Lipid profiles in the Isfahan population: an Isfahan cardiovascular disease risk factor survey, 1994

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مستويات الشحميات بين سكان إصفهان: استقصاء عوامل الخطر للأمراض القلبية الوعائية في إصفهان، 1994

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خلاصة: في سنة 1994 أجريت دراسة مجتمعية في إصفهان لتعيين مدى انتشار الأنواع المختلفة من فرط شحميات الدم، والتركيزات الوسطى لإجمالي كولستيرول المصل، وثلاثيات الغليسريد، والكولستيرول ذي البروتين الشحمي الخفيض الكثافة، والكولستيرول ذي البروتين الشحمي الرفيع الكثافة. ولقد تم اختيار عدد مجموعه 2200 شخص بطريقة عشوائية، وتم تصنيفهم في خمس فئات عمرية (20–70 سنة). وجُمعت البيانات من خلال استبيانات وقياسات أنثروبومترية، كما تم قياس شحميات المصل ومستوى سكر الدم على الريق. وتبيَّن أن فرط شحميات الدم كان أكثر انتشاراً في النساء عنه في الرجال. وأظهر تحليل التحوّف (الانحدار) الخطي المتعدد أن الكولستيرول ذا البروتين الشحمي الرفيع الكثافة وثلاثيات الغليسريد كانت وحدها ذات الصلة بمنسب كتلة الجسم. وكان شذوذ الشحميات الأكثر انتشاراً هو الكولستيرول ذو البروتين الشحمي الرفيع الكثافة. وينبغي التشجيع على تعديل النظام الغذائي ومزاولة الرياضة من أجل تخفيض فرط شحميات الدم.

ABSTRACT A population-based study was conducted in 1994 in Isfahan to define the prevalence of various types of hyperlipidaemia and the mean concentrations of serum total cholesterol, triglycerides, low-density lipoprotein cholesterol and high-density lipoprotein (HDL) cholesterol. In all, 2200 people were randomly chosen and classified into five age groups (20-70 years). The data were obtained by questionnaires and anthropometric measurements and serum lipids and fasting blood sugar were measured. The prevalence of hyperlipidaemia was higher in women than men. Multiple linear regression showed only HDL cholesterol and triglycerides to be associated with body mass index. The most prevalent lipid abnormality was HDL cholesterol. Diet modification and physical activity should be encouraged to reduce hyperlipidaemia.

Bilan lipidique dans la population d'Ispahan: étude des facteurs de risque cardiovasculaire à Ispahan, 1994

RESUME Une étude dans la population a été réalisée à Ispahan en 1994 en vue de définir la prévalence des divers types d'hyperlipidémie et les concentrations moyennes de cholestérol sérique total, des triglycérides, des lipoprotéines de basse densité, de cholestérol et de cholestérol de haute densité (HDL). Au total, 2200 personnes ont été choisies au hasard et classées en cinq groupes d'âge (20–70 ans). Les données ont été obtenues au moyen de questionnaires et par des mesures anthropométriques, et les lipides sériques ainsi que la glycémie à jeun ont été mesurés. La prévalence de l'hyperlipidémie était plus élevée chez les femmes que chez les hommes. L'analyse par régression linéaire multiple a montré que le HDL cholestérol et les triglycérides seulement étaient associés à l'indice de masse corporelle. L'anomalie lipidique la plus courante était le HDL cholestérol. Une modification de l'alimentation et l'activité physique doivent être encouragées afin de réduire l'hyperlipidémie.

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Introduction

Nowadays, one of the most common and fatal diseases in the world is cardiovascular disease. Hyperlipidaemia is one of its reversible major risk factors [*1*].

