UNIVERSITI PUTRA MALAYSIA

DIETARY AND LIFESTYLE FACTORS ASSOCIATED WITH RISK OF COLORECTAL ADENOMA IN PATIENTS AT HOSPITAL KUALA LUMPUR

AMUTHA RAMADAS

FPSK(M) 2006 7
DIETARY AND LIFESTYLE FACTORS ASSOCIATED WITH RISK OF COLORECTAL ADENOMA IN PATIENTS AT HOSPITAL KUALA LUMPUR

AMUTHA RAMADAS

MASTER OF SCIENCE
UNIVERSITI PUTRA MALAYSIA
2006
DIETARY AND LIFESTYLE FACTORS ASSOCIATED WITH RISK OF COLORECTAL ADENOMA IN PATIENTS AT HOSPITAL KUALA LUMPUR

By

AMUTHA RAMADAS

Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfilment of the Requirement for the Degree of Master of Science

December 2006
Cancer is now the third leading cause of death in Malaysia and one in four Malaysians is at risk of developing cancer. In Peninsular Malaysia, there was a slight decline in percentage of colon (-0.2%) and rectal (-0.2%) cancer incidence in males in the year 2003 compared to the previous year as reported by National Cancer Registry (2004). Yet, there was an increase in percentages of these cancer incidences in women (+0.4% in colon cancer and +0.7% in rectal cancer). Colorectal cancers are thought to develop over a period of several years, and most of them develop from benign, neoplastic adenomatous polyps (Bond, 2000). Colorectal adenomas have been shown, but not always, significantly related to various dietary and lifestyle factors. These factors have yet to be reported in relation to colorectal polyps in the Malaysian population. This case-control study was carried out to determine the relationship between dietary and lifestyle characteristics, and risk for colorectal adenomas among Malaysians. After screening for inclusion and exclusion criteria, 118 men and women with good cognition and who were at least 30 years at the time of interview and have undergone colonoscopy in Hospital
Kuala Lumpur were enrolled in the this study upon obtaining ethical clearance. Fifty nine patients diagnosed with colorectal adenomas were recruited as case subjects, while a similar number of patients diagnosed negative for any polyps were recruited as controls. A structured and pre-tested interviewer administrated questionnaire was used for data collection. The fasting blood samples were collected by trained and qualified nurse, and analyzed using relevant analysis in the laboratory. The collected data were then analyzed with SPSS version 12.0. Multivariate analysis concluded that the higher servings of fruits (adjusted OR = 0.150, 95% CI = 0.052 – 0.434) and vegetables (adjusted OR = 0.344, 95% CI = 0.149 - 0.794), crude fibre intake (adjusted OR = 0.659, 95% CI = 0.481 – 0.905) and plasma levels of total cholesterol (adjusted OR = 5.370, 95% CI = 1.861 – 15.495), LDL (adjusted OR = 1.093, 95% CI = 1.022 – 2.386) and vitamin E (adjusted OR = 0.481, 95% CI = 0.306 – 0.758) found to significantly contribute to the risk for colorectal adenomas, upon adjusting for potential covariates. A larger study and possibly a prospective study which recruits study subjects from various places in Malaysia will be an excellent effort to confirm these findings. Interventions with focuses on behavioural change may be able to reduce one’s risk for colorectal adenomas which in the long-term reduce his/her risk for developing colorectal cancer in the future.
Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Master Sains

FAKTOR-FAKTOR DIET DAN GAYAHIDUP YANG BERKAITAN DENGAN RISIKO ADENOMA KOLOREKTAL DI KALANGAN PESAKIT DI HOSPITAL KUALA LUMPUR

