Food consumption pattern in the Islamic Republic of Iran and its relation to coronary heart disease

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نمط تناول الأغذية في جمهورية إيران الإسلامية وعلاقته بأمراض القلب التاجية

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خلاصة : أجريت هذه الدراسة لتحديد نمط تـناول الأغذية في إيران وتقييم عـلاقته بأمراض القلب التـاجية وعوامل الاختطار الغذائية . فتم تحليل البيانات التي جمعت في استقصاءات أجريناها مؤخراً في جميع أرجاء البلاد . وكشفت النتائج أن الأغذية النباتية هي أساس الطعام في إيران . وكـانت السكريات هي مصدر 66% من إجمـالي مدخـول الطاقة ، بينما كـانت الدهنيات مصدر 22% . وكانت نسب الدهـنيات المستمدة من المجمـوعات الغـذائية المختـلفة على النحـو التالي : 22% من اللحم والبيض ، 10% من منتجـات الألبان ، 58% من الدهون والزيوت . وكانت النسب المئوية للأحماض الدهنية المشبعة ، أو وحيدة اللا تشبع ، أو عديدة اللا تشبع ، هي 11.3% ثم 6.8% ثم 2.1% من إجمـالي مـدخـول الـطاقة عـلى الـتوالي . ومع أن النمط الغذائي العام بين السكان يقع في حـدود النطاقات المقبولة ، إلا أن الاتجاه الملاحظ طوال الشـلاثين سنة الماضية يكشف عن زيادة مدخول الدهون بمقدار الضعف .

ABSTRACT A study was conducted to determine and evaluate the Iranian food consumption pattern in relation to coronary heart disease and dietetic risk factors. Nationwide data collected in our recent surveys were analysed. The findings reveal plant foods to be the basis of the Iranian diet. Of the total energy intake, 66% and 22% came from carbohydrates and fats respectively. The share of fat from different food groups was: meat and eggs 22%, dairy products 10%, fats and oils 58%. The percentage of saturated, monounsaturated and polyunsaturated fatty acids was 11.3%, 6.8% and 2.1% of the total energy intake respectively. Although the general food pattern of the population falls within the accepted ranges, the trend in the past 30 years reveals a twofold increase in fat intake.

La consommation alimentaire en République islamique d'Iran et sa relation avec les cardiopathies coronariennes
RÉSUMÉ La présente étude a été réalisée pour déterminer et évaluer les caractéristiques de la consommation alimentaire iranienne en relation avec les cardiopathies coronariennes et les facteurs de risque alimentaires. Nous avons procédé à l'analyse des données recueillies au niveau national au cours de nos enquêtes récentes. Les résultats montrent que les aliments d'origine végétale constituent la base de l'alimentation en Iran. Soixante-six pour cent (66%) et vingt-deux pour cent (22%) de l'apport énergétique total provenaient des glucides et des graisses respectivement. La part de graisses provenant des différents groupes d'aliments se présentait comme suit: viande et œufs 22%, produits laitiers 10%, graisses et huiles 58%. Le pourcentage d'acides gras saturés, monoinsaturés et polyinsaturés était respectivement de 11,3%, 6,8% et 2,1% de l'apport énergétique total. Bien que la consommation alimentaire générale de la population se situe dans les limites des valeurs acceptées, la tendance observée au cours des 30 dernières années est que l'apport en graisses a doublé

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Introduction

Cardiovascular diseases (CVD) are the leading cause of premature death and disability in the world today [1]. In the Islamic Republic of Iran, CVD account for 38% of deaths. Data over an 8-year period (1981–1989) reveal circulatory diseases to be the most important cause of death. with a 10% increase compared with the previous period [2]. Among a host of preventable chronic illnesses. atherosclerotic diseases, and in particular coronary heart disease (CHD) and stroke, deserve priority, not only because they continue to be the leading cause of premature death and disability in industrialized countries, and will become so in developing countries [3], but also because our knowledge regarding their prevention is more advanced than other diseases [4].

Several studies have indicated that vascular diseases have multifactorial etiology. Many factors, both known and unknown, contribute to the risk of CVD [5]. Therefore, to be fully effective, a preventive strategy must deal with multiple elements. Among the environmental factors influencing the occurrence and degree of risk factors, nutrition and lifestyle are of particular importance. Epidemiological, clinical and experimental studies have provided strong and consistent evidence that nutritional and dietary factors have an important role in the etiology of CHD [6]. Therefore, the main emphasis in population-based preventive strategies should be on nutritional risk factors and changes in dietary habits. The present study was conducted to determine and evaluate Iranian food consumption patterns in relation to CHD and dietetic risk factors.

