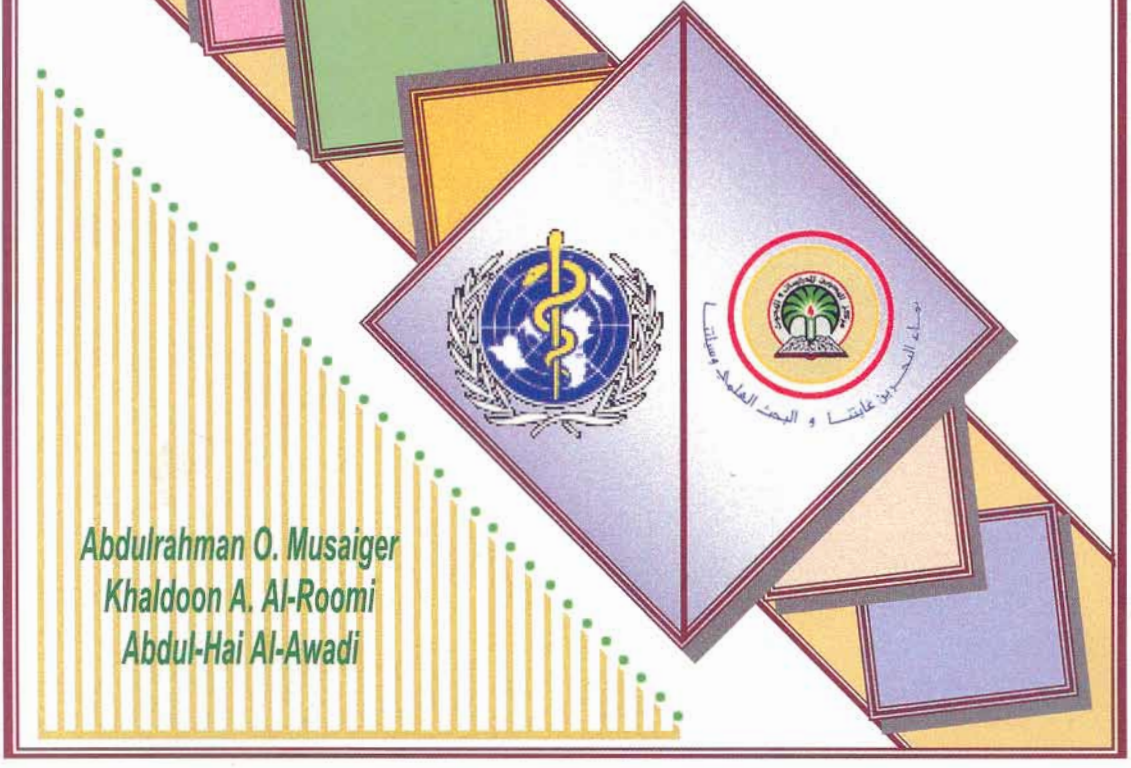
مركز البحرين للدراسات والبحوث
Bahrain Centre for Studies & Research

LIFESTYLE AND DIETARY PATTERNS ASSOCIATED WITH ACUTE MYOCARDIAL INFARCTION IN THE BAHRAINI POPULATION

(A COMMUNITY-BASED CASE-CONTROL STUDY)



Abdulrahman O. Musaiger
Khaldoon A. Al-Roomi
Abdul-Hai Al-Awadi

LIFESTYLE AND DIETARY PATTERNS ASSOCIATED WITH ACUTE MYOCARDIAL INFARCTION IN THE BAHRAINI POPULATION

(A COMMUNITY-BASED CASE-CONTROL STUDY)

Abdulrahman O. Musaiger, DrPH (Nutr)
Head of Research, Food and Nutrition Sciences
Director, Environmental and Biological Programme
Bahrain Center for Studies and Research
Manama, Bahrain.

Khaldoon A. Al-Roomi, MD, PhD
Associate Professor, Family & Community Medicine
Vice-Dean, Administration
College of Medicine and Medical Sciences
Arabian Gulf University, Bahrain.

Abdul-Hai Al-Awadi, MD
Consultant Cardiologist
Salmaniya Medical Complex
Ministry of Health, Bahrain

First Edition, 1999

Bahrain Center for Studies & Research

- This study was sponsored by World Health Organization, Regional Office for Eastern Mediterranean (EMRO), Alexadria, Egypt.

Requests for additional copies of this publication can be obtained from:

Directorate of Information, Translation and Publication
Bahrain Center for Studies and Research
P. O. Box 496
Manama – Bahrain
Tel: +973-754757
Fax: +973-754835
E-mail: Ralnajim@bcsr.gov.bh

614,5912 Musaiger, Abdulrahman O.
M985

Lifestyle and Dietary Patterns Associated with Acute Myocardial Infarction in the Bahraini Population: A community-based Case-Control Study/Abdulrahman O. Musaiger, Khaldoon A. Al-Roomi, Abdul-Hai Al-Awadi – Bahrain: Bahrain Center for Studies and Research, 1999.
71p; 24 cm.

1- Myocardial infarction - Bahrain
2- Diet – Bahrain

1- Al-Roomi, Khaldoon A
2- Al-Awadi, Abdul-Hai
3- Title

Bahrain Public Library No. 2569 L.D./98

CONTENTS

INTRODUCTION 1

OBJECTIVES 3

SUBJECTS AND METHODS 3

RESULTS AND DISCUSSION 8

- Social and Demographic factors 8
- Lifestyle Patterns 13
- Smoking Habits 20
- History of Diabetes and Hypertension 23
- Obesity 26
- Dietary Habits 30
- Multivariate Analysis 42

CONCLUSION 47

RECOMMENDATIONS 49

REFERENCES 53

APPENDICES 58

Appendix 1: Approaches and Priorities for the Prevention of CVD in EMR 58

Appendix 2: Guidelines for the Development of National Programmes for the Prevention and Control of CVD 66

INTRODUCTION

Cardiovascular diseases (CVD) are given a high priority as a field for research by the World Health Organization (WHO), as these diseases not only affect affluent populations, but also many low socio-economic populations (WHO, 1990 a). The WHO strategy for Nutrition Research stressed that the implementation of projects on the primordial prevention of CVD should be promoted in developing countries in collaboration with WHO (WHO, 1990 b).

The WHO/EMRO intercountry consultation on Malnutrition of Affluence recognized that non-communicable diseases of chronic metabolic type such as coronary heart diseases, cerebrovascular accidents, diabetes and cancer are the major causes of morbidity and mortality in a number of countries in the Eastern Mediterranean Region, and that there is an urgent need for research in this area (WHO/EMRO, 1989). Therefore, obtaining reliable data on the prevalence of major risk factors for CVD is essential for assessing the baseline magnitude and situation regarding the population distribution of the CVD risk factors. Such data is also needed in order to initiate appropriate interventions, and for monitoring future trends and for evaluating the progress of intervention (WHO/EMRO, 1995).

Cardiovascular diseases (CVD) are the leading causes of morbidity and mortality in Bahrain (MOH, 1998). This creates a heavy load on health services and absorbs a high percentage of the total health budget. There is no specific programme to prevent and control cardiovascular diseases in Bahrain. This is mainly due to the lack of information about risk factors affecting CVD in the country. The WHO reported that there are sharp contrasts between countries or between social groups within a country which are often evident in the special and environmental conditions known to place populations at risk for CVD. Investigation of such differences between groups or populations would add to our knowledge

of the determinants of risk factors in childhood and adult population. Studies both of risk factor status, and of change of social and economic developments are needed to achieve an understanding of the known differences in risk factors or changing circumstance (WHO, 1990 c).

Statement of the Problem

CVD is the major cause of death in Bahrain. The number of deaths from the circulatory system diseases in Bahrain has increased dramatically over the past twenty years. In 1997, about 30% of total deaths were due to circulatory system diseases. Deaths from diseases of the circulatory system occur as early as the 20-34 year age group, and increase sharply thereafter, whereas deaths owing to hypertension occur in the 45-54 year age group and continue to increase thereafter (MOH,1998). Risk factors for CVD such as diabetes, hypertension and obesity are considered the main health problems in Bahrain (Musaiger, 1996).

Annual health statistics published by the Ministry of Health showed that acute myocardial infarction (AMI) is the main disease of the CVD group and represents about 50% of the total cases of CVD admitted to hospitals in Bahrain (MOH, 1998). Changes in lifestyle and dietary patterns may be the main factors leading to the high increase of AMI in Bahrain. Statistics showed that there is a drastic change in the food consumption patterns during the past 20 years. The transition from traditional diet to a western diet is likely to result in a significant increase in fat and dietary cholesterol. Lack of physical exercise, especially among women, smoking and alcohol drinking may be other contributing factors (Musaiger, 1996). However, it is difficult to determine the main risk factors leading to AMI in Bahrain in the absence of detailed and reliable information.

OBJECTIVES

Main objective

The overall objective of this study was to identify the dietary, lifestyle and behavioural factors that are associated with the occurrence of AMI among the Bahraini native population.

Specific objectives

1. To describe the dietary, lifestyle and behavioural characteristics of AMI patients reporting to the heart disease unit during a six month period.
2. To find out the distribution of similar characteristics among community control subjects.
3. To discover the main risk factors that are associated with AMI such as certain demographic characteristics, dietary habits, exercise, obesity, smoking and history of diabetes and hypertension.

SUBJECTS AND METHODS

Study population

The control group consisted of Bahraini residents aged 30-79 years normally residing in the 11 geographical areas of Bahrain. A simplified general method for cluster-sample surveys of health was used to select the control subjects (Bennett et al, 1991). Bahrain was divided into 337 blocks distributed in the 11 geographical areas. Fifty-two blocks (15%) were selected randomly, using random-table technique, from the total blocks. The sampling procedure was performed according to the proportional distribution of blocks in each geographical area. Ten households were then selected from each block, to make a total sample of 520 persons.

Selection of community control subjects

Households were selected from each block using a WHO sampling technique for morbidity (WHO, 1984). The technique can be summarized as follows: at the approximate geographical center of each block, a direction was selected randomly. The interviewers then moved in a straight line in this direction and surveyed the targeted households until 10 households had been covered. Selected households are those which housed persons aged 30 to 79 years old. In each block 6:4 male to female proportion was taken. Subjects were interviewed at home by two trained female nurses working with the research team.

Selection of patients with myocardial infarction

All Bahraini patients with acute myocardial infarction (AMI) who were admitted to the Salmaniya Medical Complex (the main Governmental Hospital) during a six month period, February 1992 to July 1992, were included in the study. Non-Bahraini patients were excluded because they have different social and dietary habits than Bahrainis. Patients were interviewed by one qualified nurse during their hospitalization. Acute myocardial infarction was diagnosed according to the WHO criteria which requires the presence of at least two of the following three criteria; definite clinical picture, ECG changes (development of pathological Q waves or S-T changes) and a significant rise of the levels of the cardiac enzymes (CPK, SGOT, LAD).

The questionnaire

Data were collected by using a specially designed questionnaire which was developed by the research team and tested on the Bahraini population. The questionnaire sought the following information:

1. Socio-demographic background such as age, sex, educational level, occupation and marital status.

2. Life-style patterns such as availability of cars and servants, hours of watching television, activity in workplace and practising exercises.
3. Smoking habits: which include information on both active and passive smoking.
4. Dietary habits based on frequency intake of foods rich in fat, energy and salt, as well as other dietary practices.
5. History of chronic illness such as diabetes and hypertension.
6. Anthropometric measurements, such as weight and height.