According to a study conducted on patients with myocardial infarction (MI) in Isfahan Cardiovascular Research Centre, hyperlipidaemia is the second most important risk factor [*2*]. The prevalence of all types of hyperlipidaemia was higher in the children of Isfahan [*3*]. According to research conducted in the United States of America, 7 million people (4 million men and 3 million women) have hyperlipidaemia [*4*]. Coronary artery disease and its consequences may increase by two- to ten-fold as a result of hypercholesterolaemia, which has a mortality rate of up to 31% in males and 24% in females [*4*]. A direct relationship between serum total cholesterol (T.Cho) and coronary artery disease has been shown in many studies [*5*]. Results of a previous study carried out in Isfahan indicated the prevalence of hyperlipidaemia to be 34% in women and 25% in men who died because of myocardial infarction (based on their medical files) (Sarraf-Zadegan N et al., unpublished data). The percentage was 32.5% for women and 23.2% for men among patients hospitalized because of myocardial infarction. Our study was carried out to identify the situation in relation to hyperlipidaemia in the urban population of Isfahan in order to help put in place preventive programmes for cardiovascular disease.

Subjects and methods

A descriptive population-based study was carried out and 2315 people [1263 (45%) women and 1052 (55%) men] from 1.5 million people in Isfahan were requested to participate between February and October 1994. Isfahan is a large, homogeneous city with less immigration than Teheran and other big cities; it is at an intermediate economic level. The population of the city was divided into 40 equal clusters and all participants were randomly chosen by a two-stage cluster sampling method. The number of participants was calculated at the 5% level of significance with a power of 80% with an estimated standard deviation of 26.5 (based on a pilot study).

A participation rate of 95% was achieved. The participants were aged 19–70 years and were classified into five age groups (< 30, 30–, 40–, 50–, 60–70 years). For all participants, standard questionnaires on personal characteristics, previous history of major risk factors, smoking, physical activity and drug use were completed during home interviews. Alcohol consumption was not considered in this study because it is forbidden by Islam. Dietary habits were recorded using the 24-hour recall method. People with secondary causes of hyperlipidaemia were excluded. Anthropometric measurements were taken by trained medical students in the clinics of Isfahan Cardiovascular Research Centre.

To measure the level of T.Cho, triglycerides (TG), high-density lipoprotein cholesterol (HDL-C) and low-density lipoprotein cholesterol (LDL-C), all participants were asked to fast for 12–14 hours. The blood specimens were analysed for T.Cho and TG by an enzymatic method using an Elan 2000 autoanalyser. HDL-C was determined by the same enzymatic method for serum T.Cho following a heparin-manganese precipitation procedure [*6*]. LDL-C was calculated according to Friedewald formula [*7*], when TG was ≤ 400 mg/dL. Body mass index (BMI) as an index for obesity was calculated by measuring height and weight in light clothes and without shoes. Participants were considered to have diabetes mellitus if they had two fasting blood sugar measurements ≥ 140 mg/dL or they had a history of diabetes mellitus [8]. Blood pressure was measured by the WHO standardized method using a random zero sphygmomanometer [9]. For cigarette smoking, participants were classified as ex-smokers, current smokers and non-smokers; smokers were classified as mild, moderate or heavy smokers according to the number of cigarettes per day (mild: 1–10 cigarettes/day; moderate: 11–20 cigarettes/day; heavy: > 20 cigarettes/day). Physical activity was categorized as sedentary (< 500 kcal), light activity (500–999.9 kcal), moderate (1000–1999.9 kcal) and vigorous (≥ 2000 kcal) [10].

Statistical analyses

SPSS was used to analyse the data. Multiple linear regression analysis of serum lipids in relation to BMI and age was performed. The mean values of all factors were compared using unpaired Student's *t*-test and ANOVA. Yates corrected χ^2 tests were used to compare the frequencies respectively. A *P*-value of less than 0.05 was considered significant.

Results

The distribution of the participants by age group is presented in Table 1. The mean, standard deviation and 25th, 50th and 75th percentiles for each serum lipid based on different age groups for men and women are shown in Table 2. Mean T.Cho increased with age in women ($P = 0.00$) and men ($P = 0.00$) separately. LDL-C showed a similar increase with age in women. In spite of higher LDL-C levels in women compared with men, their serum TG levels were lower than men except in the 60–70-year-old age group. In the 40–49 year-old age group, the mean value of serum TG peaked in men.

