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Knowledge of Colorectal Cancer and Associated Factors Among the General Population in Malaysian

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Abstract: Colorectal cancer is the fourth leading cause of cancer death worldwide. The objective of this study was to determine the knowledge of colorectal cancer among the general population in Malaysia. A cross-sectional study was conducted among the general population in Shah Alam, Selangor, Malaysia. A total number of 300 subjects participate in this study. The mean age of the study participants was 31.38±11.07. The majority of the participants were female, less than 50 years of age, Malay, single and with no history of colorectal cancer (56.7%, 90.3%, 71.0%, 59.0% and 83.3%; respectively). Regarding the eating habits, 60.3% eat vegetables regularly, 45.0% eat green salad regularly, 29.3% took supplements regularly, 55.7% eat fruits regularly, 64.7% eat meat regularly, 46.3% eat fast food regularly and only 29.0% drink sufficient amount of water regularly. For lifestyle, 43.3% of the participants reported that they exercise regularly. Univariate analysis showed that sex, marital status, smoking cigarettes and shisha were significantly influence the knowledge of colorectal cancer (P=0.006, P=0.022, p<0.001, P<0.001; respectively). Multiple linear regression identified smoking and family history of colorectal cancer significantly associated with knowledge about colorectal cancer prevention (p<0.001, p=0.044; respectively). Conclusions: The population survey showed low awareness of colorectal cancer. Therefore importance of continuing public education, particularly about the link between lifestyle behaviors and colorectal cancer is urgently needed.

Key words: Colorectal Cancer % General Population % Malaysia

INTRODUCTION

Cancer is a leading cause of mortality and morbidity worldwide [1]. The World Health Organization estimated 7.6 million deaths due to cancer in the year 2005, a number expected to rise to 12 million deaths by the year 2030 [1, 2]. Cancer is a disease that provokes massive public anxiety and elicits cognitions and emotions about its cause and cure [3, 4]. It is a major cause of mortality worldwide and accounts for around 25% of all deaths across Europe and the United States [5, 6]. Colorectal cancer is the fourth leading cause of cancer death worldwide (WHO, 2012) [1, 2]. In fact that 50% to 75% of colorectal cancer can be prevented through detection and removal of precancerous polyps [7, 8]. Colorectal cancer is the third-leading cause of cancer-related deaths in the United States among men and women [5].

Evidence indicates that early detection reduces the rates of morbidity and mortality of colorectal cancer [9] and a variety of screening modes are endorsed by evidence-based guidelines [7, 8, 10]. Moreover, several behavioral factors such as exercise obesity, alcohol consumption, diet and dietary fiber has long been thought to be associated with a reduced risk of colorectal cancer [11-15]. Several studies confirmed the relation between fiber intake and risk of colorectal cancer [16-23].

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Family history of colorectal cancer is an independent risk factor for developing the disease. The relationship between family history of cancer and changes in health behaviors has not been studied in colorectal cancer patients; however, some studies developed in women with family history of breast cancer shown contradictory results [24, 25]. Lemon *et al.* [24] showed an improvement in healthy habits in women with a first-degree relative with breast cancer when comparing health habits just after the diagnosis with health habits 6 months later.

Several studies suggest that the major causes of colorectal cancer are environmental and lifestyle factors risk factors [26-29]. The fact that known high penetrance gene variants that are associated with colorectal cancer risk explain fewer than 5% of the observed cases [30], together with the wide geographical differences in colorectal cancer risk and the marked secular changes in colorectal cancer rates within certain populations and in studies of migrants [31-34], suggests that environmental and lifestyle factors including diet are important factors that influence risk. For Dietary factors, intakes of red and processed meat and alcohol consumption are considered to be risk factors for colorectal cancer [35].

Early observation Burkitt [11] that rural Africans have low rates of colorectal cancer who ate a diet with high fiber content. Whole grains are a major source of dietary fiber and contain germ, endosperm and bran, in contrast with refined grains that contain only the endosperm. The germ and bran contain numerous nutrients, which are removed during the refining process. In addition, whole grains are a major source of several vitamins, minerals and phytochemicals, which have anticancer properties and could plausibly; influence the risk of colorectal cancer by several potential mechanisms [36]. An earlier review and meta-analysis of case-control studies of whole grain intake and colorectal cancer and polyps reported a summary odds ratio of 0.79 for the highest versus the lowest intake [37]. However, the interpretation of case-control studies is hampered by possible recall and selection biases, which make it difficult to draw firm conclusions.

In Malaysia, colorectal cancer is the most common cancer in males and the third most common in females [38]. A previous Malaysian study showed that knowledge on colorectal cancer and its screening is extremely low among Malaysian patients [39]. However, no previous study reported the Knowledge of colorectal cancer and associated factors among the General Population in Malaysian. In order to fill the gap of knowledge. Therefore, the objective of this study is to determine the knowledge and practices of fiber intake and colon cancer among the general population.