Materials and methods

The study was based on existing data from our current national health and nutrition surveys. The main sources of information were: the nationwide household food consumption survey project (1991–1995) [7] and the national health survey (1990–1992) [8]. Data on food consumption patterns were obtained from the nationwide household food consumption survey project. The project was conducted by the National Nutrition and Food Technology Research Institute and the Ministry of Agriculture. In the study, a total sample of 5591 households (33 211 people) were surveyed in 24 provinces. Information on dietary intake was collected using a combination of food weighing and a 24-hour recall questionnaire for 3 consecutive days.

The average values of different food groups in the 24 provinces were analysed for cholesterol and fatty acid content using a food composition table which was developed and modified for this purpose [9]. Trans-fatty acid intake was reported based on industrially hydrogenated fats. Information on mean values of serum cholesterol levels in different provinces was obtained from the national health survey.

Results

Based on data obtained from the national health survey (1990–92), the mean total serum cholesterol concentration was 176 ± 45 mg/dl for both sexes combined and this increased with age. The provinces at low risk (total serum cholesterol < 200 mg/dl) were: Semnan, Kohkilouyeh, Charmahal, Ilam, Fars, Bushehr, Yazd, Hamadan, Tcheran, East Azarbaijan, Mazandaran, Zanjan, Kerman, Kordestan, Esfahan, Khorasan,

Gilan, Khuzestan, Sistan and Baluchestan, Bakhtaran and Lorestan. Those at moderate risk (total serum cholesterol 200–239 mg/dl) were West Azarbaijan and Markazi. The only province in the high risk level (total serum cholesterol ≥ 240 mg/dl) was Hormozgan.

According to the nationwide household consumption survey, the Iranian dietary pattern mainly consists of plant foods. About 60% of fat and 70% of protein intake is derived from plant sources. The percentage contribution of fat and carbohydrate to total energy was 22% and 66% respectively.

The total mean energy intake exceeded requirements. Carbohydrate intake was 442 g per day. Intake of simple sugars was within the upper limit and intake of crude fibre, fruits and vegetables, pulses, and nuts was within the lower limit of recommended

intake (Table 1). Data on fat and fatty acid consumption and the principal sources of dietary fat are given in Tables 2 and 3. Fats and oils, meat and eggs, and dairy products provided 90% of the total fat. Visible fats and oils, especially hydrogenated cooking fats, were the major sources of fat (58%). Comparison of fatty acid intake with recommended intake indicates that the contribution of saturated fatty acids (SFA) to dietary energy exceeds the recommended level (13% versus < 10%). Mean intake of the two main classes of cis-polyunsaturated fatty acids, N-3 and N-6 and especially N-6, were much lower than the recommended intake. Results indicate a very low polyunsaturated/saturated (P/S) ratio (0.21) compared with the recommended value [10]. Comparison of average trans-fatty acids intake revealed it to be three to six times higher than the recommended intake [1].

Table 1 Daily intake of selected nutrients and foods in comparison with recent dietary recommendations

Dietary item	Intake	Recommended intake	Comments
Total energy intake (kcal)[a]	2700	2228	Energy intake is 120% of requirements. Energy intake should be adequate to maintain desirable levels of body weight (BMI = 20–25 kg/m²)
Percentage of total energy[b]			
Carbohydrate	66	55–77	
Fat	22	15–25	
Sugars	10	0–10	
Daily intake (g)[b]			
Carbohydrates	442	–	
Sugars	70	–	
Crude fibre dietary	10	27–40	Intake estimated as total fibre 30–50 g/day
Fruits and vegetables	469	Lower limit 400	
Pulses, nuts and seeds	21	Lower limit 30	

[a]Source of recommended intake: reference 7
[b]Source of recommended intake: reference 10

Table 2 Fat and fatty acid consumption pattern of Iranian households in comparison with recommended intake

Fat/fatty acid		Intake	Recommended intake
Total fat (% total energy)	mean	22	15–25
	range	17–29	
Saturates (% total energy)	mean	13	0–10
	range	9–16	
Monounsaturates recommendation	mean	7	No
(% total energy)	range	5.6–9.0	
N-6 polyunsaturates	mean	1–5	2
(% total energy)	range	1–2	
N-3 polyunsaturates (EPA+DHA)	mean	0.06	0.3–0.4
(g/day)	range	0.02–0.34	
Trans-fatty acids (g/day)	range	15.6–30	5
(% based on hydrogenated fat)		5–10	2
P/S ratio		0.21	1.0
Cholesterol (mg/day)	mean	165	< 300
	range	103–198	

Source: reference 1
EPA = eicosapentanoic acid   DHA = docosahexanoic acid
P/S = polyunsaturates/saturates

Table 3 Average daily intake of food groups and percentage contribution of fat in different food groups

Food groups	Intake (g/day)	Contribution of fat (%)
Meat and eggs	112.0	22
Red meat	52.0	
Poultry	33.0	
Fish and shrimp	8.0	
Eggs	19.0	
Dairy products	132.0	10
Fats and oils	39.0	58
Hydrogenated fats and oils	34.5	
Animal fat	4.5	

Daily cholesterol intake varied from 103 mg to 198 mg, which is well below the 300 mg limit.

