.0	1.30 (0.90-1.86)	1.35 (0.93-1.95)	0.11
Nitrate	1.0	1.20 (0.81-1.76)	1.86 (1.29-2.68)	0.001
NDMA b	1.0	2.16 (1.46-3.21)	2.14 (1.43-3.18)	0.0002

[a]Multivariate ORs adjusted for age, residence, education, body mass index, smoking, alcohol drinking, *mate* consumption, total energy, and total vegetables and fruits intakes

Table 6. Final Model Fitted by Stepwise Forward Method[a]

Foods	OR (95% CI)	z	p value
Total eggs	1.90 (1.55-2.32)	6.24	<0.0001
Salted meat	1.41 (1.15-1.75)	3.24	0.001
Hot dog	1.39 (1.14-1.79)	3.25	0.001
Cheese	0.78 (0.64-0.93)	-2.66	0.008

[a]Multivariate ORs adjusted for age, residence, education, body mass index, smoking, alcohol drinking, *mate* consumption, total energy, and total vegetables and fruits intakes

risk of bladder cancer (OR 4.05, 95% CI 2.68-6.12, P value for trend <0.0001).

The effect of selected nutrients in bladder cancer etiology is shown in Table 5 Dietary cholesterol was strongly associated with risk of bladder cancer (OR 4.84, 95% 3.11-7.52, P value for linear trend <0.0001). Also higher risk was observed among sodium and NDMA (OR for the higher tertile vs the lower tertile of NDMA 2.14, 95% CI 1.43-3.18, P value trend = 0.0002). Nitrite intake was not associated with bladder cancer risk.

The final model for foods was fitted using the stepwise forward method (Table 6). The following variables were included in this final model: total eggs (OR 1.90, 95% CI 1.55-2.32), salted meat (OR 1.41, 95% CI 1.15-1.75), hot dog (frankfurter) (OR 1.39, 95% CI 1.14-1.79) and cheese (OR 0.78, 95% CI 0.64-0.93).

Discussion

According to the results of the present study, positive associations between meat consumption and bladder cancer risk were observed. Total meat, total processed meat, frankfurter (hot dog), ham, and salted meat showed a moderate to high risk increase of bladder cancer.

Several studies have reported results concerning meat intake and bladder cancer risk (La Vecchia and Negri, 1996; Wilkens et al., 1996; Tavani et al., 2000; Castelao et al., 2004; Wakai et al., 2004; Garcia-Closas et al., 2007; Hu et al., 2008; De Stefani et al., 2012). Associations from case-control studies of bladder cancer and meat intake have been somewhat inconsistent. A marginally significant 30% increased risk was reported for red meat and a significant 60% increased risk was reported for processed meat in a Canadian case-control study (Hu et al., 2008). Tavani et al. (2000) observed a significant 60% increased risk among the highest consumers of red meat in a study conducted in Italy. In contrast, Wakai et al. (2004) observed non-significant decreased risks for beef,

pork, ham and sausage, and Castelao et al. (2004) reported non-significant inverse associations for the highest intake levels of processed meat and preformed nitrosamine. In a recently published case-control study conducted in Spain, a non-significant odds ratio of 0.8 was reported for red meat intake and a non-significant odds ratio of 1.2 was reported for processed meat intake (Garcia-Closas et al., 2007). Finally, Wilkens et al. (1996) showed an increased risk of bladder cancer associated with bacon consumption.

Two recent prospective studies reported conflictive results concerning processed meat consumption and bladder cancer risk (Michaud et al., 2006; Jakszyn et al., 2011). Whereas the EPIC prospective study reported null results (Jakszyn et al., 2011), the study by Michaud et al. showed an increased risk of bladder cancer associated with bacon intake (Michaud et al., 2006). A third prospective study on meat intake and risk of bladder cancer displayed again null results on the effect of meat consumption (Larsson et al., 2009).

Thus, both case-control and prospective studies showed conflicting results concerning meat intake and bladder cancer risk. A multisite case-control study conducted by Aune et al. (2009a) in Uruguay displayed a significant positive association between red meat and beef with bladder cancer. In a similar study based on a different population, red meat and beef were again associated with an increased risk of bladder cancer (Aune et al., 2009b). Both multisite studies showed a null association between processed meat and bladder cancer risk. Finally, another multisite study focused on salted meat and cancer showed a strong positive association between salted meat intake and risk of bladder cancer (De Stefani et al., 2009). Salted meat, also known as charque, is a food which is considered part of the group of processed meats and is characterized by a rich content in N-Nitroso compounds. It is thus noteworthy that the present study showed a strong positive association of charque (salted meat) with bladder cancer, replicating the findings of the previous study.

Eggs consumption and dietary cholesterol displayed elevated ORs for bladder cancer. The effect of both variables was, in fact, strongly and positively associated with bladder cancer and total eggs showed the highest risk of bladder cancer among foods studied in the final model. Previous studies (Balbi et al., 2001; Aune et al., 2009c; De Stefani et al., 2011; Hu et al., 2012; Fang et al., 2012) reported an increase in risk of bladder cancer for dietary cholesterol and total eggs consumption. Also, dairy foods were related with risk of bladder cancer. In our study, cheese intake was protective, whereas whole milk displayed a moderately positively association with bladder cancer risk. Our findings replicated the findings of Brennan et al. (2000), showing an inverse association of cheese with non-smokers in lung cancer.

As other case-control studies, the present study has strengths and limitations. The high response rates, both for cases and controls, is a major strength of the study. Selection bias and recall bias are the major limitations. Selection bias is unlikely since cases and controls were drawn from the same base population. On the other hand, recall bias is very difficult to manage, since this bias could result in misclassification, differential or non-differential, which could lead to erroneous estimates.