Pilot study

A pilot study on 10 cases of AMI and 50 community control subjects was conducted in order to train the female workers and pretest the questionnaire, as well as to check the accuracy and practicability of the weighing scales and stadiometers. Based on this pilot study several modifications were then adopted.

Study Variables

1. Anthropometric measurements

Weight was measured to the nearest 0.2 Kg using a Sepa Digital scale with a 130 capacity. The weight was taken without shoes and with as few clothes as possible. Height was measured to the nearest 0.1 cm using a Sepa portable stadiometer.

2. Body Mass Index

Body Mass Index (BMI) was employed as a measure of obesity among the sample studied. BMI was calculated according to the following formula:

$$BMI = \frac{\text{Weight (Kg)}}{\text{Height (m}^2\text{)}}$$

Obesity was determined based on the following criteria for both men and women (Bray, 1978):

	BMI
Underweight	< 20
Acceptable weight	20 – 24.9
Overweight	25 – 29.9
Obese	30 +

3. Smoking habits

For both AMI patients and community control subjects, smoking habits were classified as current smoker, ex-smoker and non-smoker. A current smoker was defined as a person smoking at least one cigarette per day regularly. An ex-smoker was defined as a person who had given up smoking for at least six months. Non-smoker was defined as a person who had never smoked regularly. A passive smoker was defined as a person who does not smoke but is regularly subjected to inhaling other people's tobacco smoke, such as the spouse of a current smoker.

4. Dietary habits

Frequency of intake of some foods rich in fat, energy and salt were measured. Each person in the sample was asked about the frequency of weekly intake of these foods. Percentage and mean intake of such foods were calculated. No attempt was made to calculate the quantity of foods or nutrients at this stage because of the lack of food composition data of local foods. Frequency of intake of fresh vegetables, fruit, chicken and fish was also obtained. Some related food habits were investigated.

Data entry and analysis

After the study was completed, the questionnaires were coded and entered into a computer. Frequency distributions were produced for each variable to check possible errors in data entry.

Data were first stored in D-Base files and analyzed using EPI-INFO (Dean et al, 1990) and Statprog (McGee, 1990) programmes. Odds ratio (OR) for the associations, Chi-Square and confidence intervals for the odds ratios were calculated. The level of statistical significance was considered when p-value equal or less than 0.05. Unconditional logistic regression analysis was used to calculate the odds ratios and their corresponding 95% confidence intervals (CI), while adjustments were made for the effects of factors in the model (Schlesselman, 1982; Greenland, 1989). If the 95% CI for the odds ratios did not include the value of 1.0, the risk estimate was regarded as significant.

Since patients may change their lifestyle patterns or food habits after suffering an AMI, the multivariate analysis was repeated including only those patients who had suffered their first AMI. However, the differences between the first AMI cases and community controls were little changed even after adjusting for other risk factors (Al-Roomi et al, 1994).

RESULTS AND DISCUSSION

One hundred and five AMI cases were included in this study. These cases were compared with 516 community control subjects obtained from the population random sample.

SOCIAL AND DEMOGRAPHIC FACTORS

Age

The mean age of the AMI patients was 56.9 years (sd ± 13.8 years) compared to 50 years (sd ± 10.7 years) among the control subjects. The distribution of cases and controls by age group showed that more than 70% of cases were aged 50 years or older, while about 50% of controls were of this age group. The difference was statistically significant, $p<0.000$ (Table 1).

Sex

It is well documented that at any given age up to approximately 70 years, the prevalence of AMI is much higher in men than in women. During the study period, the proportion of men was 74% and that of women 26%. This compares with 58% and 42% respectively among the control subjects (Table 2). The sex distribution of cases compared favourably with that reported by the Ministry of Health for patients admitted to Salmaniya Medical Complex as the proportion was almost the same (MOH, 1998), which indicates that all cases of AMI during the study period were included in this study and minimizes the possibility of a selection bias. The lower proportion of men among the control subjects than among cases reflects the low proportion of older age groups (65 years and older) in the general population in Bahrain as reported in the latest 1991 Census of Household and Population in Bahrain (CSO, 1992). The study showed that males were two times more likely to develop AMI than females (odds ratio, 2.1)

Table (1)

Distribution of acute myocardial infarction (AMI) cases and community controls by age

Age (years)	Cases		Controls	
	No.	%	No.	%
< 39	12	11.5	106	20.5
40 – 49	16	15.2	141	27.3
50 – 59	29	27.6	139	26.9
60 – 69	31	29.5	110	21.3
≥ 70	17	16.2	20	4.0
Total	105	100.0	516	100.0

X^2 = 33.6, p = 0.000

Table (2)

Distribution of AMI cases and community controls by sex

Sex	Cases		Controls	
	No.	%	No.	%
Male	78	74.3	299	57.9
Female	27	25.7	217	42.1
Total	105	100.0	516	100.0

X^2 = 9.7, p = 0.002
Odds Ratio (OR) = 2.1 (95% CI; 1.28 - 3.45)

Educational level

The relationship between the socio-economic status and the risk factors for AMI was strongest and most consistent for education showing higher risk associated with lower levels of education. Using a forward selection model that allowed for inclusion of occupation, education and income after adjustment of age and time of study, education was found to be the only measure that was significantly associated with the risk factors for AMI (Winkleby et al, 1992) - Table 3.

The distribution of cases and controls by the educational level is presented in Table (3). Almost half of the cases were illiterate with a similar pattern seen among the controls (47.7%). Only 19% of the cases and 21% of the controls had a secondary or university education level. This may reflect the large proportion of cases and controls in the older age group (50 years and older), who are unlikely to have achieved a high educational status, since university education has only become available in Bahrain during the last 20 years. Not surprisingly, there was no significant association between AMI and the educational level in this analysis.

Employment status

Table (4) shows the employment status of cases and controls. It is worthwhile to note that the distribution of cases and controls by employment status was very similar, and there was no significant association between AMI and employment status.

Marital status

A number of studies in the Western population have reported that people who are not currently married (single, divorced or widowed) suffer a higher risk of developing AMI than those who are currently married (Malcolm and Dobson, 1989). The result of this study (Table 5) showed

that 20% of the cases were not currently married compared with only 7% of the controls. This increased risk among those who are not currently married is widely thought to be due to the high prevalence of cardiovascular risk factors and the lack of social support among this group. A highly significant association was seen between the occurrence of AMI and the marital status of the patients (p=0.0005).

Table (3)

Distribution of AMI cases and community controls by educational status

Educational status	Cases		Controls	
	No.	%	No.	%
Illiterate	51	48.6	246	47.7
Read & write	12	11.4	46	8.9
Primary	17	16.2	81	15.7
Intermediate	5	4.8	33	6.4
Secondary	17	16.2	69	13.4
University	3	2.9	41	7.9
Total	105	100.0	516	100.0

$X^2 = 4.7$, $p = 0.5$

Table (4)

Distribution of AMI cases and community controls by employment status

Employment status	Cases		Controls	
	No.	%	No.	%
Unemployed	62	59.0	303	58.7
Employed	43	41.0	213	41.3
Total	105	100.0	516	100.0

X^2 = 0.0, p = 0.95
OR = 1.01 (95% CI; 0.65 - 1.59)

Table (5)

Distribution of AMI cases and community controls by marital status

Marital status	Cases		Controls	
	No.	%	No.	%
Currently married	84	80.0	478	92.6
Single	6	5.7	12	2.3
Divorced	4	3.8	4	0.8
Widowed	11	10.5	22	4.3
Total	105	100.0	516	100.0

X^2 = 17.6, p = 0.0005

Table (6)

Distribution of AMI cases and community controls according to the ownership of a car

Ownership of a car	Cases		Controls	
	No.	%	No.	%
Yes	30	28.6	183	35.5
No	75	71.4	333	64.5
Total	105	100.0	516	100.0

X^2 = 1.8, p = 0.17
OR = 0.73 (95% CI; 0.45-1.18)

LIFE-STYLE PATTERNS

Ownership of a car

It was assumed that patients with AMI are more dependable on cars and housemaids than the control subjects. The findings of this study showed a contrary situation, the percentage of ownership of a car was higher among controls (35.5%) than cases (28.6%) (Table 6). However, the association between AMI and ownership of a car was not significant (p=0.17).

Availability of servants at home

It is widely thought that the availability of housemaids or servants at home had helped in part to increase the sedentary life-styles of the people in Bahrain and other Arabian Gulf states (Musaiger, 1987). The present study indicated a similarity in availability of servants at home in both case and control groups (Table 7).

Daily watching television

Almost all households in Bahrain have at least one television set. Some investigators showed that television viewing is a strong risk factor for childhood and adolescent obesity. It also decreases the remission of obesity, decreases the activity levels and possibly influences diet. After adjustment for other risk factors by logistic regression, documented associations between television viewing and obesity among adults were reported. These relationships are greater than those estimated between measures of vigorous physical activity and obesity and indicate the importance of inactivity and lack of exercise to which television viewing contributes substantially (Gortmaker et al, 1990).

Our findings indicated that cases were less likely to watch television daily (68.6%) than controls (78.1%) as shown in Table 8. The association was statistically significant (p=0.035).

Table (7)

Distribution of AMI cases and community controls by the availability of servants at home

Availability of servants	Cases		Controls	
	No.	%	No.	%
Yes	26	25.0	128	25.0
No	79	75.0	388	75.0
Total	105	100.0	516	100.0

χ^2 = 0.00, p = 0.99
OR = 1.0 (95% CI; 0.60 - 1.66)

Table (8)

Distribution of AMI cases and community controls according to the daily watching of T.V.

Daily Watching of T.V.	Cases		Controls	
	No.	%	No.	%
Yes	72	68.6	403	78.1
No	33	31.4	113	21.9
Total	105	100.0	516	100.0

X^2 = 4.4, p = 0.035
OR = 0.61 (95% CI; 0.38 - 1.00)

Activity at work-place

It has been suggested that there is an increased risk of coronary heart disease in men who are employed in occupations where the work demand is high, but where the degree of control and autonomy is low, i.e. the occupation groups termed 'high strain' occupations (National Dairy Council, 1992). The association between AMI and time spent sedentary and actively in work was highly significant (p=0.00006 and 0.0005, respectively). About 28% of cases spent all their time sedentary at work compared to 11% in controls, whereas 47% of controls have rarely spent time sedentary at work compared to 19% of cases (Table 9). However, this observed difference may simply be due to the possibility that patients with AMI have a higher prevalence of chronic illness than people in the community, which would certainly limit their activity. With regards to time spent actively at work, controls were more likely to spend all their time actively at work than cases (47% and 19%, respectively), as shown in Table 10.

Exercise practising

The epidemiological evidence linking either objectively measured physical fitness or reports on physical activity to risk of coronary heart disease is abundant but is inconclusive. A significant association between the level of fitness and the total cholesterol levels, triglycerides levels, heart rate and smoking in both men and women was reported by Lochen and Rasmussen (1992). In the present study, practising walking exercise was found to be highly related to risk of AMI (p=0.000). About one-third of the cases practised walking exercise compared to 66.5% of controls (Table 11). However, there was no significant association between risk of AMI and practising other exercises (p=0.9), as shown in Table 12.