The provinces with low levels of fat consumption (< 20% of total energy) were: Sistan and Baluchestan, Kohkilouyeh, Ilam, Gilan, Kerman, Kordestan, Bakhtaran, Khorasan. Those with moderate levels (20%–25% of total energy) were: Lorestan, Hamadan, Zanjan, Yazd, Bushehr, East Azarbaijan, Khuzestan, Markazi, Mazandaran, Hormozgan, West Azarbaijan, Fars, Charmahal, Esfahan. The only province with high levels of fat consumption (> 25% of total energy) was Teheran. Distribution of provinces based on SFA consumption as a percentage of total energy is presented in Table 4. Thus, according to the findings 22

Table 4 **Distribution of provinces based on saturated fatty acids as a percentage of total energy**

Low levels (< 5%)	Moderate levels (5%–10%)	High levels (> 10%)	
		10%–15%	>15%
–	Ilam	Kerman	Teheran
	Gilan	Kohkilouyeh	East Azarbaijan
	Sistan and Baluchestan	Kordestan	
	Yazd	Mazandaran	
		Bakhtaran	
		Khuzestan	
		Lorestan	
		Hormozgan	
		Hamadan	
		Bushehr	
		Fars	
		Zanjan	
		West Azarbaijan	
		Khorasan	
		Markazi	
		Esfahan	
		Charmahal	

of the 23 provinces fell into the low to moderate level of available fat, while most of the provinces (19) had high levels of SFA as a percentage of the total energy. The proportion of energy derived from fat in 23.5% of households ($n = 3078$) was higher than 30%.

Table 5 shows changes in the consumption of nutrients and food groups in the Iranian diet over the past 30 years. Although consumption of all food groups has increased, total energy intake has remained steady at around 2600–2700 kcal/day. Dietary fat as a proportion of energy and mean intake of fats and oils has shown a twofold increase during this period.

Discussion

In this report, based on the available information, serum cholesterol levels and food consumption patterns of the Iranian population were considered, with special focus on the identification of nutrition risk factors in relation to CHD.

Based on the findings of the national health survey, mean serum cholesterol concentration did not indicate a risk in most of the provinces. Only about 20% of the Iranian population over 40 years of age had a mean total serum cholesterol > 240 mg/dl. In many industrialized and also developing countries, the prevalence of high levels of total cholesterol among their populations is over 40% [1]. High rates of mortality parallel high levels of blood cholesterol in these countries [11]. It has been clear for many years that there is a positive association between serum cholesterol and CHD, which is consistent, strong and independent of other recognized risk factors [12]. Therefore, it seems that the mean serum choles-

Table 5 **Trends in average intake of nutrients and food groups: (1963–1976) to (1991–1995)**

Nutrients and food groups (1963–1976)	Average intake per person per day per day (1991–1995)	Current national average intake per person	Change over time
Nutrients			
Energy (kcal)	2600	2700	No change
Fat (% energy)	13	22	Twofold increase
Food groups (g)			
Bread	600–687	351	Twofold decrease
Rice	16–25	122	Sixfold increase
Legumes	13–101	21	Twofold increase
Sugars	58	60	No change
Vegetables	69–75	277	Fourfold increase
Fruit	101–136	192	One and a half-fold increase
Meat	37–46	92	Twofold increase
Eggs	5–9	19	Threefold increase
Dairy	82–171	132	No change
Fats and oils	10–25	39	Twofold increase
Miscellaneous	0.2–1.5	19	Twentyfold increase

terol concentration of the Iranian population is not a major risk factor for CHD.

Our findings indicate that plant foods are the major component of the Iranian diet. A characteristic of the Iranian diet is the dependence on bread and rice as major energy sources. The percentage contribution of carbohydrate and fat to total energy in our diet was 66% and 22% respectively. Epidemiological studies indicate that populations consuming diets rich in plant foods tend to have more limited quantities of animal proteins and fats [13]. This dietary evidence parallels the lower rates of CHD in such populations [1]. While our findings point to high levels of complex carbohydrate intake and low to moderate levels of fat intake, as well as a lower consumption of animal sources of protein and fat, nevertheless mortality due to CHD the country is rather high. This evidence emphasizes the fact that CHD is a disorder of multiple risk factors. Apart from nutrition, a number of other factors, namely physical inactivity, obesity, stress and smoking have to be taken into account.