The sex-specific distribution of serum lipids is presented in Table 3. T.Cho ≥ 300 mg/dL was seen in 6.7% of women and 4.5% of men, which was statistically significant ($P = 0.036$). LDL-C ≥ 160 mg/dL was more prevalent in women than in men (40.5% versus 23.5%) and the difference was significant ($P = 0.000$). In the studied population 51.8% had HDL-C < 35 mg/dL and it was significantly more common in men (57.6%) than in women (47.0%). According to the data in Table 3, the prevalence of TG ≥ 200 mg/dL was significantly higher in men than women.

In men, the most prevalent type of combined hyperlipidaemia was high TG and low HDL-C, followed by T.Cho ≥ 240 mg/dL and LDL-C ≥ 160 mg/dL or HDL-C < 35 mg/dL. In women it was T.Cho ≥ 240 mg/dL and LDL-C ≥ 160 mg/dL or HDL-C < 35 mg/dL followed by elevated T.Cho and LDL-C.

For both sexes, the age-specific prevalence of increased T.Cho, LDL-C and TG and decrease in HDL-C are shown in Figures 1 and 2.

Table 1 **Distribution of the studied sample in each age group by sex**

Age group (years)	Females	Males
< 30	131	222
30–	241	241
40–	340	204
50–	276	181
60–70	212	152
Total	1200	1000

Table 2 **Mean, standard deviation and some percentiles of serum lipids by age and sex, Isfahan 1994**

Age group (years)	Females Mean (*s*)	Females Percentile 25th	50th	75th	Males Mean (*s*)	Males Percentile 25th	50th	75th	*P*-value[a]
Total cholesterol (mg/dL)									
20–	213.2 (45.3)	178.5	209.5	242.7	198.1 (45.5)	162.0	201.0	228.0	0.072
30–	207.0 (42.0)	178.2	202.0	236.5	208.6 (41.5)	182.0	200.0	225.0	0.782
40–	222.8 (41.9)	193.0	248.0	250.0	224.4 (61.3)	190.7	211.0	248.7	0.829
50–	244.2 (43.6)	213.5	240.0	268.0	225.7 (44.6)	198.0	222.0	249.5	0.016
60–70	252.5 (42.3)	227.5	255.0	281.5	225.0 (49.1)	188.0	220.0	258.0	0.003
Total	229.2 (45.9)	197.0	227.0	260.0	215.6 (49.8)	184.0	212.0	241.5	0.000
P-value[b]	0.000				0.003				
Low-density lipoprotein cholesterol (mg/dL)									
20–	146.5 (37.8)	117.5	148.0	169.6	126.9 (41.2)	97.4	127.2	154.8	0.017
30–	135.8 (36.7)	109.8	134.6	160.2	128.7 (36.3)	106.8	131.8	148.8	0.184
40–	147.8 (36.8)	124.2	142.0	167.8	137.7 (47.1)	107.8	132.2	157.6	0.109
50–	162.0 (38.6)	136.0	156.0	187.6	142.3 (36.2)	118.8	139.2	165.5	0.003
60–70	170.9 (37.2)	147.0	170.8	197.6	146.8 (48.1)	116.0	149.8	179.1	0.007
Total	153.0 (39.2)	125.8	150.4	179.0	135.7 (42.3)	107.8	134.6	158.5	0.000
P-value[b]	0.000				0.219				
High-density lipoprotein cholesterol (mg/dL)									
20–	39.7 (8.6)	34.5	38.0	45.5	35.4 (7.0)	31.0	34.0	38.7	0.013
30–	35.9 (6.4)	31.2	35.0	39.0	33.8 (8.3)	29.0	33.0	38.0	0.131
40–	35.3 (7.9)	31.0	33.5	39.0	33.5 (7.0)	30.0	33.0	37.8	0.260
50–	36.3 (7.3)	32.0	35.0	40.0	35.7 (12.9)	30.0	34.0	39.2	0.743
60–70	35.6 (6.0)	32.5	35.0	40.0	34.2 (6.6)	31.0	34.0	38.0	0.276
Total	39.1 (7.3)	31.2	35.0	40.2	34.5 (8.6)	30.0	33.0	38.0	0.000
P-value[b]	0.439				0.440				
Triglycerides (mg/dL)									
20–	138.2 (85.2)	82.5	126.0	171.5	173.7 (96.5)	109.5	143.0	210.0	0.032
30–	183.0 (98.4)	111.2	161.0	246.2	235.2 (129.4)	145.0	189.0	302.0	0.006
40–	215.9 (130.5)	134.0	181.0	248.5	275.1 (218.6)	143.7	231.0	337.5	0.048
50–	230.9 (112.5)	150.0	212.0	280.0	256.3 (146.2)	154.7	232.0	294.2	0.319
60–70	238.4 (124.9)	145.5	206.0	307.5	229.8 (136.5)	137.2	183.0	289.0	0.737
Total	209.4 (119.0)	125.8	180.0	254.2	234.0 (154.2)	135.7	193.5	287.5	0.025
P-value[b]	0.000				0.005				