Physical activity depended more on leisure activities and sport than on the demands of work (James, 1991). Patients and community control subjects were asked about whether or not they practised walking around the house at leisure time or when the weather is nice. The results suggest that the risk of AMI may be related to practising exercise, since a greater proportion of community control subjects practised walking around the house at leisure time more than cases (Table 13). The association was highly statistically significant (p=0.000). Similar finding was noted regarding practising walking when the weather is nice (p=0.000) as presented in Table 14. These findings indicate that frequent practicing of simple exercise such as walking may play an important role in reducing the risk of AMI. However, this conclusion would require further investigations to show whether or not lack of physical exercise is related to the development of AMI in the Bahraini community. Nevertheless, from a public health point of view, it would seem to be a sensible advice to encourage the local community to practise physical exercises regularly and to participate in sport activities.

Table (9)

Distribution of AMI cases and community controls by time spent sedentary in work*

Time spent sedentary in work	Cases		Controls	
	No.	%	No.	%
All the time	12	27.9	23	10.8
More than half of the time	13	30.2	24	11.3
About half of the time	5	11.6	26	12.2
Less than half of the time	5	11.6	40	18.8
Rarely spends time sedentary	8	18.6	100	46.9
Total	43	100.0	213	100.0

$X^2 = 24.4$, $p = 0.00006$

* only employed cases and controls

Table (10)

Distribution of AMI cases and community controls by time spent actively in work*

Time spent actively in work	Cases		Controls	
	No.	%	No.	%
Almost no activity in work	9	20.9	21	9.9
Less than half of the time	13	30.2	24	11.3
Almost half of the time	4	9.3	28	13.1
More than half of the time	9	20.9	40	18.8
All the time	8	18.6	100	46.9
Total	43	100.0	213	100.0

$X^2 = 20.0$, $p = 0.0005$

* only employed cases and controls

Table (11)

Distribution of AMI cases and community controls by practising walking exercises

Practising walking exercises	Cases		Controls	
	No.	%	No.	%
Yes	35	33.3	343	66.5
No	70	66.7	173	33.5
Total	105	100.0	516	100.0

X^2 = 40.2, p = 0.000
OR = 0.25 (95% CI; 0.16 - 0.40)

Table (12)

Distribution of AMI cases and community controls by practising other exercises

Practising other exercises	Cases		Controls	
	No.	%	No.	%
Yes	12	11.5	56	10.9
No	93	88.5	460	89.1
Total	105	100.0	516	100.0

X^2 = 0.03, p = 0.90
OR = 1.06 (95% CI; 0.52 - 2.14)

Table (13)

Distribution of AMI cases and community controls by walking around the house

Walking around the house	Cases		Controls	
	No.	%	No.	%
Always	25	23.8	287	55.6
Sometimes	40	38.1	134	26.0
No	40	38.1	95	18.4
Total	105	100.0	516	100.0

X^2 = 37.7, p = 0.000

Table (14)

Distribution of AMI cases and community controls by practising walking when the weather is nice

Practise walking when the weather is nice	Cases		Controls	
	No.	%	No.	%
Always	24	22.9	237	45.9
Sometimes	41	39.0	169	32.8
No	40	38.1	110	21.3
Total	105	100.0	516	100.0

X^2 = 22.2, p = 0.000

SMOKING HABITS

The prevalence of smoking among the adult population in Bahrain is lower than that in most of the developed and some of the less developed countries. However, there appears to be a secular trend of increasing cigarette smoking among the adult Bahraini population (Hamadeh et al 1992). The possible association between smoking and the risk of AMI may be partly explained by the higher fibrinogen levels among current smokers than among non-smokers and that these levels fall in ex-smokers to the non-smoking level. The precise way in which smoking influences haemostasis is uncertain but it may be related to the increase in carbon monoxide levels, as was demonstrated in a recent study which examined the correlation between fibrinogen and carboxyhaemoglobin levels in smokers (National Dairy Council, 1992).

Data from this study showed that the prevalence of smoking was higher among cases than among community control subjects. Among AMI cases, 34% were non-smokers compared to 54% of the community controls (Table 15). The association between AMI and smoking status was highly statistically significant ($p=0.000$). The prevalence of those who had a history of ever having smoked was 66% in cases and 46% in controls. The association was highly statistically significant ($p=0.000$), as shown in Table (16).

Cigarette smoking was the commonest type of smoking among both cases (80%) and community control subjects (58%) (Table 17). However, a large percentage of controls used a hubble-bubble (38%), compared to AMI cases (12%). This is mainly due to a higher proportion of women among the control group than among the AMI cases, as it was found that smoking using a hubble-bubble was more widespread among Bahraini women than among men (Hamadeh et al 1992).

More than half of AMI cases were ex-smokers (55%), while the percentage of ex-smokers was 24% in controls (Table 18). The

association between AMI and ex-smoking was highly significant (p=0.000). This is in line with a dose-response relationship between cigarette smoking and the occurrence of AMI in the Bahraini population. Interestingly, the proportion of control subjects who were living in a smoking environment (passive smokers) was almost double that among cases (41% of controls compared to 22.5% of cases), as shown in Table (19). A negative association between AMI and passive smoking was observed (p=0.002). This may be explained by the fact that AMI patients have a greater proportion of cardiovascular and respiratory illnesses that may force those people who live with them not to smoke in their presence.

Table (15)

Distribution of AMI cases and community controls by smoking status

Smoking status	Cases		Controls	
	No.	%	No.	%
Current smokers	25	23.8	148	28.6
Ex-smokers	44	41.9	88	17.1
Non-smokers	36	34.3	280	54.3
Total	105	100.0	516	100.0

$X^2 = 32.9$, p = 0.000

Table (16)

Distribution of AMI cases and community controls by history of smoking

History of Smoking	Cases		Controls	
	No.	%	No.	%
Ever smoked	69	65.7	236	45.7
Never smoked	36	34.3	280	54.3
Total	105	100.0	516	100.0

X^2 = 13.9, p = 0.00024
OR = 2.27 (95% CI; 1.44 - 3.61)

Table (17)

Distribution of AMI cases and community controls by type of smoking*

Type of smoking	Cases		Controls	
	No.	%	No.	%
Cigarettes	20	80.0	86	58.1
Cigar	2	8.0	6	4.1
Hubble bubble	3	12.0	56	37.8
Total	25	100.0	148	100.0

X^2 = 6.58, p = 0.037
* Current smokers only

Table (18)

Distribution of AMI cases and community controls by ex-smoking status

Ex-smoking status	Cases		Controls	
	No.	%	No.	%
Yes	44	55.0	88	23.9
No	35*	45.0	280	76.1
Total	79	100.0	368	100.0

* one case is missing
X^2 = 31.5, p = 0.000
OR = 4.0 (95% CI; 2.34 – 6.84)

HISTORY OF DIABETES AND HYPERTENSION

Diabetes and hypertension have been shown repeatedly to predict the development of both stroke and AMI in adult populations. Studies on the prevalence of these two diseases among the Bahraini community are scarce. A community-based study on 481 Bahraini mothers aged 18 to 48 years has demonstrated that 8.5% of these mothers had diabetes (Musaiger and Al-Sayyed, 1990). The true prevalence of diabetes in Bahrain is probably higher than this estimate as many cases of diabetes are not recognized or not detected. Recently, Al-Mahroos and Mckeigue (1998) found that diabetes is highly prevalent among Bahraini natives aged 40-69 years. The crude prevalence rates for diabetes and impaired glucose tolerance (IGT) were 30% and 18%, respectively.

Data from this study showed that diabetes was significantly associated with an increased risk of the occurrence of AMI (OR = 4.0, p= 0.0001). About 29% of the cases gave a history of diabetes compared with 9% in controls (Table 20). The prevalence of diabetes among the community control subjects in the country is consistent with that reported in other studies in the Arab Gulf region (Musaiger and Miladi, 1996).

Table 21 shows the association between a history of hypertension and the occurrence of AMI. Of patients with AMI, 39% gave a positive history of hypertension compared with 12% of community controls (OR =4.6, p=0.000). This indicates that hypertension and diabetes are probably among the most important preventable risk factors for AMI in the Bahraini population and a greater attention of both the public and the medical community to this problem is needed.

Unlike many other studies in western communities, a family history of heart disease was not associated with a significant increased risk of AMI occurrence (OR =1.1, p=0.6). However, the proportion of cases who gave a family history of heart disease was slightly higher than the percentage among the controls (15% and 13%, respectively) (Table 22). In general these proportions are high, which is probably due to the higher percentage of older subjects in the sample studied and suggest that the disease is of a sizeable magnitude in this community.

Table (19)

Distribution of AMI cases and community controls by history of living in a smoking environment*

History of Living in a Smoking environment	Cases		Controls	
	No.	%	No.	%
Yes	18	22.5	151	41.0
No	62	77.5	217	59.0
Total	80	100.0	368	100.0

* Current smokers are excluded from this analysis
X^2 = 9.6, p = 0.002
OR = 0.42 (95% CI; 0.23 – 0.76)

Table (20)

Distribution of AMI cases and community controls by history of diabetes

History of diabetes	Cases		Controls	
	No.	%	No.	%
Yes	30	28.6	46	8.9
No	75	71.4	470	91.1
Total	105	100.0	516	100.0

X^2 = 31.3, p = 0.000
OR = 4.09 (95% CI; 2.35 – 7.10)

Table (21)

Distribution of AMI cases and community controls by history of hypertension

History of hypertension	Cases		Controls	
	No.	%	No.	%
Yes	41	39.0	63	12.2
No	64	61.0	453	87.8
Total	105	100.0	516	100.0

X^2 = 45.0, p = 0.000
OR = 4.61 (95% CI; 2.80 – 7.59)

Table (22)

Distribution of AMI cases and community controls by family history of heart disease

Family history of heart disease	Cases		Controls	
	No.	%	No.	%
Yes	16	15.2	69	13.4
No	89	84.8	447	86.6
Total	105	100.0	516	100.0

X^2 = 0.26, p = 0.61
OR = 1.16 (95% CI; 0.62 – 2.17)

OBESITY

The precise role of obesity in the aetiology of coronary heart disease (CHD) remains controversial. Despite the fact that there is a well established association between obesity and an increased cardiovascular risk profile, epidemiological studies which have investigated the relationship between obesity and CHD have yielded inconsistent results (Sharpnel et al, 1992). Negri et al (1992) investigated the relationship between the occurrence of AMI and the body mass index. It was found that the association between body mass index and AMI was explained, at least in part, by the raised serum cholesterol levels, and the higher prevalence of diabetes and hypertension among obese subjects. This does not, however, totally eclipse a possible causal relation between body mass index and risk of AMI, since these conditions are a consequence, rather than a confounder, of overweight.

Cases (10.5%) had a relatively higher proportion with a history of obesity than community control subjects (8.7%), but the association was not significant (p=0.5), as shown in Table 23. This may be due to the small

sample size of cases in this study. Using the weight as a single measurement, the mean weight of cases was slightly lower than that of controls (66.3 ± 15.8, and 68.4 ± 14.9, respectively). In general, cases tended to be of a lower weight than controls; for example 13.6% of cases weighed between 70 and 79 kg, while the percentage was 21.3% in controls (Table 24).