MATERIALS AND METHODS

A cross-sectional study was conducted among the general population in Shah Alam, Selangor, Malaysia. The data collected from 1st of April until 1st May 2012. The areas selected were Alam Budiman, Section U10 Shah Alam, Taman Tadisma, Section 13 Shah Alam, Seri Alam Condo Section 13 Shah Alam, Section 7 Shah Alam, Section 9 Shah Alam, Section 10 Shah Alam, Section 11 Shah Alam, Section 2 Shah Alam, Section 8 Shah Alam, TTDI jaya U2 Shah Alam. About 300 questionnaires were distributed; random sampling method was used in this study. For the area at Alam Budiman, Section U10 Shah Alam, the questionnaires were distributed by door to door. In Sri Alam Condo, the questionnaires were distributed at the mamak stall or at the café provided. In the Taman Tadisma, section 13 and section 7, the questionnaires were distributed at the 'surau' where basically it is the place people gather and it is also the area where mostly elderly and adult who have been married with successful career stay. For section 9, the questionnaire were distributed at Plaza Masalam and for the rest, it had been distributed at the events done at the housing area nearby. This survey includes several socio-demographic questions, of which the following were used in these analyses: gender; age (dichotomized into <50 and >=50 year), ethnicity (Malay, Chinese, Indian and others), marital status (single; ever married); and income (<1000, 1000-5000, >5000). Respondents below 18 years old and above 70 years old were excluded from this study. The protocol of this study approved by the research committee, International Medical School, Management and Science University and Consent form were obtained from the participants. The research conforms to the NHMRC standards and the Helsinki Declaration. Data were analyzed using SPSS 13.0; t-test was used for univariate analysis and multiple linear regression was used in multivariate analysis.

RESULTS

The mean age of the study participants was 31.38±11.07, maximum age was 72 years old and minimum was 16 years old. The majority of the participants were female (56.7%), less than 50 years old of age (90.3%);

Table 1: Socio-demographic characteristics and factors associated with knowledge about colon cancer among the general population (n=300)

Variable	Categories	Number	Percentage	p-value
Sex	Male	121	40.3%	0.006
	Female	179	59.7%	
Age	< 50	271	90.3%	0.155
	>= 50	29	9.7%	
Race	Malay	213	71.0%	0.625
	Chinese	35	11.7%	
	Indian	33	11.0%	
	Others	19	6.3%	
Marital status	Single	177	59.0%	0.022
	Ever Married	123	41.0%	
Income (RM)*	<1000	116	38.7%	0.568
	1000-5000	137	45.7%	
	>5000	47	15.7%	
Smoking cigarettes	Yes	77	25.7%	<0.001
	No	223	74.3%	
Smoking Shisha	Yes	70	23.3%	<0.001
	No	230	76.7%	
Family history of colon cancer	Yes	50	16.7%	0.098
	No	250	83.3%	

*RM =Ringgit Malaysia

Table 2: Lifestyle practice among the study participants (n=300)

Variables	Categorize	Number	Percentage
Exercise	Regular	130	43.3%
	Irregular	170	56.7%
Supplements intake	Regular	88	29.3%
	Irregular	212	70.7%
Fruits intake	Regular	167	55.7%
	Irregular	133	44.3%
Vegetable	Regular	181	60.3%
	Irregular	119	39.7%
Green salad intake	Regular	135	45.0%
	Irregular	165	55.0%
Meat	Regular	194	64.7%
	Irregular	106	35.3%
Daily Water intake	<4 glasses	47	15.7%
	4-8 glasses	166	55.3%
	>8glasses	87	29.0%
Fast food intake	Regular	139	46.3%
	Irregular	161	53.7%
Bakery food intake	Regular	126	42.0%
	Irregular	174	58.0%
Soft drink	Regular	124	41.3%
	Irregular	176	58.7%
Proceed food intake	Regular	143	47.7%
	Irregular	157	52.3%

Table 3: Predictors of knowledge for colon cancer using Multivariate Stepwise Logistic Regression Analysis

Independent variables	B	SE	Beta	p-value
(Constant)				
Marital Status	0.135	0.070	0.104	0.056
Smoking Cigarettes	0.548	0.082	0.378	<0.001
Smoking Shisha	0.140	0.087	0.093	0.109
Family History of Colon Cancer	-0.182	0.090	0.107	0.044

R^2=0.199, p-value <0.001

Malay (71.0%), single (59.0%), with no history of colorectal cancer (83.3%) (Table 1). This study shows that sex, marital status, smoking cigarettes and shisha were significantly influence the knowledge of colorectal cancer (P=0.006, P=0.022, p<0.001, P<0.001; respectively).