[a]*P-value of t-test between men and women*
[b]*P-value of ANOVA test between age groups of the given sex*
s = standard deviation

Table 3 **Distribution of lipid levels by sex, Isfahan 1994**

Serum lipid	Females (n = 1200)		Males (n = 1000)		P-value
	No	%	No	%	
T.Cho (mg/dL)					
< 200	340	28.3	401	40.1	
200–400	476	39.7	401	40.1	0.000
250–299.9	304	25.3	153	15.3	
≥300	80	6.7	45	4.5	
LDL-C (mg/dL)					
< 131	347	28.9	454	45.4	
131–159.9	367	30.6	311	31.1	0.000
≥ 160	486	40.5	235	23.5	
HDL-C (mg/dL)					
< 35	564	47.0	576	57.6	
35–49.9	584	48.7	377	37.7	0.000
≥50	52	4.3	47	4.7	
TG (mg/dL)					
< 200	680	56.7	522	52.2	
200–400	443	36.9	364	36.4	0.000
≥400	77	6.4	114	11.4	
T.Cho ≥ 240 and HDL-C < 35 (mg/dL)	226	18.8	135	13.5	0.001
T.Cho ≥ 240 and LDL-C ≥ 160 (mg/dL)	395	32.9	186	18.6	0.000
T.Cho ≥ 240 and LDL-C ≥ 160 and HDL-C < 35 (mg/dL)	179	14.9	90	9.0	0.000
T.Cho ≥ 240 and LDL-C ≥ 160 or HDL-C < 35 (mg/dL)	449	37.4	236	23.6	0.000
TG ≥ 200 and HDL-C < 35 (mg/dL)	610	30.5	251	25.1	0.002

T.Cho = total cholesterol; LDL-C = low-density lipoprotein cholesterol; HDL-C = High-density lipoprotein cholesterol; TG = triglycerides

Mean lipid values classified into three subgroups of BMI are given in Table 4. Serum levels of T.Cho and TG increased and HDL-C decreased from the lowest to the highest BMI subgroup in women ($P \leq 0.01$).

The coefficients for regression of T.Cho, LDL-C, HDL-C and TG on BMI controlled for age were statistically significant (the results are not shown).

The prevalence of increased T.Cho, LDL-C and TG and HDL-C < 35 mg/dL for BMI ≥ 25 kg/m^2 between men and women differed significantly ($P < 0.004$), and except for hypertriglyceridaemia the differences in prevalence between men and women with BMI < 25 kg/m^2 were significant ($P < 0.05$) (Table 5).

Multiple regression analyses were applied for serum lipids as a dependent variable and age, sex, BMI, fasting blood sugar (FBS), smoking and physical activity as independent variables (Table 6). Age, sex and FBS significantly affected the levels of the serum lipids. In addition, BMI had a significant effect on the serum levels of HDL-C and TG.