Based on weight and height, body mass index (BMI) is the most appropriate index of obesity. It has a relatively high association with body fat, and a weaker relationship with weight (Simpoulos, 1985). As has seen in weight, the cases had in general a lower mean of BMI than controls (25.8 ± 6.2 and 27.9 ± 5.0, respectively). Most cases either had an acceptable nutritional status (36.6%) or were overweight (33.7%). Among controls about 33% were obese, and 34% were overweight (Table 25). The difference in BMI between cases and controls could be attributed to two factors. First, the proportion of women was higher among the control group, and this increased the percentage of overweight and obese subjects among controls, since it was reported that Bahraini women have a higher prevalence of obesity then men (Musaiger and Al-Sayyed, 1990). Second, many AMI patients have a history of chronic diseases which are linked with obesity such as diabetes and hypertension and such patients may have been advised to reduce their weight as a measure to control these diseases. Another explanation is that obesity is probably not an independent risk factor for coronary heart disease but it predisposes patients to the development of two strong risk factors for AMI; hypertension and diabetes (National Dairy Council, 1992). In a case-control study among women, Tavani et al (1997) found that AMI is related to excess BMI, with a population attributable risk of 17%. The excess risk was substantial among overweight women with history of diabetes or hyperlipidemia, stressing the importance of controlling body weight among these women.

Table (23)

Distribution of AMI cases and community controls by history of obesity

History of obesity	Cases		Controls	
	No.	%	No.	%
Yes	11	10.5	45	8.7
No	94	89.5	471	91.3
Total	105	100.0	516	100.0

X^2 = 0.33, p = 0.57
OR = 1.22 (95% CI; 0.57 – 2.56)

Table (24)

Distribution of AMI cases and community controls by weight group

Weight (kg)	Cases		Controls	
	No.	%	No.	%
< 60	31	30.1	156	30.2
60 – 69	40	38.8	142	27.6
70 – 79	14	13.6	110	21.3
80 +	18	17.5	108	20.9
Total	103*	100.0	516	100.0

* Information is missing for 2 cases
X^2 = 6.80, p = 0.08

Table (25)

Distribution of AMI cases and community controls by nutritional status based on body mass index (BMI)

Nutritional status	Cases		Controls	
	No.	%	No.	%
Underweight	12	11.9	29	5.7
Acceptable weight	37	36.6	138	27.3
Overweight	34	33.7	170	33.7
Obese	18	17.8	168	33.3
Total	101*	100.0	505*	100.0

* Information is missing for 4 cases and 11 controls

X^2 = 13.8, p = 0.003

Table (26)

Distribution of AMI cases and community controls by frequency of vegetables intake

Frequency of vegetables Intake (per week)	Cases		Controls	
	No.	%	No.	%
None	4	3.8	37	7.2
Daily	77	73.3	412	79.8
1 – 3	18	17.2	52	10.1
4 – 6	6	5.7	15	2.9
Total	105	100.0	516	100.0

X^2 = 7.8, p = 0.05

DIETARY HABITS

The relatively high prevalence of CHD in the Bahraini community is thought to be largely due to environmental factors, particularly diet. Dietary components such as high intake of saturated fat, low fiber intake and high alcohol consumption have been shown to increase CHD risk while consumption of other food groups such as fish and vegetables reduce the risk of CHD (Beilin et al, 1992). Food consumption in Bahrain has changed dramatically during the past two decades as a result of changes in the socio-economic situation. The transition from traditional diet to a western diet has resulted in a significant increase in the intake of animal foods, and hence increase in energy intake, saturated fat and dietary cholesterol (Musaiger, 1990). Statistics (AOAD, 1987) showed that the per capita intake of red meat in Bahrain increased by 76% during 1972-84, while that of milk, chicken and eggs increased by 332%, 282% and 86% respectively, for the same period. It is highly probable that this trends in increasing intake of these foods was continued during 1985-1998. The Household Budget Survey (CSO, 1985) demonstrated that each Bahraini individual consumes annually 46.4 Kg of red meat, 26.6 Kg of chicken, 10 Kg of oil and fat and about 282 eggs.

Intake of vegetables and fruit

A high intake of vegetables, fruit and high fiber foods is thought to reduce the risk of CHD through several mechanisms, including lowering serum cholesterol and blood pressure levels (Shrapnel et al, 1992 and Rimme et al, 1996). Table 26 shows that the daily frequency intake of vegetables was slightly higher in controls than in cases (79.8% and 73.3%, respectively). The association between AMI and frequency of vegetables intake was statistically significant ($p=0.05$). When the intake of vegetables was divided into two groups, daily and infrequent intake, it was found that daily vegetables intake appears to be protective of AMI ($OR=0.5$, $p=0.01$).

A similar pattern was observed with fruit intake (Table 27). Community control subjects (64%) were more likely to consume fruit daily than cases (56%), and the association was highly statistically significant (p=0.000). Excluding those who did not take fruit, the frequent intake of fruit was found to be protective of AMI (OR =0.5, P=0.004, not showing in the table).

Intake of dates was analyzed separately as they are grown locally in Bahrain and are commonly consumed. Dates are rich sources of cartenoids and fiber. Data presented in Table 28 indicate that the daily intake of dates was higher among controls (64%) than cases (56%). However, the association was not significant (p=0.26).

Intake of milk and cheese

Whole milk and cheese (processed) contain a considerable amount of saturated fats and cholesterol. A higher percentage of controls did not consume milk (38%) compared with only 8.6% of cases (Table 29). However, cases were more likely to consume half cream milk than controls (36% and 0.6%, respectively). The association between milk intake and AMI was highly statistically significant (p=0.000).

Processed cheese was consumed considerably by cases (42%) compared to controls (14%). Control subjects reported a higher consumption of cream cheese than cases (Table 30). This association between cheese intake and AMI was highly significant (p=0.000).

Meat, chicken and fish intake

About 15% of AMI cases did not consume red meat compared with 4% of controls (Table 31). Goat or sheep meat was more likely to be consumed by community controls than cases. The association between intake of red meat and AMI was highly significant (p=0.000). This is unlike the frequency of intake of chicken which was similar among cases

and controls (Table 32). Twenty percent of AMI patients consumed chicken meat with skin and a similar percentage (18.8%) of controls. The association was not significant (p=0.9) - Table 33. It is well known that the skin of chicken contains high amounts of fat and cholesterol. It is interesting to note that most AMI patients and controls did not report consuming such skin in this study. This may be due to the effect of nutritional education since the mass media has been emphasizing the role of fat intake in promoting CHD in Bahrain, given that both cases and controls had similar literacy levels.

Data from epidemiological and clinical trials suggest a beneficial effect on the reduction in CHD with the consumption of three fish meals per week (Beilin et al, 1992). Our data did not show any association between fish intake and the occurrence of AMI (p=0.8) (Table 34). This may be attributed to the fact that fish is a popular food in Bahrain, and all sectors in the community consume fish regularly.

Oil used in cooking

The fat intake in Bahrain has two contradictory trends. People have switched from using animal fat for cooking purposes to vegetable oil, particularly corn oil. At the same time the high intake of animal products has led to more consumption of animal fat (Musaiger and Cossack, 1991). Corn oil seems to be the most common oil used for cooking purposes, and the controls tend to use this oil more than cases (80.6% and 64.8%, respectively) (Table 35). As shown in the table, various types of vegetable oils were more likely to be used by the cases than by the controls. The association between the type of oil used in cooking and risk of AMI was statistically significant (p=0.002).

Preference for salty foods

High salt intake is related to hypertension especially in those groups of people known to be salt sensitive (Sharpnel et al, 1992). The control

subjects had more preference for salty foods than the cases (51.7% and 20%, respectively) (Table 36). The association was highly statistically significant (p=0.000). A possible explanation for the low preference of salty foods among cases is that a higher percentage of cases had a history of hypertension, and thus they would have probably been under instructions from their physicians to reduce their salt intake.

Intake of foods rich in fat, energy and salt

Table 37 shows the weekly reported mean intake of some foods known to be rich in fat (which will increase the cholesterol levels), energy and salt among patients with AMI and community subjects. The table shows that the mean intake of cheese products, hamburger, butter and salted dried fish is consistently higher among AMI cases than controls. This pattern described here is consistent with the hypothesis that food products that are high in fat content may have a role in the aetiology of AMI in the Bahraini community.

The distribution of cases and controls by the intake of several foods rich in fat, energy and salt is presented in Table 38. Cases were more likely than community controls to consume processed cheese, whole milk yoghurt, hamburger, fried chicken, cream, shrimps, fried fish, olives, half cream milk and dates.

The data from the previous two tables suggest that dietary habits may play a role in the occurrence of AMI in the Bahraini community. However, one should be cautious with this conclusion because of the absence of information on the quantity of foods intake, especially the quantity of fat, cholesterol and salt intake, make it difficult to obtain the actual effect of diet on the occurrence of AMI. In addition, there are many other confounding factors which may be associated with the occurrence of AMI, and without considering these factors using statistical adjustment techniques, it would be inappropriate to conclude that qualitative food intake is a risk factor for AMI.

Table (27)

Distribution of AMI cases and community controls by frequency of fruit intake

Frequency of fruit intake (per week)	Cases		Controls	
	No.	%	No.	%
None	7	6.7	72	14.0
Daily	59	56.2	332	64.3
1 – 3	37	35.2	84	16.3
4 – 6	2	1.9	28	5.4
Total	105	100.0	516	100.0

X^2 = 22.9, p = 0.0004

Table (28)

Distribution of AMI cases and community controls by frequency of dates intake

Frequency of dates intake (per week)	Cases		Controls	
	No.	%	No.	%
None	2	1.9	3	0.6
Daily	59	56.2	332	64.3
1 – 3	41	39.0	168	32.6
4 – 6	3	2.9	13	2.5
Total	105	100.0	516	100.0

X^2 = 3.9, p = 0.26

Table (29)

Distribution of AMI cases and community controls by type of milk consumed

Type of milk consumed	Cases		Controls	
	No.	%	No.	%
None	9	8.6	196	38.0
Whole milk	50	47.6	275	53.3
Half cream milk	38	36.2	3	0.6
Skimmed milk	8	7.6	42	8.1
Total	105	100.0	516	100.0

X^2 = 190.9, p = 0.000

Table (30)

Distribution of AMI cases and community controls by type of cheese consumed

Type of cheese consumed	Cases		Controls	
	No.	%	No.	%
None	36	34.3	190	36.8
Processed cheese	44	41.9	72	14.0
Cream cheese	16	15.2	242	46.9
White cheese (salty)	9	8.6	12	2.3
Total	105	100.0	516	100.0

X^2 = 67.8, p = 0.000

Table (31)

Distribution of AMI cases and community controls by type of meat consumed

Type of meat consumed	Cases		Controls	
	No.	%	No.	%
None	16	15.2	22	4.3
Beef	8	7.6	54	8.7
Goat and/or sheep meat	81	77.2	440	87.0
Total	105	100.0	516	100.0

X^2 = 18.57, p = 0.00009

Table (32)