For lifestyle, 43.3% of the participants reported that they exercise regularly. About 29.3% took supplements regularly. About 55.7% eat fruits regularly. About 60.3% eat vegetables regularly. About 45.0% eat green salad regularly. About 64.7% of them eat meat regularly. Only 29.0% drink sufficient amount of water regularly. 46.3% eat fast food regularly (Table 2).

Multiple linear regressions identified smoking and family history of colorectal cancer significantly associated with knowledge about colorectal cancer prevention (Table 3).

DISCUSSION

This study conducted to determine the knowledge of the general population in Malaysia towards colorectal cancer prevention. Empowering the general population with correct knowledge of cancer prevention and related to lifestyle is crucial. In general; in this study, the knowledge of the participants about colorectal cancer is poor. Similarly, British studies reported that knowledge was poor among all respondents [40]. Similarly several studies reported that people have only a hazy understanding of the causes or prevention of cancer including colorectal cancer [40-44].

This study shows that sex, marital status and smoking are significantly influence the knowledge of the participant about colorectal cancer. Furthermore, this study shows that smoking cigarettes is significantly influence the knowledge of the participant about colorectal cancer. In a meta-analysis, Botteri *et al*. [45] estimated that ever-smokers were 18% more likely to develop colorectal cancer than never-smokers. Similar findings were reported that an increased risk of colorectal cancer rectal cancer, with cigarette smoking [46-50].

About 45.0% eat green salad regularly. Only 29% drink sufficient amount of water regularly. 46.3% eat fast food regularly. Dietary factors have been reported to account for about 30% of cancers in Western countries [28], making diet second only to tobacco as a preventable cause of cancer. The contribution of diet to cancer risk in developing countries has been considered to be lower, perhaps around 20% [51].

Our study shows that family history of colon cancer significantly influences the knowledge of the general population about the disease. Family history is a risk factor for Colon cancer. It is estimated that 20% of all colorectal cancer cases are attributable to familial aggregation [52]. Combinations of genetic and environmental factors are thought to play a role in the clustering of familial colorectal cancer [53]. Evidence indicates that early detection reduces the rates of morbidity and mortality of colorectal cancer [9] and a variety of screening modes are endorsed by evidence-based guidelines [7, 8, 10]. Moreover, several behavioral factors such as exercise [14], obesity [15], alcohol consumption [12] and diet [13] have been suggested to modify the risk for this cancer. Research has shown that interventions have been beneficial in improving risk perceptions for BRCA, colorectal cancer and PRCA [54-56]. Moreover, perceived risk is often a motivator for positive health-related behaviors, particularly with respect to cancer screenings. For example, women are becoming more knowledgeable about breast cancer risk and as a result are more closely adhering to screening guidelines [56-59]. Blumenthal *et al*. [58] evaluated culturally appropriate media messages related to screening and found that among African American participants these interventions were associated with an increase in BRCA, colorectal cancer and PRCA screenings. Approximately 20% of CRC cases are associated with a family history, including 5% of colorectal cancer cases associated with single-gene cancer syndromes [60, 61]. People with a family history of colorectal cancer are 2.3 to 4.3 times more likely to develop colorectal cancer than those without it, depending on the number, relation and age of onset of the relative(s) with cancer [62-64]. People whose relatives have early-onset colorectal cancer are at higher risk than those with relatives diagnosed later in life [65] (Church 2005). Consequently, several organizations recommend early screening for people with a positive family history, depending on the age at which the relative was diagnosed [7, 8, 66, 67]. Given the potential to reduce illness and death, early detection and prevention of colorectal cancer among people at high familial risk have important public health implications. These goals are achievable through clinician-mediated strategies and patient-mediated strategies (risk-reducing lifestyle changes or use of screening). Other research has demonstrated that having a close family member with a chronic disease is associated not only with increased perception of risk but also with preventive and health-promoting behaviors [68-70].

In our study, about 64.7% of them eat meat regularly. International correlation studies show a strong association between consumption of meat and colorectal cancer mortality and several mechanisms have been

proposed through which meat may increase cancer risk. Mutagenic heterocyclic amines and polycyclic aromatic hydrocarbons can be formed during the cooking of meat at high temperatures [71, 72] and nitrites and their related compounds found in smoked, salted and some processed meat products may be converted to carcinogenic N-nitrous compounds in the colon [73] Bingham et al. 1996. In addition, high iron levels in the colon may increase the formation of mutagenic free radicals [74]. The results of observational studies of meat and colorectal cancer have varied; a recent systematic review concluded that preserved meat is associated with an increased risk for colorectal cancer but that fresh meat is not and most studies have not observed positive associations with poultry or fish. However, mortality rates for colorectal cancer are similar in Western vegetarians and comparable non-vegetarians [75]. Overall, the evidence is not conclusive but suggests that high consumption of preserved and red meat probably increases the risk for colorectal cancer.