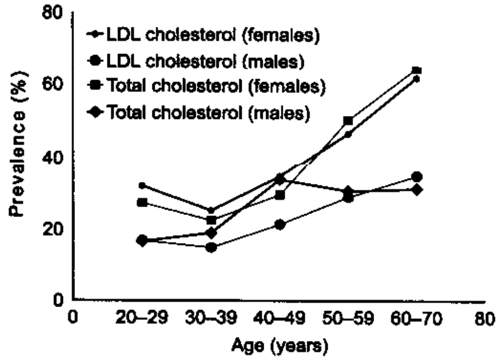

Figure 1 **Prevalence of total cholesterol of ≥ 240 mg/dL and LDL-cholesterol ≥ 160 mg/dL by age and sex, Isfahan 1994**

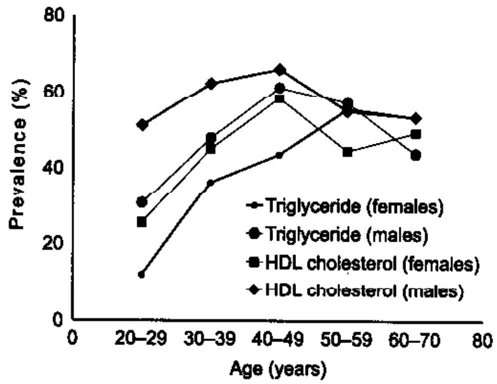

Figure 2 **Prevalence of triglyceride of ≥ 200 mg/dL and HDL-cholesterol < 35 mg/dL by age and sex, Isfahan 1994**

Discussion

The prevalence of different types of hyperlipidaemia was higher in women than in men. The mean levels of T.Cho, LDL-C and TG increased with increasing BMI levels in women. A relative decrease has been seen in the mean of those lipids in the BMI level > 30 kg/m^2 due to the low frequency of men within this range of BMI [*11*].

According to our results, the mean value of T.Cho increased with age in both sexes, except for women in the age group 30–< 40 years. Higher levels of T.Cho in the age group 20–< 30 years in women can be explained by the higher dietary cholesterol intake in this age group (Boshtam M, Rafiei M, Sarraf-Zadegan N, unpublished data). Diets rich in saturated fats and dietary cholesterol and low physical activity that predisposes people to obesity tend to raise serum lipids levels [*12–14*]. Our population uses saturated fats and foods high in cholesterol extensively and does not have an adequate level of physical activity [*11*], which explains the trend observed in the present study.

The rate of increase in the mean concentration of T.Cho varies considerably between different populations. This variation may depend more upon environmental factors, diet in particular, than on some inherent biological characteristics [*15*]. Similar results to ours have been found in Canadians [*16*].

Mean T.Cho is generally lower in women than men until the age of 50 years and above. Women have the menopause at around this age and it is believed that changes in serum T.Cho at this time may be due partly to the decrease in estrogen and

Table 4 **Mean value of serum lipids by subgroups of body mass index (BMI) for both sexes, Isfahan 1994**

Serum lipid (mg/dL)	BMI (kg/m²)[a]	Females Mean (*s*)	Males Mean (*s*)	*P*-value[b]
Total cholesterol	< 25	217.7 (45.4)	206.2 (46.4)	0.001
	25–29.9	230.5 (45.5)	289.1 (187.1)	0.146
	≥30	256.0 (138.4)	272.9 (152.5)	0.002
P-value[c]		0.001	0.002	
HDL-cholesterol	< 25	37.2 (8.1)	35.1 (7.3)	0.001
	25–29.9	35.7 (6.5)	33.5 (8.1)	0.001
	≥30	35.7 (7.4)	36.2 (15.3)	0.860
P-value[c]		0.010	0.327	
LDL-cholesterol	< 25	147.2 (38.3)	134.5 (42.8)	0.000
	25–29.9	153.6 (39.7)	137.1 (42.1)	0.000
	≥30	159.2 (37.7)	133.6 (41.7)	0.000
P-value[c]		0.288	0.711	
Triglycerides	< 25	173.6 (116.0)	179.8 (97.0)	0.528
	25–29.9	208.2 (101.5)	255.3 (53.7)	0.000
	≥30	240.9 (43.2)	219.1 (42.6)	0.470
P-value[c]		0.001	0.000	

[a] *The number of participants in the three subgroups of BMI was 503, 669 and 28 women and 563, 422 and 15 men.*
[b] *P-value of t-test*
[c] *P-value of ANOVA test*
s = *standard deviation*

the consequent decrease in LDL-receptor activity [*12*].