Oleh

AMUTHA RAMADAS

Disember 2006

Pengerusi : Profesor Madya Mirnalini Kandiah, PhD

Fakulti : Perubatan dan Sains Kesihatan

Kanser menduduki tempat ketiga dalam senarai punca kematian di Malaysia dan seorang daripada empat rakyat Malaysia berisiko mendapat kanser. Menurut laporan National Cancer Registry (2004) terdapat sedikit penurunan dalam peratusan kejadian kanser kolon (-0.2%) dan rektal (-0.2%) di kalangan lelaki Semenanjung Malaysia pada tahun 2003 berbanding tahun sebelumnya. Walau bagaimanapun, terdapat peningkatan dalam peratusan kejadian kanser ini di kalangan wanita (kanser kolon +0.4% dan kanser rektal +0.7%). Kanser kolorektal dikatakan berkembang dalam tempoh masa beberapa tahun dan kebanyakannya berpunca daripada polip adenoma neoplastik dan yang pada mulanya tidak berbahaya (Bond, 2000). Kanser kolorektal menunjukkan perkaitan yang signifikan dengan faktor diet dan gaya hidup. Namun, hubungan antara faktor – faktor ini dan polip adenoma di kalangan penduduk Malaysia masih belum dibuktikan. Kajian kes-kawalan ini bertujuan mengenalpasti hubungan antara ciri-ciri diet dan gaya hidup, dan risiko adenoma kolorektal di kalangan penduduk Malaysia. Selepas penyaringan kriteria inklusi dan eksklusi, seramai 118 orang lelaki dan wanita yang waras akal dan berumur 30 tahun
ke atas ketika ditemuramah dan telah menjalani kolonoskopi di Hospital Kuala Lumpur dipilih menyertai kajian ini. Lima puluh sembilan pesakit yang didiagnosis dengan adenoma kolorektal dipilih menyertai kumpulan kes manakala lima puluh sembilan pesakit lain yang tidak didiagnosis dengan sebarang jenis polip dipilih menyertai kumpulan kawalan. Satu borang soal-selidik yang telah diuji dan digunakan oleh seorang penemuramah dalam pengumpulan data. Sampel darah pesakit yang berpuasa diambil oleh jururawat terlatih, dan dianalisa menggunakan kaedah yang relevan di makmal sains. Data yang dikumpulkan dianalisa dengan menggunakan SPSS versi 12.0. Analisis multivariat telah menunjukkan bahawa peningkatan dalam bilangan hidangan buah – buahan (adjusted OR = 0.150, 95% CI = 0.052 – 0.434) dan sayuran (adjusted OR = 0.344, 95% CI = 0.149 - 0.794), pengambilan serat kasar (adjusted OR = 0.659, 95% CI = 0.481 – 0.905) serta paras kolesterol dalam plasma (adjusted OR = 5.370, 95% CI = 1.861 – 15.495), LDL (adjusted OR = 1.093, 95% CI = 1.022 – 2.386) dan vitamin E (adjusted OR = 0.481, 95% CI = 0.306 – 0.758) menyumbang kepada risiko adenoma kolorektal secara signifikan, selepas mengawal kovariat yang lain. Satu kajian yang lebih menyeluruh dan merangkumi subjek dari pelbagai tempat di Malaysia adalah cara yang lebih baik untuk mengesahkan hasil kajian ini. Faktor risiko yang mempunyai potensi untuk diubahsuai seperti pengambilan buah-buahan dan sayur-sayuran yang rendah dan biomarker plasma yang tidak disenangi harus diberi perhatian. Kajian intervensi yang memfokuskan perubahan dalam tingkah laku mungkin dapat mengurangkan risiko seseorang terhadap adenoma kolorektal dan seterusnya mengurangkan risiko mereka untuk mendapat kanser kolorektal.
ACKNOWLEDGEMENTS

First, I would like to take this opportunity to extend my gratitude to my supervisor, Assoc. Prof. Dr. Mirmalini Kandiah, who has been a great supervisor and mentor. She has put in great effort in supervising my research work, offering her valuable expertise and advising me at all times. I thank her for all the encouragement given to me at difficult moments. My sincere thanks goes to my co-supervisor, Assoc. Prof. Dr. Zarida Hambali, Deputy Dean of the Faculty of Medicine and Health Sciences in guiding me throughout my study. The support given by both supervisors has given me the strength to complete my thesis.

I take this opportunity to thank the surgeons and staffs of the Surgical Department of Hospital Kuala Lumpur for their co-operation and commitment in making this research a success. Invaluable co-operation given by the patients helped me to collect my data within the stipulated time period. Without their participation, this study would not have been possible.