In this study, about 55.7% eat fruits regularly and about 60.3% eat vegetables regularly. Many case-control studies of colorectal cancer have observed moderately lower risk in association with high consumption of dietary fiber, fruits and vegetables [37, 76], but the results of recent large prospective studies have been inconsistent [61, 77]. Furthermore, results from randomized controlled trials have not shown that intervention over a 3-4 year period with supplemental fibre or a diet low in fat and high in fibre and fruits and vegetables can reduce the recurrence of colorectal adenomas [78-80]. It is possible that some of the inconsistencies are due to differences between studies in the types of fibre eaten and in the methods for classifying fibre in food tables. Other possibilities are that the association with fruits and vegetables is principally due to an increase in risk at very low levels of consumption [47], or that high intakes of refined flour or sugar (rather than low intakes of fibre) increase risk through chronic hyperinsulinaemia or other mechanisms [81, 82]. At present, the hypothesis that fruits, vegetables and fibre may reduce the risk for colorectal cancer has not been firmly established.

In the present study only 43.3% of the participants reported that they exercise regularly. People with family history of colorectal cancer do not adopt protective behavioral patterns, such as weight control, more physical exercise, or a decrease in alcohol consumption. Public health initiatives to increase awareness of these risk factors are essential in ensuring better understanding of the links between lifestyle and cancer. Greater awareness could also lead to increased healthy behaviours [83] and thus could go some way towards reducing the overall burden of ill-health on the population.

Some recent prospective studies have suggested that a methyl-deplete diet (i.e. a diet low in folate and methionine and high in alcohol) is associated with an increased risk of colon cancer [84, 85]. Also, use of folic acid- containing multiple vitamin supplements has been associated with lower risk of colon cancer [86]. A diminished folate status may contribute to carcinogenesis by alteration of gene expression and increased DNA damage [87, 88] and chromosome breakage [89]. The finding that a common polymorphism in the methylenetetrahydrofolate reductase gene involved in folic acid metabolism may also be associated with colorectal cancer [90] strengthens the hypothesis that dietary folate may be an important factor in colorectal carcinogenesis. Another promising hypothesis is that relatively high intakes of calcium may reduce the risk for colorectal cancer, perhaps by forming complexes with secondary bile acids in the intestinal lumen [35]. Several observational studies have supported this hypothesis [35, 90] and two trials [80, 92] have suggested that supplemental calcium may have a modest protective effect on the recurrence of colorectal adenomas.

CONCLUSIONS

The population survey showed low awareness of colorectal cancer. Therefore importance of continuing public education, particularly about the link between lifestyle behaviors and colorectal cancer is urgently needed. A national colorectal cancer screening programme will increase public awareness of colorectal cancer and earlier diagnosis in symptomatic patients may be one of the benefits from this. Education about colorectal cancer should include targeting of higher-risk population groups in whom knowledge is particularly lacking and should emphasize discrimination about the significance of different bowel symptoms.