Unlike other lipids, TG levels were higher in men than women in all age groups except the age group 60–70 years. This is similar to Canadian men and women [*16*]. As the serum TG level is affected by diet more than the other lipids [*17*], this result may be due to a greater intake of carbohydrate in men than in women in our society (Boshtam M, Rafiei M, Sarraf-Zadegan N, unpublished data). As Table 2 shows, the TG mean value increased with age in women. This increase could be a result of the increased prevalence of obesity by age that has been observed in our population too [*11*]. The age-based trend of the serum TG level is similar to the BMI trend found in men in another study [*18*]. The mean levels of TG decreased in the sixth decade of life in men, probably due to the fact that elderly men tend to have lower BMI for various reasons, such as a lower desire for food, lower rate of absorption, slowing down of the anabolic processes and increased rate of catabolism.

The mean levels of serum T.Cho and TG in our study were greater than the Chinese urban population, while the mean HDL-C was lower [*19*]. Unlike other serum lipids, HDL-C concentration showed an inverse correlation with age (Table 6).

HDL-C levels were lower in men than women, which is similar to data from some

Table 5 **Prevalence of different types of hyperlipidaemia by sex according to body mass index (BMI)[a], Isfahan 1994**

Serum lipids	Both sexes		Females		Males		P^b
	No	%	No	%	No	%	
			BMI < 25 kg/m²				
TG ≥ 200 mg/dL	266	28.9	110	27.3	156	30.2	0.000
T.Cho ≥ 240 mg/dL	230	25.4	126	31.3	104	20.1	0.995
HDL-C < 35 mg/dL	441	47.7	170	42.2	271	52.4	0.000
LDL-C ≥ 160 mg/dL	259	28.4	140	34.7	119	23.0	0.967
			BMI ≥ 25 kg/m²				
TG ≥ 200 mg/dL	715	55.4	407	51.1	308	63.8	0.131
T.Cho ≥ 240 mg/dL	488	38.5	342	42.9	146	30.2	0.000
HDL-C < 35 mg/dL	691	53.6	391	49.0	300	62.1	0.210
LDL-C ≥ 160 mg/dL							

T.Cho = total cholesterol, LDL-C = low-density lipoprotein cholesterol, HDL-C = high-density lipoprotein cholesterol, TG = triglycerides

[a] *Except for HDL-cholesterol in women and LDL-cholesterol in men, all differences between the two BMI levels were significant.*

[b] *P-value of Yates corrected χ^2 test*

population-based studies in other countries [*20,21*]. This may explain why the incidence of coronary heart disease is greater in men than women and also that mortality rates from coronary heart disease for women lag behind those of men by about 10 years [*22–24*].

The mean value of blood lipids in men aged 25–64 years in our study was greater than that reported in the Nine Provincial Heart Health surveys [16]. The same results for serum LDL-C and TG were obtained, while the mean HDL-C value in our study was lower than the Canadian study. These differences were also found for women.

The prevalence of hypercholesterolaemia and hypertriglyceridaemia in our study was higher than that reported in other countries [*25–28*]. Hypertriglyceridaemia can be attributed to the high carbohydrate diet in the Isfahan population of which bread, rice and other cereals are the main source (Boshtam M, Rafiei M, Sarraf-Zadegan N, unpublished data).

Our data indicate a direct significant relation between T.Cho levels and saturated fats in the diet. The LDL-C level is associated with T.Cho and therefore the high prevalence of elevated LDL-C can be explained (Boshtam M, Rafiei M, Sarraf-Zadegan N, unpublished data).