Distribution of AMI cases and community controls by frequency of chicken intake

Frequency of chicken intake (per week)	Cases		Controls	
	No.	%	No.	%
None	13	12.4	62	12.0
Daily	3	2.9	13	2.5
1 – 3	80	76.2	397	76.9
4 – 6	9	7.6	44	8.5
Total	105	100.0	516	100.0

X^2 = 0.05, p = 0.9

Table (33)

Distribution of AMI cases and community controls by eating the chicken with skin

Eating chicken with skin	Cases		Controls	
	No.	%	No.	%
Yes	21	20.0	97	18.8
No	84	80.0	419	81.2
Total	105	100.0	516	100.0

X^2 = 0.08, p = 0.8
OR = 1.08 (95% CI; 0.62 – 1.88)

Table (34)

Distribution of AMI cases and community controls by frequency of fish intake

Frequency of fish intake (per week)	Cases		Controls	
	No.	%	No.	%
None	3	2.9	22	4.3
Daily	16	15.2	68	13.2
1 – 3	60	57.1	300	58.1
4 – 6	26	24.8	126	24.4
Total	105	100.0	516	100.0

X^2 = 0.72, p = 0.86

Table (35)

Distribution of AMI cases and community controls by type of oil used in cooking

Type of oil used in cooking	Cases		Controls	
	No.	%	No.	%
Corn oil	68	64.8	416	80.6
Sunflower oil	12	11.4	43	8.3
Other vegetable oil	23	21.9	54	10.5
Animal fat	2	1.9	3	0.6
Total	105	100.0	516	100.0

X^2 = 14.9, p = 0.002

Table (36)

Distribution of AMI cases and community controls by preference for salty foods

Preference for salty foods	Cases		Controls	
	No.	%	No.	%
Yes	21	20.0	267	51.7
No	84	80.0	249	48.3
Total	105	100.0	516	100.0

X^2 = 35.3, p = 0.000
OR = 0.23 (95% CI; 0.14 - 0.40)

Table (37)

Number of persons, mean ($\bar{X}$) and standard deviation (SD) of weekly intake of some foods rich in fat, energy and salt in AMI patients (cases) and community control subjects.

Foods	Cases		Controls		P-value
	N	$\bar{X} \pm SD$	N	$\bar{X} \pm SD$	
Processed cheese, sliced	43	3.4 ± 2.6	151	2.8 ± 2.3	N.S.
Cheese, cream	45	4.1 ± 2.8	214	3.8 ± 2.5	N.S.
Cheese, cheddar	31	3.9 ± 2.7	61	3.1 ± 2.5	N.S.
Milk, whole	48	5.3± 2.4	227	5.6 ± 2.3	N.S.
Yoghurt (whole milk)	66	2.7 ± 2.2	212	3.1 ± 2.4	N.S.
Ice cream (milk)	18	2.2 ± 1.6	96	2.5 ± 2.3	N.S.
Hamburger	31	1.8 ± 1.5	103	1.7 ± 1.2	N.S.
Fried chicken (with skin)	21	2.6 ± 1.8	25	2.0 ± 1.9	N.S.
Cream	28	1.9 ± 1.6	97	2.3 ± 2.0	N.S.
Shrimps	29	1.3 ± 0.5	104	1.5 ± 1.1	N.S.
Fried fish	104	3.8 ± 1.8	423	3.0 ± 1.9	N.S.
Local sweets (Halwah)	6	1.5 ± 0.8	151	2.1 ± 1.8	N.S.
Eggs	76	3.0 ± 2.0	361	3.6 ± 2.3	N.S.
Butter	18	3.2 ± 2.6	100	3.0± 2.4	N.S.
Nuts	18	4.1 ± 2.5	210	3.4 ± 2.5	N.S.
Rice	104	6.0 ± 2.0	466	6.7 ± 1.2	N.S.
Fermented fish (Mehiawah)	11	2.0 ± 1.1	38	3.2 ± 2.7	N.S.
White cheese, salted	10	2.0 ± 1.9	31	3.0 ± 2.2	N.S.
Dried fish, salted	6	2.0 ± 0.9	13	1.1 ± 0.3	N.S.
Dried shrimps, salted	3	1.7 ± 1.2	26	1.2 ± 0.4	N.S.
Olives, pickled	33	3.0 ± 2.0	58	2.5 ± 2.1	N.S.
Milk, half cream	72	5.6 ± 2.4	6	4.5 ± 2.7	N.S.
Dates, dried	90	5.8 ± 2.2	396	6.4 ± 1.6	N.S.

Table (38)

Distribution of AMI patients and community controls according to the intake of some foods known to be rich in fat, energy and salt.

Food	Intake	Cases (N=105)		Controls (N=516)		P-value
		No.	%	No.	%	
Processed cheese, sliced	Yes	43	41.0	151	29.3	0.02
	No	62	59.0	365	70.7	
Cheese, cream	Yes	45	42.9	214	41.5	N.S.
	No	60	57.1	302	58.5	
Cheese, cheddar	Yes	31	29.5	61	11.8	0.000
	No	74	70.5	455	88.2	
Milk, whole	Yes	48	45.7	227	44.0	N.S.
	No	57	54.3	289	56.0	
Yoghurt (whole milk)	Yes	66	62.9	212	41.1	0.000
	No	39	37.1	304	58.9	
Ice cream (milk)	Yes	18	17.1	96	18.6	N.S.
	No	87	82.9	420	81.4	
Hamburger	Yes	31	29.5	103	20.0	0.03
	No	74	70.5	413	80.0	
Fried chicken	Yes	21	23.5	25	4.9	0.000
	No	84	76.5	491	95.1	
Cream	Yes	28	26.7	97	18.8	N.S.
	No	77	73.3	419	81.2	
Shrimps	Yes	29	27.6	104	20.2	N.S.
	No	76	72.4	412	79.8	
Fried fish	Yes	104	99.0	423	82.0	0.000
	No	1	1.0	93	90.0	
Local sweets (Halwah)	Yes	6	5.7	151	29.3	0.000
	No	99	94.3	365	70.7	
Eggs	Yes	76	72.4	361	70.0	N.S.
	No	29	27.6	155	30.0	

Table (38) continued:

Food	Intake	Cases (N=105)		Controls (N=516)		P-value
		No.	%	No.	%	
Butter	Yes	18	17.1	100	19.4	N.S.
	No	87	82.9	416	80.6	
Nuts	Yes	18	17.1	210	40.7	0.000
	No	87	82.9	306	59.3	
Rice	Yes	104	99.0	466	90.3	0.003
	No	1	1.0	50	9.7	
Fermented fish (Mehiawah)	Yes	11	10.5	38	7.4	N.S.
	No	94	89.5	478	92.6	
White cheese, salted	Yes	10	8.6	31	6.0	N.S.
	No	95	91.4	485	94.0	
Dried fish, salted	Yes	6	5.7	13	2.5	N.S.
	No	99	94.3	503	97.5	
Dried shrimps, salted	Yes	3	2.9	26	5.0	N.S.
	No	102	97.1	490	95.0	
Olives, pickled	Yes	33	31.4	58	11.2	0.000
	No	72	68.6	458	88.8	
Milk, half cream	Yes	72	68.6	6	1.2	0.000
	No	33	31.4	510	98.8	
Dates, dried	Yes	90	85.7	396	76.7	0.04
	No	15	14.3	120	23.3	

MULTIVARIATE ANALYSIS OF RISK FACTORS ASSOCIATED WITH MYOCARDIAL INFARCTION

Because AMI cases and community controls had different sex and age distributions, multiple logistic regression was used to estimate the risks of the occurrence of AMI in relation to hypertension, diabetes, lifestyle patterns and dietary habits. The multiple logistic regression – derived adjusted odds ratios and their corresponding 95% confidence intervals (CI) are presented in Table 39. The adjusted odds ratio (adjusted for age, sex and several other possible confounding variables) for the occurrence of an episode of AMI in a subject with a history of hypertension was 4.80 (95% CI, 2.69–8.67) and in those with a history of diabetes was 3.42 (95% CI, 1.80-6.49). The risk of developing AMI, in line with many studies from western communities (Grundy et al, 1998), was higher among men than women (adjusted odds ratio, 3.80; 95% CI, 1.87-7.69), increased with older age (adjusted odds ratio for those aged 50 years or older, 1.36; 95% CI, 0.76-2.42) and in those persons who were not currently married (adjusted odds ratio, 4.31; 95% CI, 1.98-9.38).

Although 15% of AMI cases were obese subjects (had a BMI equal to or greater than 30), this proportion was lower than that among the community controls (33% were obese). Using the weight as a single measurement, the mean weight of cases was slightly lower than that for controls (66.3% kgs ± 15.8, and 68.4 kgs ± 14.9, respectively).

Persons who do not practise walking exercises (adjusted odds ratio, 3.69, 95% CI, 2.19-6.19), those who reported infrequent intake of fresh fruit (adjusted odds ratio, 1.45; 95% CI, 0.80-2.63) and persons who infrequently consume fresh vegetables (adjusted odds ratio, 1.50; 95% CI, 0.73-3.07) were still at an increased risk of developing myocardial infarction, even after adjustments were made for the effects of all factors in Table 39. Similar findings were obtained when the logistic regression analysis was repeated excluding those older subjects aged 70-79 years (17 cases and 20 controls).

The multivariate analysis presented in this study (Table 39) shows that patients who have had a myocardial infarction tended to consume fresh vegetables and fruit less frequently than did community controls. This observation confirms several reports in western countries (Gramenzi et al, 1990, Rimm et al, 1998), La-Vecchia et al, 1998), and is consistent with the hypothesis that the frequency of intake of certain foods such as fresh vegetables and fresh fruits may influence the subsequent risk of developing AMI.

The proportion of AMI patients who were obese (had a BMI equal to or greater than 30) was lower than that among community controls and the multivariate analysis did not demonstrate a positive relationship between body mass index and the likelihood of developing AMI in Bahraini persons. The relationship between body mass index and the risk of AMI remains controversial and some studies have reported that there is no association between body mass index and the risk of AMI in both men (Keys, 1980) and women (Beard et al, 1992). In view of the strikingly higher proportions of AMI cases with hypertension and diabetes than community controls, it may be that patients with AMI were advised by their doctors to reduce their weight as a measure to control their high blood pressure or impaired glucose levels. In addition, the proportion of Bahraini women, who are known to have higher prevalence rates of obesity than Bahraini men (Musaiger, 1990), was higher among the control subjects than among AMI cases. We performed additional analyses which showed that the prevalence of obesity was higher among those persons with a history of hypertension (50%) than among persons with no such history (30%). A similar pattern was seen for diabetes, with 50% of persons with diabetes having obesity compared with 31% of non-diabetic persons. It may be that the lack of association between body mass index and AMI does not necessarily indicate that BMI does not influence the risk of AMI but rather that obesity is not an independent risk factor for AMI in this population. Negri et al (1992) reported that the relation between body mass index and myocardial infarction was

explained, at least in part, by higher serum cholesterol levels and the prevalence of diabetes and hypertension among fatter subjects. This does not, however, totally eclipse a possible casual relation between body mass and risk of myocardial infarction, since these conditions are a consequence, rather than a confounded, of overweight. Obese persons in Bahrain are also known to have higher cholesterol levels and impaired glucose tolerance compared to others with normal weights (BMI range 20 to 24.9) (Al-Mahroos and Mckeigue, 1998).