In conclusion, the present study showed that total meat, processed meat, hot dog, ham, salted meat, boiled eggs, fried eggs, total eggs, and whole milk were positively associated with increased risk of bladder cancer. These associations suggest that meat intake and eggs could be important risk factors in urothelial carcinoma of the urinary bladder.

References

Aune D, De Stefani E, Ronco AL, et al (2009a). Meat consumption and cancer risk: a case-control study in Uruguay. *Asian Pac J Cancer Prev,* **10**, 429-436.

Aune D, Ronco A, Boffetta P, et al (2009b). Meat consumption and cancer risk: a multisite case-control study in Uruguay. *Cancer Therapy*, **7**, 174-187.

Aune D, De Stefani E, Ronco AL, et al (2009c). Egg consumption and risk of cancer: a multisite case-control study in Uruguay. *Asian Pac J Cancer Prev*, **10**, 869-876.

Balbi JC, Larrinaga MT, De Stefani E, et al (2001). Food and risk of bladder cancer: a case-control study in Uruguay. *Eur J Cancer Prev*, **10**, 453-458.

Barrios E, Vassallo JA, Alonso R, et al (2010). III Atlas of Cancer Incidence in Uruguay 2002-2006. National Cancer Registry, Honorary Commission of Fight Against Cancer, Uruguay, (In Spanish).

Brennan P, Fortes C, Butler J, et al (2000). A multicenter case-control study of diet and lung cancer among non-smokers. *Cancer Causes Control*, **11**, 49-58.

Castelao JE, Yuan JM, Gago-Dominguez M, et al (2004). Carotenoids/vitamin C and smoking-related bladder cancer. *Int J Cancer*, **110**, 417-423.

De Stefani E, Aune D, Boffetta P, et al (2009). Salted meat consumption and the risk of cancer: a multisite case-control study in Uruguay. *Asian Pac J Cancer Prev*, **10**, 853-857.

De Stefani E, Deneo-Pellegrini H, Ronco AL, et al (2011). Dietary cholesterol and risk of cancer: a multisite case-control study in Uruguay. *Med Hypotheses Res*, **7**, 17-25.

De Stefani E, Boffetta P, Ronco AL, et al (2012). Processed meat consumption and risk of cancer: a multisite case-control study in Uruguay. *Br J Cancer*, **107**, 1584-1588.

Fang D, Tan F, Wang C, et al (2012). Egg intake and bladder cancer risk: A meta-analysis. *Exper Therap Medicine*, **4**, 906-912.

Garcia-Closas R, Garcia-Closas M, Kogevinas M, et al (2007). Food, nutrition and heterocyclic amine intake and the risk of bladder cancer. *Eur J Cancer*, **43**, 1731-40.

Hu J, La Vecchia C, DesMeules M, et al (2008). Meat and fish consumption and cancer in Canada. *Nutr Cancer*, **60**, 313-24.

Hu J, La Vecchia C, de Groh M, et al (2012). Dietary cholesterol intake and cancer. *Ann Oncol*, **23**, 491-500.

Jakszyn P, Gonzalez CA, Lujan-Barroso L, et al (2011). Red meat, dietary nitrosamines, and heme iron and risk of bladder cancer in the European Prospective Investigation into Cancer and Nutrition (EPIC). *Cancer Epidemiol Biomarkers Prev*, **20**, 555-9.

La Vecchia C, Negri E (1996). Nutrition and bladder cancer. *Cancer Causes Control*, **7**, 95-100.

Larsson SC, Johansson JE, Andersson SO, Wolk A (2009). Meat consumption and bladder cancer risk in a prospective cohort. *Cancer Causes Control*, **20**, 35-40.

Michaud DS, Holick CN, Giovannucci E, Stampfer MJ (2006). Meat intake and bladder cancer risk in 2 prospective cohort studies. *Am J Clin Nutr*, **84**, 1177-83.

Moore MA, Baumann F, Foliaki S, et al (2009). Cancer

epidemiology in the Pacific Islands-past, present, and future. *Asian Pac J Cancer Prev*, **10**, 93-8.

Rohani-Rasaf M, Abdollahi M, Jazayeri S et al (2013). Correlation of cancer incidence with diet, smoking and socio-economic position across 22 districts of Tehran in 2008. *Asian Pac J Cancer Prev,* **14**, 1669-76.

Ronco AL, De Stefani E, Boffetta P, et al (2006). Food patterns and risk of breast cancer: a factor analysis study in Uruguay. *Int J Cancer*, **119**, 1672-8.

Rothman KJ, Greenland S, Lash TL (2008). Modern Epidemiology. Third Edition. Lippincott Williams & Wilkins, Philadelphia, pp 381-417.

StataCorp (2013). Stata Statistical Software: Release 13. College Station, Texas: StataCorp LT.

Tavani A, La Vecchia C, Gallus S, et al (2000). Red meat intake and cancer risk: a study in Italy. *Int J Cancer*, **86**, 425-8.

Wakai K, Hirose K, Takezaki T, et al (2004). Foods and beverages in relation to urothelial cancer: a case-control study in Japan. *Int J Urol*, **11**, 11-9.

Wilkens LR, Kadir MM, Kolonel LN, et al (1996). Risk factors for lower urinary tract cancer: the role of total fluid consumption, nitrites and nitrosamines and selected foods. *Cancer Epidemiol Biomarkers Prev*, **5**, 161-6.

Willett WC (1998). Nutritional Epidemiology. Second Edition. Monographs in Epidemiology and Biostatistics Volume 30. Oxford University Press, New York, pp 273-301.

World Cancer Research Fund/American Institute Cancer Research (2007). Food, Nutrition, Physical Activity, and the Prevention of Cancer, a Global Perspective. Washington DC.