In our study we found that mean energy intake exceeded requirements. Excessive accumulation of body fat inevitably follows chronic energy consumption in excess of expenditure, and is associated with higher mortality from CHD and stroke [14]. Results of a household food security survey in Teheran province [15] showed that 49% of people aged 16 years and over were overweight based on BMI > 25 kg/m^2. Also, the contribution of fat as total energy in 41% of households in this province was in excess of 31%. Evidence indicates that diets relatively rich in fat appear to be particularly conducive to the development of obesity [16]. Therefore, knowledge of prevalence

rates of obesity and those most susceptible to become obese are of considerable importance.

The results of the present study show that total fat intake as a percentage of energy is within the recommended range. While the contribution of saturated fatty acids to dietary energy exceeded the recommended limits, it was lower compared with intakes in many industrialized countries [13]. This difference can be explained in terms of the lower consumption of meat and milk as principal sources of saturated fatty acid in the Islamic Republic of Iran.

Ample data exist regarding the correlation between dietary fat intake, especially saturated fatty acids, trans-fatty acids and dietary cholesterol, with CHD in different populations [6]. The seven countries study showed a strong positive correlation between saturated fatty acid intake and the 10-year incidence of CHD. Populations with an average saturated fatty acid intake between 3% and 10% of energy intake had low mortality rates from CHD [17]. When saturated fatty acid intake was greater than 10% of energy, a marked and progressive increase in CHD mortality was observed [10]. In addition, low consumption of vegetable oils and fish contributes to very low P/S ratios and low intakes of n-3 and n-6 polyunsaturated fatty acids. Thus, high levels of saturated fatty acid intake and low levels of polyunsaturated fatty acid intake may have contributed to the high prevalence of CHD in the Islamic Republic of Iran.

Major sources of fat in the Iranian diet were visible fat, especially hydrogenated cooking fats, resulting in the excessive intake of trans-fatty acids. Typical intakes of trans-fatty acids range from almost zero in the traditional Japanese diet to 10–15 g/day in the Netherlands; in most industrialized European and North American countries the mean intake is 5–10 g/day [18]. As data indicate (Table 2), mean intake of trans-fatty acids in the Iranian diet is much higher than most industrialized countries [1,18], which merits further study.

Evidence linking plasma cholesterol to CVD comes from epidemiological, clinical and biochemical studies. Recent surveys indicate that the average American and British dietary cholesterol intake is about 400–500 mg/day and 280–390 mg/day respectively [1]. In contrast, dietary cholesterol intake is within desirable levels in the Islamic Republic of Iran (165 mg/day). A recent meta-analysis by Hopkins [19] based on 27 published studies which had utilized controlled diets has increased the confidence with which the effects of cholesterol intake can be said to influence plasma cholesterol concentration. Increasing consumption from virtually 0 mg to 500 mg, increased plasma cholesterol by 12%–15%. In the NHANES II (National Health and Nutrition Examination Survey) among 8679 Americans, dietary cholesterol was an independent positive predicator of serum cholesterol ($P < 0.04$) [20]. The low level of cholesterol intake in our country may partially explain the low levels of serum cholesterol of the Iranian people examined in the national health survey project.

This study highlights the presence of nutritional risk factors among the Iranian population in relation to CHD. Because of the high prevalence of CHD and the role of dietary factors in their causation and prevention, national nutrition policies must be developed accordingly.

Recommendations

In view of the increasing fat consumption and its high total contribution to dietary energy in a sizable portion of the population, efforts must be made to reverse the trend.

Since hydrogenated fat is the main source of dietary fat with undesirable trans-fatty acid content and as the mean saturated fatty acid intake is too high, it is recommended that fats rich in saturated fatty acid be replaced with oils to reduce saturated fatty acid intake to below 10% of the total calorie consumption. Trans-fatty acids should provide no more than 2% of dietary energy. According to the results, an increase in the consumption of fish and seafood and fruits and vegetables is also recommended.

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The food and dietary analysis software (EMRO version), which incorporates food composition tables from countries of the Region and which was developed by the Danish Catering Centre, WHO Collaborating Centre for Nutrition, in Copenhagen, Denmark, has been used in a number of countries and will be developed further based on the initial experiences. A training workshop was held in the Islamic Republic of Iran, to train nationals on the use of computer programs like *Epi-info* and *Dankost* for conducting dietary intake surveys and analysing nutritional status. At the regional level, a further training course using *Dankost* (EMRO version) and the new training modules will take place in 1998. The importance of valid dietary intake data and information on consumption patterns was again brought out by a conference on nutrition and chronic diseases held jointly by the Bahraini Ministry of Health and WHO in late 1997.

Source: The Work of WHO in the Eastern Mediterranean Region. Annual Report of the Regional Director, 1 January–31 December 1997, *page 82.*