This epidemiological investigations also confirms that hypertension and other well-established risk factors for myocardial infarction such as cigarette smoking and diabetes mellitus are applicable for the Bahraini population. However, while the magnitude of the risk estimate for both cigarette smoking (2.2) and a history of hypertension (5.0) are comparable to those published in western literature (Pais et al, 1996, Grundy et al, 1998), Bahraini persons with a history of diabetes experienced a four-fold increase in risk of AMI, which is higher than that which has been found in industrialized populations and it would appear that diabetes may play a greater role in the aetiology of AMI in Bahrain and other less economically developed populations (Mckeigue et al, 1989) than previously thought. Furthermore, the high levels of diabetes and other cardiovascular risk factors among the Bahraini population (12% of community controls had a history of hypertension, 33% were obese and 46% were smokers) is a source of great concern and indicates the need for more comprehensive community surveys (Musaiger, 1992, Al-Mahroos and Mckeigue, 1998).

The multivariate adjustment for the frequency of intake of fruit and vegetables did not affect the association between hypertension and the subsequent development of AMI. This contrasts with the association between cigarette smoking and the occurrence of AMI that was substantially reduced by such an adjustment for nutrients intake. This is because cigarette smokers tended to consume significantly less fresh

vegetables and fruit than did non-smokers (76% of smokers reported eating fresh vegetables three times or more per week compared with 83% of non smokers, while the comparative figures for fresh fruit intake were 60% for smokers and 67% for non smokers). Similar observations were reported by other researchers (Cade and Margetts, 1991, Midgette, 1992), and while the underlying mechanisms for the increased risk of developing myocardial events among cigarette smokers compared with non-smokers remain unclear (Midgette, 1992), it is possible that the increased AMI risk among smokers is partly due to their dietary habits.

Table (39)

Multivariate risk of acute myocardial infarction (AMI), adjusted* odds ratios and 95% confidence intervals from logistic regression analysis of 104 AMI cases and 514 community controls.

Variable	Adjusted* Odds Ratio	Confidence Interval	P-Value
Age			
30-49 years	1.0**		
50-79 years	1.36	0.76-2.42	N.S.
Sex			
Female	1.0		
Male	3.80	1.87-7.69	<0.001
Marital status			
Currently married	1.0		
Not currently married	4.31	1.98-9.38	<0.001
Smoking status			
Not currently smoking	1.0		
Current smoker	1.0	0.50-1.73	N.S.
History of hypertension			
No	1.0		
Yes	4.80	2.69-8.67	<0.001
History of diabetes			
No	1.0		
Yes	3.42	1.80-6.49	<0.001
Body mass Index (kg/m^2)			
Not obese (<30)	1.0		
Obese (>=30)	0.36	0.18-0.71	<0.01
Practising walking exercises			
Yes	1.0		
No	3.69	2.19-6.19	<0.001
Time spent watching T.V. at home			
Rarely or occasionally	1.0		
Most of the time	1.0	0.58-1.97	N.S.
Intake of vegetables			
Three times or more/week	1.0		
Less than three times/week	1.50	0.73-3.07	N.S.
Intake of fruit			
Three times or more/week	1.0		
Less than three times/week	1.45	0.80-2.63	N.S.

* **Odds ratios are adjusted for effects of all factors in the model.**

** **Odds ratio of 1.0 for reference category.**

CONCLUSION

Acute Myocardial Infarction (AMI) is a major cause of morbidity and mortality in the Bahraini population. Myocardial infarction and its complications (including death) are consequences of the athroselerosis process and coronary artery sterosis. A number of risk factors are well documented to enhance the process of coronary artery sterosis in western communities. Such factors include non-modifiable risk factors (age, sex, genetics) and modifiable factors such as raised blood lipid levels, hypertension, diabetes, cigarette smoking and obesity. Any preventive strategy in a westernized (or a newly developed) community with a sizeable proportion of coronary attack cases such as the Bahraini community must start by identifying those factors that are associated with an increased risk of AMI in the population. This case-control community-based study represents a milestone in this direction. This is the first time that dietary and environmental risk factors for AMI have been documented in the Bahraini population. The fact that the age distribution (AMI being more common in older persons) and the sex distribution (AMI rates are more common in men than in women), which are in line with our knowledge about the pathogenesis of this disease suggest that the data is accurate and is a true reflection of the aetiological factors that contribute to this disease in the Bahraini community.

In this study, it was found that those cardiovascular risk factors that are well-established in western populations such as hypertension, diabetes, cigarette smoking and intake of fatty food products also operate to a similar magnitude in the Bahraini population. However, it would appear that diabetes mellitus may play a greater role in the aetiology of AMI in the Bahraini community than that expected in Western communities. This is not surprising in view of the high prevalence of diabetes among Bahraini adults (Al-Mahroos and Mackeigue, 1998). In this study, patients with AMI were four times more likely to have a positive history of diabetes than community control subjects. In addition, sedentary life

styles and lack of physical exercise appear also to play a role in the aetiology of AMI in the Bahraini community.

With the increase in the numbers of middle-aged and elderly persons (who are the potential risk group for cardiovascular diseases) in developing countries and the change to more westernized diets that has accompanied the economic development, there is no doubt that the problem of cardiovascular diseases in the developing world will become more severe in the very near future (Manton, 1988). The findings of this study suggest that there is a scope for life-style change in reducing AMI risk, by changes in physical activity, smoking and food habits. Because of the large proportion of sedentary persons in the community, physical inactivity can be viewed as an important risk factor for AMI, and individuals should be encouraged to engage in exercise programmes. In addition, measures to control hypertension and diabetes should be given a high priority in any national health policy to prevent AMI as well as other diet related chronic non-communicable diseases.

RECOMMENDATIONS

There is a clear evidence that diet-related chronic diseases such as heart disease, hypertension, diabetes, obesity and some forms of cancer are increasing in Bahrain (MOH, 1998). The present study demonstrates that overweight and obesity is highly prevalent among both patients with AMI and community subjects. It is well known that obesity is a risk factor for diabetes and hypertension. The history of diabetes and hypertension among AMI cases was very high, but it was also high among community control subjects. Therefore, measures should be undertaken to establish programmes to control the diet-related chronic diseases in Bahrain, with more emphasis on reducing the incidence of obesity among adults. Inorder to prevent and control diet-related chronic diseases including cardiovascular disease, the following recommendations are suggested:

1. Programmes that aim to prevent and reduce diet-related chronic diseases should be an integral part of any health plan in this country.

2. The Ministry of Health in collaboration with College of Medicine and Medical Sciences, Arabian Gulf University and College of Health Sciences should initiate and strengthen professional training programmes at both undergraduate and postgraduate levels, to ensure that the role of diet in the prevention of chronic diseases is understood by the medical profession, health and social workers.

3. The Ministry of Health in collaboration with the Ministry of Education should include sufficient information on preventive measures for chronic diseases in the school curriculum.

4. Encourage exercise habits among school children and adults, as this can play an important role in the prevention and control of most chronic diseases. The WHO (1990a) urges countries to encourage the public to prefer physical exercise, both familial and social factors

influencing behavior must be taken into account as well as the availability of necessary facilities. Sedentary-life-style are encouraged by familial habits of watching television and using cars. In connection with need for greater physical activity and general fitness, the WHO (1990a) recommended the following short terms measures:

- Encourage children to adopt a life-style involving aerobic forms of exercise.
- Introduce health education on exercise for school children.
- Encourage families participation in taking exercise all the year round.
- Train physical educators to recognize the importance of frequent aerobic exercise for children in addition to skills.
- Allow sufficient time in the school schedule for exercise activities (ideally every day) and evoking a heart rate response between 65% and 80% of the maximum for a period of 15-60 minutes; the optimum is 65% for 20-30 minutes.
- Provide physical educators with the skills to teach and supervise appropriate aerobic exercise for children.
- Encourage routine physical examinations of young adults before they enter competitive sporting activities.

5. Modification of dietary habits: In general, the intake of food rich in fat, cholesterol and sodium is relatively high in Bahrain (Musaiger, 1990). Dietary guidelines for Bahrain should be initiated. These guidelines should not prejudice normal growth and development of children or the quality of nutrition for adult, nor should they detract from the pleasure of eating (WHO, 1990a).

The WHO (1990a) considered that the following dietary changes would be appropriate for the populations with high incidence of heart diseases:

- a reduction in saturated fat and dietary cholesterol, which together are the primary factors that raise blood-cholesterol levels. This can be assisted by replacing some of the saturated fat by mono-unsaturated and polyunsaturated fat;
- an increase in complex carbohydrate consumption;
- avoidance or correction of overweight; and
- a reduction of cholesterol intake to below 100mg per 4.18 MJ (1000 kcal) per day, or below an average of 300 mg for the adult population.

6. Reduce the rates of smoking among both school children and adults. Based on three WHO Expert Committees (WHO, 1990c) concerned with smoking, the following recommendations should be emphasized:

- High priority should be given to smoking prevention and control activities. They should be well planned and adequately funded, especially in schools.
- The sale of cigarettes to minors should be prohibited and cigarette vending machines, if any, should not be located in places where young people are likely to have access to them.
- All advertising and promotion of tobacco products should be prohibited so as to end the attempt to depict smokers as role models to be imitated by children and young people.
- Sponsorship of sports events by cigarette manufacturers and advertising on television of such sponsored events should not be allowed, so as to end the efforts to link smoking with sport in the mind of children and young people.
- Special antismoking campaigns should be launched and directed towards the parents of children and adolescents so as to prevent the untoward effects of passive smoking.

- Legislation prohibiting the promotion of alternative forms of tobacco use (smokeless tobacco) should be introduced.
- Role modelling of parents as non-smokers should be encouraged at home and in the workplace and other public places.

7. The Government should consider its investment and subsidy policy in both agriculture and the food industry to ensure that they are consistent with the nutritional concepts mentioned above. Food policy should be geared to promoting the growing of plant foods, including vegetables and fruit, and to limiting the promotion of fat-containing products, wherever possible (WHO, 1990a).

8. The Governmental and Private Organization should encourage epidemiological studies on dietary factors associated with chronic diseases. In this context, it is hoped that this study would provide baseline data for any further studies to investigate the role of lifestyle patterns and dietary factors in the occurrence of chronic diseases in Bahrain.

REFERENCES

Al-Mahroos, F. and McKeigue, P.M. (1998): High prevalence of diabetes in Bahainis: Associations with ethnicity and raised plasma cholesterol. *Diabetes Care*, 21,6,936-942.

Al-Roomi, K. et al (1994): Lifestyle and the risk of acute myocardial infarction in a Gulf Arab population. *Int J Epidemiol,* 23,5, 931-939.

AOAD (1987): *Statistical Analysis Book. Arab Organization for Agricultural Development.* League of Arab States, Sudan.

Beard, C.M. et al (1992): Body mass index and the initial manifestation of coronary heart disease in women aged 40-59 years. *Int J Epidemiol,* 21,656-664

Beilin, L. et al (1992): The management of hyperlipidaemia: a consensus statement. *Med.J.Aust.* 156, supplement, S1-S8.