Most of all, I would like to thank my family and friends who have always been there with me, through thick and thin. Thanking my parents in this juncture, as well as my siblings who put up with my struggles, ups and downs through the 26 years of my life. They are my pillar of strength. Not forgetting my friends, who have been great support. As there are too many of them, it is impossible to name everyone. Yet all of them will always be remembered. Thank you.
I certify that an Examination Committee has met on 21\textsuperscript{st} December 2006 to conduct the final examination of Amutha Ramadas on her Master of Science thesis entitled “Dietary and Lifestyle Factors Associated with Risk of Colorectal Adenoma in Patients at Hospital Kuala Lumpur” in accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher Degree) Regulations 1981. The Committee recommends that the candidate be awarded the relevant degree. Members of the Examination Committee are as follows:

\textbf{Zaitun Yassin, PhD}  
Associate Professor  
Faculty of Medicine and Health Sciences  
Universiti Putra Malaysia  
(Chairman)

\textbf{Zalilah Mohd. Shariff, PhD}  
Associate Professor  
Faculty of Medicine and Health Sciences  
Universiti Putra Malaysia  
(Internal Examiner)

\textbf{Latiffah A. Latiff, PhD}  
Associate Professor  
Faculty of Medicine and Health Sciences  
Universiti Putra Malaysia  
(Internal Examiner)

\textbf{Suzana Shahar, PhD}  
Associate Professor  
Faculty of Allied Health Sciences  
Universiti Kebangsaan Malaysia  
(External Examiner)

\textbf{GHAZALI, PhD}  
School of Graduate Studies  
Universiti Putra Malaysia

\underline{HASANAH MOHD. GHAZALI, PhD}  
Professor/Deputy Dean  
School of Graduate Studies  
Universiti Putra Malaysia

Date: 22 MARCH 2007
This thesis submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Master of Science. The members of the Supervisory Committee are as follows:

**Mirnalini Kandiah, PhD**  
Associate Professor  
Faculty of Medicine and Health Sciences  
Universiti Putra Malaysia  
(Chairman)

**Zarida Hambali, PhD**  
Associate Professor and Deputy Dean  
Faculty of Medicine and Health Sciences  
Universiti Putra Malaysia  
(Member)

![Signature]

**AINI IDERIS, PhD**  
Professor / Dean  
School of Graduate Studies  
Universiti Putra Malaysia

Date: 12 APR 2007
DECLARATION

I hereby declare that the thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at UPM or other institutions.

AMUTHA RAMADAS

Date: 15/05/07
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABSTRACT</td>
<td>ii</td>
</tr>
<tr>
<td>ABSTRAK</td>
<td>iv</td>
</tr>
<tr>
<td>ACKNOWLEDGEMENT</td>
<td>vi</td>
</tr>
<tr>
<td>APPROVAL</td>
<td>vii</td>
</tr>
<tr>
<td>DECLARATION</td>
<td>ix</td>
</tr>
<tr>
<td>LIST OF TABLES</td>
<td>xiv</td>
</tr>
<tr>
<td>LIST OF FIGURES</td>
<td>xvi</td>
</tr>
<tr>
<td>LIST OF ABBREVIATIONS</td>
<td>xvii</td>
</tr>
</tbody>
</table>

## CHAPTER

1  INTRODUCTION

1.1  Background
1.2  The problem statement
1.3  Significance of the study
1.4  Research objectives
   1.4.1  General objective
   1.4.2  Specific objective
1.5  Null hypothesis
1.6  Glossary of terms

2  LITERATURE REVIEW

2.1  What is cancer?
2.2  The burden of cancer
2.3  Colorectal adenomas and colorectal cancer
2.4  Dietary factors and colorectal adenomas
   2.4.1  Dietary fat
   2.4.2  Dietary fibre
   2.4.3  Red meat
   2.4.4  Fruits and vegetables
2.5  Selected micronutrients and risk of CRA
   2.5.1  Vitamin A
   2.5.2  Carotenoids
   2.5.3  Vitamin C
   2.5.4  Vitamin E
   2.5.5  Vitamin D and calcium
   2.5.6  Folate
2.6  Lifestyle behaviours as risk factors for colorectal adenomas
   2.6.1  Physical activity
   2.6.2  Tobacco smoking and alcohol consumption
   2.6.3  Overweight and obesity
2.7  Total lipid profile
3 METHODOLOGY