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REFERENCES

1. World Health Organization, 2013. Cancer. http://www.who.int/mediacentre/factsheets/fs297/en/index.html.
2. World Health Organization. Fact sheet No. 297, February 2012. http://www.who.int/mediacentre/factsheets/fs297/en/.
3. Kent A., 2000. Raising awareness or spreading fear? BMJ, 321(7255): 247.
4. Reynolds T., 2000. News headlines feed on fear of cancer risk, experts say. J. Natl. Cancer Inst., 93(1): 9-11.
5. American Cancer Society, 2012. Colorectal cancer facts and figures 2008-2010. Atlanta, GA: Author.
6. Ferlay, J., F. Bray, P. Pisani and D.M. Parkin, 2000. GLOBOCAN Cancer Incidence Mortality and Prevalence Worldwide, Version 1.0. IARC Cancer Base No. 5. Lyon, IARC Press.
7. Levin, B., D.A. Lieberman, B. McFarland, K.S. Andrews, D. Brooks and J. Bond, 2008. American Cancer Society Colorectal Cancer Advisory Group, US Multi-Society Task Force, American College of Radiology Colon Cancer Committee. Screening and surveillance for the early detection of colorectal cancer and adenomatous polyps 2008: a joint guideline from the American Cancer Society, the US Multi-Society Task Force on Colorectal Cancer and the American College of Radiology. Gastroenterology, 134: 1570-95.
8. Levin, B., D.A. Lieberman, B. McFarland, R.A. Smith, D. Brooks and K.S. Andrews, 2008. Screening and surveillance for the early detection of colorectal cancer and adenomatous polyps: a joint guideline from the American Cancer Society, the US Multi-Society Task Force on Colorectal Cancer and the American College of Radiology. CA Cancer J. Clin, 58(3): 130-60.
9. Mendel, J.S., J.H. Bond, T.R. Church, D.C. Snover, G.M. Bradley and L.M. Schuman, 1993. Reducing mortality from colorectal cancer by screening for fecal occult blood. Minnesota Colon Cancer Control Study. N. Engl. J. Med., 328: 1365-71.
10. Rex, D.K., D.A. Johnson, J.C. Anderson, P.S. Schoenfeld, C.A. Burke and J.M. Inadomi, 2009. American College of Gastroenterology Guidelines for Colorectal Cancer Screening Am. J. Gastroenterol., 104: 739-50.
11. Burkitt, D.P., 1971. Epidemiology of cancer of colon and rectum. Cancer, 28(1): 3-13.
12. Cho, E., S.A. Smith-Warner, J. Ritz, P.A. Van Den Brandt, G.A. Colditz and A.R. Folsom, 2004. Alcohol intake and colorectal cancer: a pooled analysis of 8 cohort studies. Ann. Intern Med., 140: 603-13.
13. Ryan-Harshman, M. and W. Aldoori, 2007. Diet and colorectal cancer: review of the evidence. Can Fam Physician, 53(19): 13-20.
14. Harriss, D.J., G. Atkinson, K. George, N.T. Cable, T. Reilly and N. Haboubi, 2009. C-CLEAR group. Lifestyle factors and colorectal cancer risk (1): systematic review and meta-analysis of associations with body mass index. Colorectal Dis, 11: 547-63.
15. Harriss, D.J., G. Atkinson, A. Batterham, K. George, N.T. Cable and T. Reilly, 2009. Colorectal Cancer, Lifestyle, Exercise And Research Group. Lifestyle factors and colorectal cancer risk (2): a systematic review and metaanalysis of associations with leisure-time physical activity. Colorectal Dis., 11: 689-701.
16. Shin, A., H. Li, X.O. Shu, G. Yang, Y.T. Gao and W. Zheng,2006. Dietary intake of calcium, fiber and other micronutrients in relation to colorectal cancer risk: results from the Shanghai Women's Health Study. Int. J. Cancer, 119: 2938-42.
17. Otani, T., M. Iwasaki, J. Ishihara, S. Sasazuki, M. Inoue and S. Tsugane, 2006. Dietary fiber intake and subsequent risk of colorectal cancer: the Japan Public Health Center-based prospective study. Int. J. Cancer, 119: 1475-80.
18. McCarl McCarl, M., L. Harnack, P.J. Limburg, K.E. Anderson and A.R. Folsom, 2006. Incidence of colorectal cancer in relation to glycemic index and load in a cohort of women. Cancer Epidemiol Biomarkers Prev., 15: 892-6.
19. Wakai, K., C. Date, M. Fukui, K. Tamakoshi, Y. Watanabe and N. Hayakawa, 2007. Dietary fiber and risk of colorectal cancer in the Japan collaborative cohort study. Cancer Epidemiol Biomarkers Prev., 16: 668-75.
20. Schatzkin, A., T. Mouw, Y. Park, A.F. Subar, V. Kipnis and A. Hollenbeck, 2007. Dietary fiber and whole-grain consumption in relation to colorectal cancer in the NIH-AARP Diet and Health Study. Am. J. Clin Nutr., 85: 1353-60.
21. Nomura, A.M., J.H. Hankin, B.E. Henderson, L.R. Wilkens, S.P. Murphy and M.C. Pike, 2007. Dietary fiber and colorectal cancer risk: the multiethnic cohort study. Cancer Causes Control, 18: 753-64.