Bennett, S. et al (1991): A simplified general method for Cluster-sample surveys of health in developing countries. *Wld Hlth Statist. Quart*, 44, 98-105.

Bray, G.A. (1978): Definition, measurement and classification of the syndrome of obesity. *Int J Obes*, 2, 99-112.

Cade, J.E. and Margetts, B.M. (1991): Relationship between diet and smoking,. Is the diet of smokers different? *J Epidemiol Comm Hlth,* 45, 270-271.

Central Statistics Organization (CSO) (1985): *Household Budget Survey*, 1983-1984. Bahrain.

Central Statistics Organization (CSO) (1992): *Results of Population and Households Census*, 1992. Bahrain (in Arabic).

Dean, AG. et al (1990): *Epi-Info; Version 5*, Center for Disease Control, Atlanta, Georgia.

Gramenzi, A. et al (1990): Association between certain foods and risk of acute myocardial infarction in women. *BMJ*, 24,300 (6727), 771-773

Greenland, S. (1989): Modelling and variable selection in epidemiologic analysis. *Am J Public Hlth*, 79,340-349.

Gortmaker, et al (1990): Inactivity, diet, and the fattening of America. *J Am Diet Assoc* 90, 1247-1252, 1255.

Grundy, S.M. et al (1998): Primary prevention of coronary heart disease: Guidance from Framingham. *Circulation*, 97, 1876-1887.

Hamadeh, R.R. et al (1992): Prevalence of smoking in Bahrain. *Tobacco Control*, 1, 102-106.

James, W.P.T. (1991): New concepts of a balanced diet. *Wld Hlth*, July-August, 5-7.

Keys, A. (1980): *Seven Countries, A Multivariate Analysis of Death and Coronary Heart Disease*. Harvard University Press, Cambridge, USA.

La-Vecchia, C. et al (1998): Vegetable consumption and risk of chronic disease. *Epidemiology*, 9,2, 208-210.

Lochen, M.L. and Rasmussen, K. (1992): The Tromso study: Physical fitness, self-reported physical activity, and their relationship to other coronary heart disease. *J Epidemiol Comm Hlth*, 26, 103-107.

Malcolm, J.R. and Dobson, A.J. (1989): Marriage is associated with a lower risk of Ischaemic Heart Disease in men. *Med J Aust*, 151, 181-188.

McGee, DM (1990): *Statprog Statistical Software Manual.* Center for Disease and Control Atlanta, Georgia.

Manton, K.G. (1988): The global impact of non-communicable diseases: estimates and projections: *Wld Hlth Statist Quart* 41, 255-2666.

McKeigue, P.M. (1989): Coronary heart disease in South Asians overseases: A review. *J Clin Epidemiol*, 42, 597-609

Midgette, A.S. et al (1993): Do cigaratte smokers have diets that increase their risk of coronary heart disease and cancer? *Am J Epidemiol.* 137, 521-529.

Ministry of Health (1998): *Health Statistics*, 1996/1997, Manama, Bahrain.

Musaiger, A.O. (1983): The impact of television food advertisements on dietary behavior of Bahraini housewives. *Ecol Food Nutr*, 13, 109-114.

Musaiger, A.O. (1987): The state of food and nutrition in the Arabian Gulf countries. *Wld Rev Nutr Diet*, 54, 105-173.

Musaiger, A.O. (1990): Nutritional Disorders Associated with Affluence in Bahrain, *Family Practice*, 7:1, 9-13.

Musagier, A.O. (1996): Diet-Related Non-Communicable Disease in Bahrain. In Musaiger, A.O. and Miladi, S. (editors), *Diet-Related Non-Communicable Diseases in the Arab Countries of the Gulf.* FAO/RNEA, Cairo, Egypt.

Musaiger, A.O. and Al-Sayyed, J. (1991): *Nutritional Status of Mothers and Children in Bahrain*. UNICEF, Gulf Area Office, Riyadh and Ministry of Health, Bahrain.

Musaiger, A.O. and Cossack, Z.T. (1991): Cholesterol, total fat, and fatty acid composition of foods and dishes commonly consumed in Bahrain. *J Food Comp Analysis*, 4, 485-488.

Musaiger, A.O. and Miladi, S. (1996): *Diet-Related Non-Communicable Diseases in the Arab Countries of the Gulf*. FAO/RNEA, Cairo, Egypt.

National Dairy Council (1992): *Coronary Heart Disease-II*. Fact file, No.8. London, U.K.

Negri, E. et al (1992): Body mass and acute myocardial infarction. *Preventive Medicine*, 21, 292-301.

Pais, P. Et al (1996): Risk factors for acute myocardial infarction in Indians: a case-control study. *Lance*t, 10,348,358-363.

Public Health Directorate (1987): *Annual Report*, Ministry of Health, Bahrain.

Rimme, E.B. et al (1996): Vegetable, fruit, and cereal fiber intake and risk of coronary heart disease among men. *JAMA*, 275(6), 447-451.

Schlesselman, J.J. (1982): *Case-control Studies: Design, Conduct, Analysis*. Oxford University press, London, UK.

Sharpnel, W.S. et al (1992): Diet and coronary heart disease *Med J Aust*, 156, supplement, S9-S16.

Simpoulos, A. (1985): The health implication of overweight and obesity. *Nutr Review*, 43, 33-40.

Tavani, A et al (1997): Body weight and risk of nonfatal acute myocardial infarction among women: a case-control study from northern Italy. *Prev Med* 26,4, 550-555.

WHO (1984): *Guideline for a Sample of Diarrhoeal Diseases Morbidity, Mortality and Treatment.* Geneva, Switzerland.

WHO (1990a): Diet, *Nutrition and the Prevention of Chronic Diseases.* Technical Report Series 797, Geneva, Switzerland.

WHO (1990b): *Nutrition Research, Food Policies, Nutrition and Health: Towards the Development of WHO Strategy for Nutrition Research.* Geneva, Switzerland.

WHO (1990c): *Prevention in Childhood and Youth of Adult Cardiovascular Diseases, Time for Action.* Technical Report Series 792, Geneva.

WHO/EMRO (1989): *Clinical Disorders Arising from Dietary Affluence in Countries of the Eastern Mediterranean Region.* Technical Publication No. 14, Alexandria, Egypt.

WHO/EMRO (1995): *Prevention and Control of Cardiovascular Diseases.* Technical Publication No.22, Alexandria, Egypt.

Winkleby, M.A. et al (1992): Socio-economic status and health: how education, income and occupation contribute to the risk factors for cardiovascular disease. *Am J Public Hlth*, 82, 816-820.

Appendix 1

Approaches and Priorities for the Prevention of Cardiovascular Diseases in the EMR*

CVDs are emerging as public health problems of considerable dimension and increasing concern in countries of the EMR. Their adverse impact on health and the economy is enormous and the need to initiate action for their prevention and control is undoubtedly great.

CVDs are largely preventable. Scientific knowledge and experience are nowadays available to control the commonly encountered problems like CHD, stroke, and hypertension. Health authorities must, therefore, initiate effective efforts to respond to the challenge made by the progressively increasing magnitude and negative impact of these diseases.

The types and extent of CVDs differ from region to region and from one country to another. This fact, together with variation in the availability of resources, as well as cultural and socioeconomic factors, plays an important role in influencing policies and in determining approaches and priorities that are region and country-specific.

Major issues relating to the prevention and control of CVDs in countries of the EMR were discussed during the Intercountry Workshop on CVD Control organized by WHO/EMRO in Amman from 27-30 March 1994. The following represents the consensus that emerged from this workshop.

---

* *Source: WHO/EMRO (1995): Prevention and Control of Cardiovascular Diseases EMRO Technical Publication No. 22. Alexandria, Egypt.*

Data Collection

For intervention programmes to be effective, they should be supported by a solid database. Given the public health magnitude of CVDs in the EMR, the current lack of reliable data is striking. There is a pressing need to strengthen health information systems, provide a comprehensive situation analysis, and promote essential epidemiological research and data collection. Such activities are necessary for selecting priorities and appropriate methods of intervention. The same data will be used for programme monitoring and evaluation. Table 1 summarizes the data presently available in Member States.

Table (1)

Availability of Baseline Data on CVDs in Member States

Country	CVD risk factor	Hypertension	RF/RHD prevalence	Proportional CVD mortality
Bahrain				•
Cyprus	•			• [1]
Djibouti				
Egypt	• [2]	•	•	•
Jordan	• [2]			•
Libyan Arab Jamahiriya	• [2]		•	
Iran, Islamic Republic of	• [2]	•	•	• [2]
Iraq	• [2]	•	•	•
Morocco	• [2]		•	
Oman	• [2]	•	•	• [1]
Pakistan	•	•	•	
Saudi Arabia		•		
Sudan	• [2]			
Tunisia		•		
Yemen, Republic of				

[1] Hospital-based
[2] Incomplete

As indicated above, the circumstances and available resources of countries should be taken into consideration. Each country should identify its own requirements according to the local situation. However, basic or minimum data requirements necessary to initiate effective CVD control programmes should include the following:

Demographic data

These include population growth, age distribution, birth rate, population density, death rate, etc.

Mortality statistics

According to age, sex and, cause of death. Such data, when available, may be incomplete and/or inaccurate. There is a pressing need to improve and validate death certification by cause at the national level. ICD coding should be used. Where this is not presently feasible, other alternatives could be considered. For example, mortality data may be obtained from well defined samples of the population or from organized sectors with high access to quality health care like industrial workers or participants in health insurance schemes. Another option, in some cases, is to consider initiating studies utilizing the verbal autopsy method (a simple symptom-based inquiry to determine the cause of death for use in countries without reliable and/or valid death certification). A standardized protocol for verbal autopsy is now being developed and tested by WHO.

Reliable data on the levels of major risk factors

Such data are essential for assessing the baseline magnitude and situation regarding the population distribution of the CVD risk factors, for initiating appropriate intervention, and for monitoring future trends and evaluating progress of intervention.

Special emphasis should be placed on the use of standardized methodologies in risk factors surveys. The extent of data and number of parameters required to be studied in these surveys will vary from one

country to another. However, the core data needed as a minimum may include:

- Socioeconomic status
- Tobacco use
- Blood pressure
- Anthropometric measurements (body mass index)
- Diabetes and measurements of cholesterol levels

Data obtained should be of high quality and conform to epidemiological concepts and the survey protocols used should be standardized.

In situations where local facilities are extremely limited, measurements of cholesterol levels and investigating the prevalence of diabetes (including impaired glucose tolerance) using a glucose tolerance test may not be regarded as prerequisites for initiating CVD control activities. However, baseline data on diabetes and lipid profile should be obtained whenever possible.

Other optional parameters should be considered in countries able to aim at an optimal level of data collection. These include:

- Food consumption patterns
- Physical activity
- Assessment of health knowledge and behavior

Morbidity data

Statistics may sometimes be useful. They should be provided in a standardized form using the ICD system. Registries and notification systems may also be used in diseases like rheumatic fever/rheumatic heart disease (RF/RHD). CVD prevalence surveys are unlikely to be cost-effective. However, epidemiological data on hypertension and diabetes are important and should be part of the risk factor surveys mentioned above.