3.1 Study design 57
3.2 Sample size 57
3.3 Subjects 59
3.4 Pre-testing of the questionnaire 61
3.5 Exposure assessment 61
3.6 Determination of biomarkers 69
3.7 Determination of plasma vitamin A (retinol) and vitamin E (α-tocopherol) 69
3.8 Determination of total lipid profile 71
3.9 Data analysis 71

4 RESULTS

4.1 Socio-demographic characteristics 73
4.1.1 Gender 73
4.1.2 Age 73
4.1.3 Ethnicity and religion 76
4.1.6 Marital status 77
4.1.7 Education status 77
4.1.8 Occupation 77
4.1.9 Household and personal income 78
4.1.10 Family size 79
4.1.11 Duration of residence in Klang Valley 79

4.2 Dietary factors 80
4.2.1 Frequency of food consumption 80
4.2.1.1 Fruits 80
4.2.1.2 Vegetables 81
4.2.1.3 Cereals and cereal products 82
4.2.1.4 Legumes and legume products 82
4.2.1.5 Milk and milk products 83
4.2.1.6 Meat and meat products 84
4.2.1.7 Fish and seafood 85
4.2.1.8 Eggs 86
4.2.1.9 Fast foods 86
4.2.1.10 Confectionary 87
4.2.1.11 Drinks and beverages 87
4.2.1.12 Alcohols 88
4.2.1.13 Flavour enhancers / food additives 89
4.2.1.14 Oils 90
4.2.1.15 Snacks 90

4.2.2 Supplement intake 91
4.2.3 Cooking techniques 94
4.2.3.1 Frying 95
4.2.3.2 Steaming 97
4.2.3.3 Curries 97
4.2.3.4 Barbequing
4.2.3.5 Boiling
4.2.4 Removal of fat from meats
4.2.5 Nutrients intake of study subjects
4.2.5.1 Macronutrients
4.2.5.2 Antioxidant vitamins
4.2.5.3 Minerals
4.2.5.4 Crude fibre
4.2.6 Nutrient intake of the study subjects as compared to the Recommended Nutrient Intake (RNI)
4.2.7 Serving size of foods consumed by the study subjects
4.2.8 Plasma biomarkers of the study subjects
4.2.8.1 Plasma vitamin A and E
4.2.8.2 Lipid profile of the study subjects
4.3 Lifestyle factors
4.3.1 Tobacco smoking pattern of study subjects
4.3.1.1 Current smoking and passive smoking
4.3.1.2 Past smoking habits
4.3.2 Alcohol consumption pattern of study subjects
4.3.2.1 Current consumption of alcohol
4.3.2.2 Past consumption of alcohol
4.3.3 Eating pattern of the subjects
4.3.4 Physical activity pattern of the subjects
4.3.4.1 Physical activity at work
4.3.4.2 Physical activity at home
4.3.4.3 Transportation
4.3.4.4 Sports and physical activity during leisure time
4.3.5 Physical measurements of the study subjects
4.3.5.1 Anthropometrical measurements
4.3.5.2 Body fat composition
4.3.5.3 Blood pressure and resting heart rate
4.4 Binary logistic regression model
4.5 Testing of null hypothesis for dietary factors
4.6 Testing of null hypothesis for lifestyle factors

5 DISCUSSION
5.1 Socio-demographic characteristics
5.2 Dietary factors
5.2.1 Food intake
5.2.2 Supplement intake
5.2.3 Cooking technique
5.2.4 Nutrient intake
5.2.5 Plasma biomarkers
5.3 Lifestyle factors
5.3.1 Tobacco smoking
5.3.2 Alcohol consumption
5.3.3 Physical activity pattern
5.3.4 Physical measurements