22. Kabat, G.C., J.M. Shikany, S.A. Beresford, B. Caan, M.L. Neuhouser and L.F. Ti Nker, 2008. Dietary carbohydrate, glycemic index and glycemic load in relation to colorectal cancer risk in the Women's Health Initiative. Cancer Causes Control, 19: 1291-8.
23. Butler, L.M., R. Wang, W.P. Koh and M.C. Yu, 2008. Prospective study of dietary patterns and colorectal cancer among Singapore Chinese. Br. J. Cancer, 99: 1511-6.
24. Lemon, S.C., J.G. Zapka and L. Clemow, 2004. Health behaviour change among women with recent familial diagnosis of breast cancer. Prev. Med., 39: 253-62.
25. Madlensky, L., R.A. Vierkant, C.M. Vachon, V.S. Pankratz, J.R. Cerhan and S.T. Vadaparampil, 2005. Preventive health behaviors and familial breast cancer. Cancer Epidemiol Biomarkers Prev., 14: 2340-2345.
26. Armstrong, B. and R. Doll, 1975. Environmental factors and cancer incidence and mortality in different countries, with special reference to dietary practices. Int. J. Cancer, 15: 617-31.
27. Kolonel, L.N., 1980.Cancer patterns of four ethnic groups in Hawaii. J. Natl Cancer Inst, 65: 1127-39.
28. Doll, R. and R. Peto, 1981. The causes of cancer - quantitative estimates of avoidable risks of cancer in the United-States today. J. Natl. Cancer Inst, 66(6): 1191-308.
29. Kono, S., 2004. Secular trend of colon cancer incidence and mortality in relation to fat and meat intake in Japan. Eur. J. Cancer Prev., 13: 127-32.
30. Aaltonen, L., L. Johns, H. Jarvinen, J.P. Mecklin and R. Houlston, 2007. Explaining the familial colorectal cancer risk associated with mismatch repair (MMR)-deficient and MMR-stable tumors. Clin Cancer Res., 13(1): 356-361.
31. Ferlay, J., P. Autier, M. Boniol, M. Heanue, M. Colombet and P. Boyle, 2007. Estimates of the cancer incidence and mortality in Europe in 2006. Ann. Oncol., 18(3): 581-92.
32. Yiu, H.Y., A.S. Whittemore and A. Shibata, 2004. Increasing colorectal cancer incidence rates in Japan. Int. J. Cancer, 109(5): 777-81.
33. Flood, D.M., N.S. Weiss, L.S. Cook, J.C. Emerson, S.M. Schwartz and J.D. Potter, 2000. Colorectal cancer incidence in Asian migrants to the United States and their descendants. Cancer Causes Control, 11(5): 403-11.
34. Stirbu, I., A.E. Kunst and F.A. Vlems, 2006. Cancer mortality rates among first and second generation migrants in the Netherlands: convergence toward the rates of the native Dutch population. Int. J. Cancer, 119(11): 2665-72.
35. World Cancer Research Fund/American Institute for Cancer Research, 2007. Food, nutrition, physical activity and the prevention of cancer: a global perspective. AICR, pp: 741.
36. Slavin, J.L., M.C. Martini, D.R. Jacobs Jr and L. Marquart, 1999. Plausible mechanisms for the protectiveness of whole grains. Am. J. Clin Nutr., 70: S459-63.
37. Jacobs, D.R.J., L. Marquart, J. Slavin and L.H. Kushi, 1998. Whole-grain intake and cancer: an expanded review and meta-analysis. Nutrition and Cancer, 30: 85-96.
38. National Cancer Registry, Ministry of Health Malaysia, 2006. Malaysian Cancer Statistics - Data and Figure Peninsular Malaysia.
39. Harmy, M.Y., D. Norwati, M.N. Norhayati and A.R. Amry, 2001. Knowledge and attitude of colorectal cancer screening among moderate risk patients in West Malaysia. Asian Pacific J. Cancer Prev., 12: 1957-60.
40. Brunswick, N., J. Wardle and M.J. Jarvis, 2001. Public awareness of warning signs for cancer in Britain. Cancer Causes Control, 12(1): 33-7.
41. Breslow, R.A., J.D. Sorkin, C.M. Frey and L.G. Kessler, 1997. Americans' knowledge of cancer risk and survival. Prev. Med., 26(2): 170-7.
42. Brown, M.L., A.L. Potosky, G.B. Thompson and L.G. Kessler, 1990. The knowledge and use of screening tests for colorectal and prostate cancer: data from the National Health Interview Survey. Prev. Med., 19(5): 562-74.
43. Kavanagh, A.M. and D.H. Broom, 1997. Women's understanding of abnormal cervical smear test results: a qualitative interview study. BMJ, 314(7091): 1388-91.
44. Wardle, J., J. Waller, N. Brunswick and M.J. Jarvis, 2001. Awareness of risk factors for cancer among British adults. Public Health, 115(3): 173-4.
45. Botteri, E., S. Iodice and V. Bagnardi, 2008. Smoking and colorectal cancer: a meta-analysis. JAMA, 300(23): 2765-28.
46. Giovannucci, E., 2001. An updated review of the epidemiological evidence that cigarette smoking increases risk of colorectal cancer. Cancer Epidemiol Biomarkers Prev., 10: 725-31.