Prevention

Priorities for prevention will be determined by the epidemiological situation in each country. However, at the regional level, the following conditions are generally considered problems of the highest priorities:

- CHD
- Hypertension
- Stroke
- RF/RHD

While the first three represent priority conditions in almost all countries of the Region, RF/RHD is also important in some countries where it may still be a cause of major public health concern, requiring urgent intervention.

For CHD, hypertension, and stroke, both the population and high-risk strategies should be considered. The population strategy, aiming at reduction of the CVD risk factor profile in the community, should, however, receive more emphasis.

It may be possible to establish specific national goals in some countries but all countries should generally strive towards:

- Prolongation of life expectancy

- Improvement in the situation and living conditions of rural areas
- Promotion of healthy lifestyles

The achievement of these goals will depend on several factors, such as political will and commitment, available resources, leadership, and the degree of intersectional collaboration.

Specific actions include the following areas:

Tobacco control. Tobacco control is one major area that requires intensified action. A comprehensive national plan of action for tobacco control should be formulated. Political commitment and support should be ensured. Special emphasis in the tobacco control plans in the EMR should be given to prevention of tobacco use in women, amongst whom smoking rates are, fortunately, still relatively low, and on efforts to prevent children and adolescents from forming the smoking habits.

Benefit should be made from experience gained in this field in other regions. Effective health education activities should be implemented and evaluated. The plan should also include taking the necessary legislative action, as well as measures to ensure implementation and the enforcement of this legislation. Examples of such legislation are:

- Banning smoking in public places, schools, and health care facilities
- Banning vending machines and selling cigarettes to children
- Banning of tobacco advertising and promotion
- Preventing new investment in the development of the tobacco industry
- Increasing taxation on tobacco products
- Appropriate warning labels.

The power of the community should be used to introduce this legislation. The health care system should have a major role as far as education and counselling are concerned. Additionally, professionals in health and health-related fields, as well as school teachers, should provide role

models. There is also a place for strengthening social and cultural beliefs as well as religious values against smoking.

Physical activity

Activities to promote exercise and physical activity should be part of any CVD prevention programme. Specific activities to achieve this objective should be planned and implemented. These activities should be feasible and able to be incorporated into daily life. They should include encouraging sport activities at schools and workplaces. In view of the increasing prevalence of obesity, emphasis should also be given to promote physical exercise among women. Simple guidelines on physical exercise should be formulated and used. The attitude and misconceptions of both women and the community about obesity should be changed through health education.

Nutrition and dietary modifications

In most countries of the EMR, no specific policies exist to prevent diet-related NCDs. A comprehensive national food and nutritional policy, with a specific emphasis on promoting healthy dietary habits, should be established. Since the policy will involve action that covers all aspects of the food chain from production to consumption, multisectoral collaboration is essential. Such an approach will have to include the active participation of many government sectors like agriculture, education, and industry, in addition to health. Health education and legislation and its enforcement are basic components in the implementation of such policy.

Dietary guidelines, which should have the credibility provided by scientific and epidemiological evidence, need to be formulated. Such guidelines would generally ensure:

- A balanced intake of calories
- A reduced salt content of the diet

- A reduced total saturated fat intake
- A rise in the consumption of fruit and vegetables
- Prevention of unhealthy dietary habits and stopping the cultural invasion of fast food.

As far as health education is concerned, it is recommended giving priority to strengthen the role of the school health curriculum. A critical review is needed to construct a curriculum that covers the acquisition of knowledge and attitudes needed for CVD prevention.

Management

There is a need for setting national guidelines for the minimally acceptable standards) of health care for people suffering from the major CVDs, namely hypertension, CHD, and stroke, taking into consideration available resources and local circumstances.

For RF/RHD, primary prevention (prevention and prompt treatment of streptococcal infection may be feasible in some countries through health education and better health care service. Otherwise, efforts should focus on secondary prevention and penicillin prophylaxis.

Appendix 2

Guidelines for the Development of National Programmes for the Prevention and Control of Cardiovascular Diseases*

The development of national programmes to prevent CVDs and to promote healthy lifestyles should be considered by the health authorities in all countries of the EMR. Table 1 shows the initiatives taken by many countries of the region to establish CVD control programmes. Although most of these countries have already been involved in some activities, only a few have clearly planned activities covering the major aspects of CVD prevention.

Although the plan of action and activities of the national programme will vary according to each country's priorities, existing health care system, and socioeconomic circumstances, the following guidelines may generally be used for planning, implementing, and evaluating these programmes.

Policy-makers have become aware of CVDs as a problem of major public health concern as they are affecting a growing proportion of the population and also because of the increasing hospitalization of such cases. Establishment of the programme can be further justified by: (1) the emerging epidemic due to the ageing of populations, as well as increasing levels of risk factors due to changes in lifestyles; and (2) the availability and feasibility of effective interventions. However, certain essential requirements should be addressed before the programme can be established. These include:

---

* *Source: WHO/EMRO (1995): Prevention and Control of Cardiovascular Diseases EMRO Technical Publication No. 22. Alexandria, Egypt.*

- Public awareness about the increasing problem of CVDs and the need for intervention is generally inadequate in most countries of the region and should be strengthened.

- Political will and commitment should be solicited. Many countries have some sort of government commitment towards the prevention of CVDs, either through legislation, health education or financial support. However, more efforts should be made, in most countries, to convince governments to play a more active role. To achieve this goal, it is important to make the essential data about the magnitude and impact of these diseases available to policy-makers.

- A competent and highly motivated leadership should be identified.

- Adequate resources should be made available. Availability of resources for CVD control varies from one country to another. The government is the major source of support in some countries but it has also been possible to secure some private funds in some cases. Professional NGOs and heart associations in the region do not play (with a few exceptions), an active role in this respect.

When the above requirements are fulfilled, the following actions should be considered as part of the planning process:

- A national committee should be formed and charged with the planning, implementation, and evaluation of the programme. The membership of this committee should include, as a minimum, the following specialties: cardiology, internal medicine, paediatrics, epidemiology and public health, and nutrition. Medical education institutions, military medical services, the private medical sector, and certain Ministry of Health departments such as health education, nutrition, tobacco control, school health and information should also be represented. NGOs, including the national medical association should also be involved. The involvement of other ministries like agriculture

(food and nutrition polices), education (school health curriculum), industry, and information is essential.

- A national coordinator should be appointed, within the MOH, to coordinate the activities of the committee.

- Initial situation analysis and data collection constitute the preliminary tasks of the programme on which planning and evaluation will be based.

- Priorities should be identified concerning the diseases to be addressed and risk factors to be prevented. Appropriate intervention strategies should be selected.

- A national plan of action should be prepared with the objective and targets set and detailed activities planned within a time-frame. Process and outcome measures should be formulated.

In addition to the approaches proposed in this document, a demonstration project may initially be established in a pilot area, especially in countries with a large population. Such a project would:

- Provide a focus for action and opportunities for practice and training.
- Ensure reliable monitoring and evaluation by measuring outcome periodically, e.g. every five years.
- Serve as a model to demonstrate the effectiveness and feasibility of intervention before it is extended to cover the whole country

Activities for the primary prevention of CHD and hypertension should be planned in coordination with similar integrated efforts directed against diabetes and cancer.

The programme should emphasize the importance of PHC in CVD control and define the role of PHC workers in the primary and secondary

prevention of the priority CVDs. PHC can also contribute in identification of high-risk groups.

Implementation of the programme is achieved through strengthening of human resources development and full integration into the existing health care system.

Training of the health care professionals at all levels is needed. Guidelines for prevention, identification of risk factors and high-risk groups, early detection of cases, and clinical management should be prepared. Close coordination with medical and nursing schools should be maintained. Involvement of NGOs is essential.

Evaluation is based on monitoring the process and outcome measures set and the achievement of targets. Obstacles are identified and targets are revised from time to time.

Research is an important component of prevention programmes. Epidemiological research should involve provision of basic data about risk factors, morbidity, and mortality as well as the establishment of an ongoing monitoring system. Health system research should focus on improvement of methods of training of personnel and on strengthening the efficiency of PHC units and their integration into the programme. Qualitative social research is needed to address the cultural behaviour of different populations and means to improve it. Coordination and links between the different research centres of the region should be established.

Table (1)

Status of CVD Control Programmes in the Region*

Country	WHO Collaboration In CVD control	National Plan of action	National Committee For CVD control	Tobacco control committee
Bahrain	•		•	•
Cyprus	•			
Djibouti	•			
Egypt	•		• [1]	
Iran, Islamic Republic of	•	• [2]	• [2]	
Iraq	•	• [1]	•	•
Jordan	•		•	•
Libyan Arab Jamahiriya	•	• [1]	•	
Morocco	•	• [1]		•
Oman	•	•	•	•
Pakistan	•			
Saudi Arabia	•		•	•
Sudan	•	• [1]	• [1]	
Tunisia	•			
Yemen, Republic of	•			

[1] For RF/RHD only

[2] For RF/RHD and hypertension

* The information contained in this table is derived from the contribution of country participants at the Intercountry Workshop on the Prevention and control of CVDs in the Eastern Mediterranean Region, Amman, Jordan, 27-30 March 1994.

Table (2)

Availability of Baseline Data on CVDs in Member States

Country	Coronary heart Disease	Hypertensions	Rheumatic fever/ Rheumatic heart disease
Bahrain	•		
Cyprus	•	•	
Djibouti	•	•	•
Egypt		•	
Jordan	•	•	•
Libyan Arab Jamahiriya	•	•	•
Iran, Islamic Republic of	•	•	•
Iraq	•	•	•
Morocco	•	•	
Oman	•	•	
Pakistan	•	•	•
Saudi Arabia	•	•	
Sudan			•
Tunisia	•	•	
Yemen, Republic of	•	•	

* The information contained in this table is derived from the contribution of country participants at the Intercountry Workshop on the Prevention and Control of CVDs in the Eastern Mediterranean Region, Amman, Jordan, 27-30 March 1994.

ACKNOWLEDGEMENTS

Like any other research project, this work would not have been completed without the help of many organizations and people. First of all, we thank the Ministry of Health, Bahrain, for facilitating the execution of this study. Special thanks must go to WHO/EMRO who provided the financial support for this study.

Thanks are also due to the Bahrain Center for Studies and Research for providing facilities for typesetting and funds for printing this book.

Without the generous co-operation of the physicians, and the eager participation of patients diagnosed with myocardial infarction and the people selected in the community sample, this study would not have been possible.

Finally, we would like to thank Dr. El-Fatih Al-Samani from WHO/EMRO for his help in preparing the protocol of this study, and to the female interviewers who helped in the data collection.

Cardiovascular diseases (CVD) are the leading causes of morbidity and mortality in Bahrain. This creates a heavy load on health services and absorbs a high percentage of the total health budget.

Annual health statistics published by the Ministry of Health showed that acute myocardial infarction (AMI) is the main disease of the CVD group and represents about 50% of the total cases of CVD admitted to hospitals in Bahrain. Changes in lifestyle and dietary patterns may be the main factors leading to the high increase of AMI in Bahrain. However, it is difficult to determine the main risk factors leading to AMI in Bahrain in the absence of detailed and reliable information.

The overall objective of this study was to identify the dietary, lifestyle and behavioural factors that are associated with the occurrence of AMI among the Bahraini native population.