6 CONCLUSION AND RECOMMENDATION
6.1 Conclusion
6.2 Recommendation
6.3 Limitation
LIST OF TABLE

<table>
<thead>
<tr>
<th>Table</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>10</td>
</tr>
<tr>
<td>2.1</td>
<td>23</td>
</tr>
<tr>
<td>2.2</td>
<td>44</td>
</tr>
<tr>
<td>3.1</td>
<td>59</td>
</tr>
<tr>
<td>3.2</td>
<td>62</td>
</tr>
<tr>
<td>3.3</td>
<td>64</td>
</tr>
<tr>
<td>3.4</td>
<td>65</td>
</tr>
<tr>
<td>3.5</td>
<td>65</td>
</tr>
<tr>
<td>3.6</td>
<td>66</td>
</tr>
<tr>
<td>3.7</td>
<td>66</td>
</tr>
<tr>
<td>4.1</td>
<td>74</td>
</tr>
<tr>
<td>4.2</td>
<td>80</td>
</tr>
<tr>
<td>4.3</td>
<td>81</td>
</tr>
<tr>
<td>4.4</td>
<td>83</td>
</tr>
<tr>
<td>4.5</td>
<td>84</td>
</tr>
<tr>
<td>4.6</td>
<td>84</td>
</tr>
<tr>
<td>4.7</td>
<td>85</td>
</tr>
<tr>
<td>4.8</td>
<td>85</td>
</tr>
<tr>
<td>4.9</td>
<td>86</td>
</tr>
<tr>
<td>4.10</td>
<td>87</td>
</tr>
<tr>
<td>Section</td>
<td>Title</td>
</tr>
<tr>
<td>---------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>4.11</td>
<td>Frequency of confectionary intake</td>
</tr>
<tr>
<td>4.12</td>
<td>Frequency of drinks intake</td>
</tr>
<tr>
<td>4.13</td>
<td>Frequency of alcohol intake</td>
</tr>
<tr>
<td>4.14</td>
<td>Frequency of flavour enhancers/food additives intake</td>
</tr>
<tr>
<td>4.15</td>
<td>Frequency of oil intake</td>
</tr>
<tr>
<td>4.16</td>
<td>Frequency of snacks intake</td>
</tr>
<tr>
<td>4.17</td>
<td>Supplement intake</td>
</tr>
<tr>
<td>4.18</td>
<td>Cooking techniques</td>
</tr>
<tr>
<td>4.19</td>
<td>Nutrients intake of the study subjects</td>
</tr>
<tr>
<td>4.20</td>
<td>Percentage of Recommended Nutrient Intake (RNI)</td>
</tr>
<tr>
<td>4.21</td>
<td>Comparison of serving sizes</td>
</tr>
<tr>
<td>4.22</td>
<td>Plasma biomarkers</td>
</tr>
<tr>
<td>4.23</td>
<td>Tobacco smoking pattern</td>
</tr>
<tr>
<td>4.24</td>
<td>Alcohol consumption characteristics</td>
</tr>
<tr>
<td>4.25</td>
<td>Eating out pattern</td>
</tr>
<tr>
<td>4.26</td>
<td>Physical activity of the study subjects at workplace and home</td>
</tr>
<tr>
<td>4.27</td>
<td>Transportation</td>
</tr>
<tr>
<td>4.28</td>
<td>Sports and physical activity pattern</td>
</tr>
<tr>
<td>4.29</td>
<td>Physical measurements</td>
</tr>
<tr>
<td>4.30</td>
<td>Binary logistic regression model</td>
</tr>
</tbody>
</table>
### LIST OF FIGURES

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>The conceptual framework – behavioural factors which will be investigated in its association with colorectal adenomas.</td>
<td>6</td>
</tr>
<tr>
<td>2.1</td>
<td>Ten most frequent cancers in males, Peninsular Malaysia, 2003</td>
<td>18</td>
</tr>
<tr>
<td>2.2</td>
<td>Ten most frequent cancers in females, Peninsular Malaysia, 2003</td>
<td>19</td>
</tr>
<tr>
<td>3.1</td>
<td>Research framework</td>
<td>58</td>
</tr>
<tr>
<td>4.1</td>
<td>Frequency of supplements consumption</td>
<td>92</td>
</tr>
<tr>
<td>4.2</td>
<td>Respondents’ habit of removing fat from meat or skin from chicken before cooking</td>
<td>100</td>
</tr>
<tr>
<td>4.3</td>
<td>Reasons for eating out</td>
<td>121</td>
</tr>
</tbody>
</table>
### LIST OF ABBREVIATIONS