47. Terry, P., A. Ekbom, P. Lichtenstein, M. Feychting and A. Wolk, 2001. Long-term tobacco smoking and colorectal cancer in a prospective cohort study Int. J. Cancer, 91: 585-7.
48. Terry, P.D., A.B. Miller and T.E. Rohan, 2002. Prospective cohort study of cigarette smoking and colorectal cancer risk in women. Int. J. Cancer, 99: 480-3.
49. Sanjoaquin, M.A., P.N. Appleby, M. Thorogood, J.I. Mann and T.J. Key, 2004. Nutrition, lifestyle and colorectal cancer incidence: a prospective investigation of 10998 vegetarians and non-vegetarians in the United Kingdom. Br. J. Cancer, 90: 118-21.
50. Slattery, M.L., W. Samowtiz, K. Ma, M. Murtaugh, C. Sweeney and T.R. Levin, 2004. CYP1A1, cigarette smoking and colon and rectal cancer Am. J. Epidemiol., 160: 842-52.
51. Miller, A.B., Diet in cancer prevention 2004. http://www.who.int/ncd/cancer/publications/abstracts/abs9810_05.
52. Lynch, H.T. and A. De La Chapelle, 2003. Hereditary colorectal cancer. N. Engl. J. Med., 348 :919-932.
53. Noe, M., P. Schory, M.F. Demierre and R. Babayan, 2008. Increased cancer risk for individuals with a family history of prostate cancer, colorectal cancer and melanoma and their associated screening recommendations and practices. Cancer Causes Control, 19: 1-12.
54. Carlos, R.C. and W. Underwood, 2005. Behavioral associations between prostate and colon cancer screening. Journal of the American College of Surgery, 200(2): 216-23.
55. DiLorenzo, T.A. and J. Schnur, 2006. A model of disease-specific worry in heritable disease: the influence of family history, perceived risk and worry about other illnesses. Journal of Behavioral Medicine, 29(1): 37-49.
56. Pavic, D. and M.J. Schell, 2007.Comparison of three methods to increase knowledge about breast cancer and breast cancer screening in screening mammography patients. Academic Radiology, 14(5): 553-60.
57. Basch, C.E. and R.L. Wolf, 2006. Telephone outreach to increase colorectal cancer screening in an urban minority population. American Journal of Public Health, 96(12): 2246-53.
58. Blumenthal, D.S. and J.G. Fort, 2005. Impact of a two-city community cancer prevention intervention on African Americans. Journal of the National Medical Association, 97(11): 1479-88.
59. Powe, B.D. and E. Ntekop, 2004. An intervention study to increase colorectal cancer knowledge and screening among community elders. Public Health Nursing, 21(5): 435-42.
60. Ahsan, H., A.I. Neugut, G.C. Garbowski, J.S. Jacobson, K.A. Forde and M.R. Treat, 1998.Family history of colorectal adenomatous polyps and increased risk for colorectal cancer. Ann Intern Med., 128(11): 900-5.
61. Fuchs, C.S., E.L. Giovannucci and G.A. Colditz, 1999. Dietary fiber and the risk of colorectal cancer and adenoma in women. New England Journal of Medicine, 340: 169-76.
62. Johns, L.E. and R.S. Houlston, 2001. A systematic review and meta-analysis of familial colorectal cancer risk. Am. J. Gastroenterol, 96(10): 2992-3003.
63. Taylor, D.P., R.W. Burt, M.S. Williams, P.J. Haug and L.A. Cannon-Albright, 2010. Population-based family history-specific risks for colorectal cancer: a constellation approach. Gastroenterology, 138(3): 877-85.
64. Butterworth, A.S., J.P. Higgins and P. Pharoah, 2006. Relative and absolute risk of colorectal cancer for individuals with a family history: a meta-analysis. Eur. J. Cancer, 42(2): 216-27.
65. Church, J.M., 2005. A scoring system for the strength of a family history of colorectal cancer. Dis Colon Rectum, 48(5): 889-96.
66. Whitlock, E.P., J.S. Lin, E. Liles, T.L. Beil and R. Fu, 2008. Screen ing for colorectal cancer: a targeted, updated systematic review for the US Preventive Services Task Force. Ann. Intern. Med., 149(9): 638-58.
67. Bur, R.W., J.S. Barthel, K.B. Dunn, D.S. David, E. Drelichman and J.M. Ford, 2010.NCCN clinical practice guidelines in oncology. Colorectal cancer screening. J. Natl. Compr Canc Netw., 1: 8-61.
68. Harrison, T.A., L.A. Hindorff, H. Kim, R.C. Wines, D.J. Bowen, B.B. Mc Grath and K.L. Edwards, 2003. Family history of diabetes as a potential public health tool. Am. J. Prev. Med., 24(2): 152-9.
69. Le Marchand, L., L.R. Wilkens, J.H. Hankin, L.N. Kolonel and L.C. Lyu, 1999. Independent and joint effects of family history and lifestyle on colorectal cancer risk: implications for prevention. Cancer Epidemiol Biomarkers Prev., 8(1): 45-51.
70. Claassen, L., L. Henneman, A.C. Janssens, M. Wijdenes-Pijl, N. Qureshi and F.M. Walter, 2010. Using family history information to promote healthy lifestyles and prevent diseases: a discussion of the evidence. BMC Public Health, 10: 248.