It has been shown that physical activity can directly affect serum HDL-C [*29*]. Since 60.4% of our people are obese (67.7% of women and 49.3% of men) [*18*], and because obesity results in TG, T.Cho and LDL-C increases [*30–32*] and HDL-C decrease [*1,33,34*], this risk factor may be one of the major reasons for a higher prevalence of hyperlipidaemia in women than in men. When BMI was stratified in two different levels, except for low HDL-C in women and high LDL-C in men, there

Table 6 **Multiple linear regression analyses of each serum lipid on selected variables, Isfahan 1994**

Dependent variable	Independent variable[a]	Beta		*P*-value
Total cholesterol (mg/dL)	Age	0.248		0.000
	Body mass index	0.017		0.558
	Smoking	0.019		0.531
	Physical activity	0.033		0.259
	Fasting blood sugar	0.154		0.000
	Sex	–0.089		0.004
	R^2		0.124	
HDL cholesterol (mg/dL)	Age	–0.042		0.185
	Body mass index	0.105		0.001
	Smoking	0.037		0.243
	Physical activity	0.074		0.017
	Fasting blood sugar	–0.082		0.009
	Sex	–0.113		0.001
	R^2		0.035	
LDL cholesterol (mg/dL)	Age	0.214		0.000
	Body mass index	0.025		0.408
	Smoking	0.013		0.686
	Physical activity	0.011		0.714
	Fasting blood sugar	0.118		0.000
	Sex	–0.183		0.000
	R^2		0.122	
Triglycerides (mg/dL)	Age	0.139		0.000
	Body mass index	0.088		0.002
	Smoking	–0.005		0.856
	Physical activity	0.030		0.309
	Fasting blood sugar	0.217		0.000
	Sex	0.113		0.000
	R^2		0.101	

[a] Units for independent variables are: age (years), BMI (kg/m²), smoking (code 0 = non-smoker, 1 = current smoker), physical activity (code 0 = < 4 kcal/min, 1 = ≥ 4 kcal/min)

was a significant relation between BMI and lipid levels. However, in multiple linear regression, after adjusting for age, sex, smoking, physical activity and serum FBS, only HDL-C and TG showed a significant association with BMI. Therefore, it is suggested that diet rather than obesity has an influence on other lipids.

In the participants with BMI < 25 kg/m², the prevalence of hypertriglyceridaemia and decreased HDL-C levels was higher in men, while increased T.Cho and LDL-C levels were more prevalent in women. The most prevalent type of lipid abnormality seen in our study was HDL-C <35 mg/dL, while the least frequent abnormality was elevated T.Cho. As regards the age- and sex-related differences, women aged 50– years and men aged 40– years had the highest prevalence of total hyperlipidaemia. This can be explained by the results of another study performed in Isfahan (Boshtam M, Rafiei M, Sarraf-Zadegan N, unpublished data) which showed that the above-mentioned age groups consumed more fats in their diet. Therefore, the high intake of fatty foods could be a reason for the high prevalence of hyperlipidaemia in these age groups.

Interventional actions, such as diet modification, reinforcing the benefits of physical activity and educating the public, seem necessary to bring hyperlipidaemia to an acceptable level in order to reduce this risk factor in the Isfahan population.

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Familial hypercholesterolaemia must be treated to prevent coronary artery disease

It is estimated that more than 10 million people worldwide have familial hypercholesterolaemia. They constitute a unique population at high risk for the premature development of coronary heart disease. Studies conducted prior to the availability of effective cholesterol lowering drugs have indicated that without treatment the mean age of onset of coronary heart diseases in men with this genetic disorder is around the age of 40 years, whereas it occurs 10–15 years later in women. The risk of a man with familial hypercholesterolaemia suffering a myocardial infarction is 5% below the age of 30 years, 50% by the age of 50 years and 85% by the age of 60 years. Corresponding values for women are less than 1% before age 30 years, 15% by age 50 years and 50% by the age 60 years.

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