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMI</td>
<td>Body Mass Index</td>
</tr>
<tr>
<td>CI</td>
<td>Confidence Intervals</td>
</tr>
<tr>
<td>OR</td>
<td>Odds Ratio</td>
</tr>
<tr>
<td>RR</td>
<td>Relative Risk</td>
</tr>
<tr>
<td>WHR</td>
<td>Waist-Hip Ratio</td>
</tr>
<tr>
<td>CRA</td>
<td>Colorectal adenomas</td>
</tr>
<tr>
<td>CRC</td>
<td>Colorectal cancer</td>
</tr>
<tr>
<td>SBP</td>
<td>Systolic blood pressure</td>
</tr>
<tr>
<td>DBP</td>
<td>Diastolic blood pressure</td>
</tr>
<tr>
<td>WHO</td>
<td>World Health Organization</td>
</tr>
<tr>
<td>NCI</td>
<td>National Cancer Institute</td>
</tr>
<tr>
<td>ACS</td>
<td>American Cancer Society</td>
</tr>
<tr>
<td>ASGE</td>
<td>American Society for Gastrointestinal Endoscopy</td>
</tr>
</tbody>
</table>
CHAPTER 1

INTRODUCTION

1.1 Background
Cancer is a general term defining any malignant neoplasm characterized by an uncontrolled growth of anaplastic cells that tend to invade surrounding tissues and to metastases to distant body sites (Anderson et al., 2002). It encompasses a group of neoplastic disease where normal body cells are transformed into malignant ones. Over 200 types and subtypes of cancer have been identified. These cancers have different etiological features, manifest with different symptoms and require different treatments (Cancer Research UK, 2002).

Worldwide, more than ten million people are diagnosed with cancer and 6 million deaths occur every year (World Health Organization, 2003). In Western countries such as the US, the lifetime risk of developing cancer is almost equal for both men and women. The lifetime risk of developing cancer is one in two in men and one in three in women (American Cancer Society, 2004). The Malaysian National Cancer Registry (2003) reported that for Malaysians, at least 1 in 4 have lifetime risk for developing cancer.

Cancer type varies with age; in young adults (15-49 years old), the common cancers are cancers of the nasopharynx, leukaemia, lymphoma, lung, colon and rectum in men, and cancers of the breast, cervix, ovary, uterus, thyroid gland and leukaemia in women. In
older subjects (50 years old and above), cancers of the lung, colon, rectum, nasopharynx, prostate and stomach are predominant among men, while cancers of the breast, cervix, colon, uterus, lung and rectum occurred commonly in women (NCR, 2003).

Colorectal cancer (CRC) was estimated to be the third and fourth most commonly occurring cancer worldwide among men and women respectively in the year 2002. Colorectal cancer was estimated to contribute to 9.5% and 9.3% of total cancer cases among males and females respectively in 2002 (International Association of Cancer Registries, 2002). Among Malaysians, colon cancer ranked third among cancers reported in males and females, accounting for 7.8% and 6.0% of all cancer cases in males and females respectively in 2003 (NCR, 2003). The age-standardized rate for colon cancer in males and females were 13.9 and 11.2 respectively. Cancer of the rectum, on the other hand, ranked fifth among cancers reported in Malaysian males (6.8%) and females (4.1%) respectively.

It is a well-known fact that almost all CRCs arise from benign, neoplastic adenomatous polyps (Bond, 2000). The progress of adenoma to cancer may take five to ten years (Young et al., 2002). These polyps are benign growths that protrude from the inner walls of colon and rectum, and are relatively common in people over the age of 50. It is estimated that the average 60 year-old without special risk factors for polyps had a 25% chance of having a polyp (American Society for Gastrointestinal Endoscopy, 2006a). Besides sporadic adenomatous polyps that develop as a result of diet and lifestyle factors, mutation in genes and DNA may also cause conditions known as familial adenomatous
polyposis syndrome (FAP) or hereditary non-polyposis colorectal cancer (HNPCC) syndrome, which lead to development of multiple polyps (Burt, 2000).

The role of diet in the aetiology of CRC remains an area of active investigation. Of all the food groups studied, plant-based diets are constantly associated with decreased risk of colorectal neoplasia. Intakes of fruits and grain appear to be inversely related to risk of CRC and polyps although less consistent evidence has been observed for vegetables (Pecipans & Sandler, 1994). Similarly, a recent study by Michels et al., 2006 found that frequent consumption of fruits was inversely related to the risk of being diagnosed with polyps, while little association was found for vegetable consumption. The authors also found legumes to be protective of colorectal adenomas (CRA). These potentially protective associations may have resulted from the high levels of dietary fibber, antioxidants and other phytochemicals in plant foods.