71. Gooderham, N.J., S. Murray and A.M. Lynch, 1997. Assessing human risk to heterocyclic amines. Mutation Research, 376: 53-60.
72. Kazerouni, N., R. Sinha, C.H. Hsu, A. Greenberg and N. Rothman, 2001. Analysis of 200 food items for benzo[a]pyrene and estimation of its intake in an epidemiologic study. Food Chemistry and Toxicology, 39: 423-36.
73. Bingham, S.A., B. Pignatelli and J.R. Pollock, 1996. Does increased endogenous formation of N-nitroso compounds in the human colon explain the association between red meat and colon cancer? Carcinogenesis, 17: 515-23.
74. Lund, E.K., S.G. Wharf, S.J. Fairweather-Tait and I.T. Johnson, 1999. Oral ferrous sulfate supplements increase the free radical-generating capacity of feces from healthy volun-teers. American Journal of Clinical Nutrition, 69: 250-5.
75. Key, T.J., G..E. Fraser and M. Thorogood, 1998. Mortality in vegetarians and non-vegetarians: a collaborative analysis of 8300 deaths among 76,000 men and women in five prospective studies. Public Health Nutrition, 1: 33-41.
76. Potter, J.D., 1996. Steinmetz K. Vegetables, fruit and phytoestrogens as preventive agents. In: B.W. Stewart, D. McGregor, eds. Principles of Chemoprevention. IARC Scientific Publication No. 139. Lyon: 1ARC, 61-90.
77. Michels, K.B., G. Edward and K.J. Joshipura, *et al*., 2000. Prospectivestudy of fruit and vegetable consumption and incidence of colon and rectal cancers. Journal of the National Cancer Institute, 92: 1740-52.
78. Schatzkin, A., E. Lanza and D. Corle, 2000. Lack of effect of a low-fat, high-fiber diet on the recurrence of colorectal adenomas. Polyp Prevention Trial Study Group. New England Journal of Medicine, 342: 1149-55.
79. Alberts, D.S., M.E. Martinez and D.J. Roe, 2000. Lack of effect of a high-fiber cereal supplement on the recurrence of colorectal adenomas. Phoenix Colon Cancer Prevention Physicians' Network. New England Journal of Medicine, 342: 1156-62.
80. Bonithon-Kopp, C., O. Kronborg, A. Giacosa, U. Rath and J. Faivre, 2000. Calcium and fibre supplementation in prevention of colorectal adenoma recurrence: a randomised intervention trial. European Cancer Prevention Organisation Study Group. Lancet, 356: 1300-6.
81. McKeown-Eyssen, G., 1994. Epidemiology of colorectal cancer revisited: are serum triglycerides and/or plasma glucose associated with risk? Cancer Epidemiology Biomarkers and Prevention, 3: 687-95.
82. Franceschi, S., L. Dal Maso and L. Augustin, 2001. Dietary glycemic load and colorectal cancer risk. Annals of Oncology, 12: 173-8.
83. Hawkins, N.A., Z. Berkowitz and L.A. Peipins, 2010. What does the public know about preventing cancer? Results from the Health Information National Trends Survey (HINTS). Health Educ Behav, 37: 490-503.
84. Giovannucci, E., E.B. Rimm, A. Ascherio, M.J. Stampfer, G.A. Colditz and W.C. Willett, 1995. Alcohol, low-methionine, low-folate diets and risk of colon cancer in men. Journal of the National Cancer Institute, 87: 265-73.
85. Glynn, S.A., D. Albanes and P. Pietinen, 1996.Alcohol consumption and risk of colorectal cancer in a cohort of Finnish men.Cancer Causes and Control, 7: 214-23.
86. Giovannucci, E., M.J. Stampfer and G.A. Colditz, 1998. Multivitamin use, folate and colon cancer in women in the Nurses' Health Study. Annals of Internal Medicine, 129: 517-24.
87. Choi, S.W. and J.B. Mason, 2000. Folate and carcinogenesis: an integrated scheme. Journal of Nutrition, 130: 129-32.
88. Potter, J.D., 1999. Colorectal cancer: molecules and populations. Journal of the National Cancer Institute, 91: 916-32.
89. Blount, B.C., M.M. Mack and C.M. Wehr, 1997. Folate deficiency causes uracil misincorporation into human DNA and chromosome breakage: implications for cancer and neuronal damage. Proceedings of the National Academy of Sciences of the United States of America, 94: 3290-5.
90. Ma, J., M.J. Stampfer and B. Christensen, 1999. A polymorphism of the methionine synthase gene: association with plasma folate, vitamin B12, homocyst(e)ine and colorectal cancer risk. Cancer Epidemiology Biomarkers and Prevention, 8: 825-9.
91. COMA, 1998. Nutritional Aspects of the Development of Cancer (Report of the Working Group on Diet and Cancer of the Committee on Medical Aspects of Food and Nutrition Policy). London: The Stationery Office.
92. Baron, J.A., M. Beach and J.S. Mandel, 1999. Calcium supplements and colorectal adenomas. Polyp Prevention Study Group. Annals of the New York Academy of Sciences, 889: 138-45.