Micronutrients found in plant-based food have been linked to the protective effect of these foods against the development of CRA. Of all the micronutrients found in fruits and vegetables, folate, calcium and several antioxidant vitamins have been the main focus of interest (Tseng et al., 1994). Antioxidant vitamins such as vitamin A, carotenoids, vitamin E and vitamin C are strong free-radical quenchers and have the ability to reduce oxidative damage to DNA (Noguchi & Niki, 1999). However, epidemiological evidence on the dietary intakes of these vitamins and minerals have been inconsistent in many recent studies and therefore warrant further investigation (Grau et al., 2003; Senesse et al., 2005).
CRAs have been regularly, but not always significantly, found to be related to various lifestyle behaviours such as physical activity, tobacco smoking, alcohol consumption, as well as overweight and obesity. Therefore this study was conducted to examine the relative contribution of dietary and lifestyle factors to the occurrence of polyps in Malaysian subjects. Identification of these factors may help in the initiation of dietary and lifestyle education for behavioural change in people with polyps which in turn may arrest the development of CRC.

1.2 The problem statement

Most colorectal cancers arise from pre-existing adenomatous polyps or adenomas. Although true incidence of colorectal adenomas are difficult to be calculated, Midgley and Kerr (1999) estimated its' prevalence to be about 35% in Europe and USA, and between 10 – 15% in Asia and Africa. No Malaysian figure is available to this date. However verbal information obtained from the experts in the field of colorectal cancer revealed that the figure may be between 10% and 20%. About five percent to ten percent of adenomatous polyps are estimated to become malignant, a process that takes five to ten years (ASGE, 2006a).

The other common type of polyp is hyperplastic polyps which are non-precancerous or benign. Although all polyps will be removed during colonoscopy, people with history of having these adenomas have as much as 50% chance of developing polyps again usually within three years of diagnosis. This makes colorectal adenomas a vital risk factor for colorectal cancer.
Active investigations have been identifying the risk factors for CRA, which have been complied and presented in Figure 1.1. Although the exact association is still unclear, dietary factors such as various food items/food groups such as dietary fat (Mathew et al., 2004), fruits and vegetables especially carotenoids vegetables, cruciferous vegetables, high vitamin C fruits (Witte et al., 1995) and red meat (Breuer-Katschinski et al., 2001a); nutrients such as antioxidant vitamins (Enger et al., 1996 and Lubin et al., 1997), vitamin D (Platz et al., 2000 and Peters et al., 2004), calcium (Grau et al., 2003) and folate (Benito et al., 1993); high temperature cooking techniques especially cooking of red meat in high temperature (Sinha et al., 1999), and unfavourable lipid profile (Park et al., 2000) have been associated with the risk.

Besides dietary factors, lifestyle habits such as tobacco smoking (Larsen et al., 2006 and Almendingen et al., 2000), alcohol consumption (Todoroki et al., 1995 and Bardou et al., 2002) and physical inactivity (Hauret et al., 2004 and Enger et al., 1997) also have been shown to increase the risk for CRA, although there are studies which have shown insignificant relationships (Boutron–Rault et al., 2001). Physical factors such as anthropometrical measurements (Giovannucci et al., 1995 and Morimoto et al., 2002), body composition (Almendingen et al. 2001), and blood pressure are factors that have least evidences linking them to the risk for CRA. No documented evidence available on Malaysian population, although Rajendra et al. (2005) have tried to explore general risk factors associated with CRA. They found significant increase in the risk for CRA with age and family history of CRC. This study on the other hand, actively investigates the relationship between several dietary and lifestyle risk factors for CRA.
Dietary factors
- fat,
- fibre
- red meat
- fruits
- vegetables
- nutrients
- cooking techniques
- supplements

Physical factors
- anthropometry measurements
- body composition
- blood pressure
- resting heart rate

Lifestyle behaviours
- smoking habit
- alcohol consumption
- eating out pattern

Blood biomarkers
- plasma vitamins
- lipid profile

Adenomatous Polyps

Colorectal Cancer

5 to 10 years

Figure 1.1: The conceptual framework - behavioural factors which will be investigated for its association with colorectal adenomas.