Awareness, treatment and control of hypertension, dyslipidaemia and diabetes mellitus in an Iranian population: the IHHP study

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المعرفة بالإصابة بفرط ضغط الدم وخلل شحوم الدم والسكري ومعالجتها وضبطها لدى السكان في جمهورية إيران الإسلامية: دراسة برنامج إصفهان للقلب المعافى

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الخلاصة: استخدم الباحثون المعطيات المستمدة من المسح القاعدي لبرنامج أصفهان للقلب المعافى للتعرُّف على معدل انتشار فرط ضغط الدم وخلل شحوم الدم والسكري، ضمن عينة ممثلة تتألف من 12514 بالغاً، يعيشون في 3 مدن في جمهورية إيران الإسلامية. وقد وجدوا أن معدل انتشار فرط ضغط الدم 17.3٪، وخلل شحوم الدم 66.3٪، والسكري 5.6٪، فيما بلغ معدل معرفة الناس بإصابتهم بفرط ضغط الدم 40.3٪ ومعدل معالجته 35.3٪، ومعدل ضبطه 5.9٪، أما معدل معرفة الناس بإصابتهم بخلل شحوم الدم فكان 14.4، ومعدل معالجته 7.1٪ ومعدل ضبطه 6.5٪ ومعدل معرفة الناس بالسكري 54.6٪ ومعدل معالجته 46.2٪.

ABSTRACT We used data from the baseline survey from the Isfahan Healthy Heart Programme to determine the prevalence of hypertension, dyslipidaemia and diabetes among a representative samples of 12 514 adults living in 3 cities in the Islamic Republic of Iran. The prevalence of hypertension, dyslipidaemia and diabetes was 17.3%, 66.3% and 5.6% respectively. Awareness, treatment and control of hypertension were 40.3%, 35.3%, and 9.1% respectively. The rates for dyslipidaemia were 14.4%, 7.1% and 6.5% respectively, and 54.6% of diabetics were aware of their disease and 46.2% were under treatment.

Connaissance, traitement et contrôle de l'hypertension, de la dyslipidémie et du diabète sucré dans une population iranienne : l'étude IHHP

RÉSUMÉ Nous avons utilisé les données de l'étude de référence réalisée par le programme de santé cardiaque d'Ispahan (IHHP) afin de déterminer la prévalence de l'hypertension, de la dyslipidémie et du diabète dans un échantillon représentatif de 12 514 adultes vivant dans trois villes de la République islamique d'Iran. La prévalence de l'hypertension, de la dyslipidémie et du diabète était respectivement de 17,3 %, 66,3 % et 5,6 %. Les taux de connaissance, de traitement et de contrôle de l'hypertension étaient respectivement de 40,3 %, 35,3 % et 9,1 %. Les taux de dyslipidémie étaient respectivement de 14,4 %, 7,1 % et 6,5 %. En outre, 54,6 % des diabétiques étaient informés sur leur maladie et 46,2 % étaient sous traitement.

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Introduction

Hypertension, dyslipidaemia and diabetes mellitus are well-documented, modifiable risk factors for cardiovascular disease (CVD) [1]. The rise in noncommunicable diseases (NCDs) is increasing much more rapidly in developing countries than in industrialized countries, and CVDs are known to be the leading cause of mortality and morbidity worldwide [2,3].

Hence, CVD risk reduction has been the focus of many health education programmes. Cholesterol levels < 200 mg/dL or low-density lipoprotein cholesterol (LDL-C) < 130 mg/dL, blood pressure (BP) < 140/90 mmHg and control of plasma glucose in diabetics are the aims for optimal health in these programmes.

One strategy for achieving these objectives is to increase awareness of hypertension, dyslipidaemia and diabetes at the population level [4]. Population studies are essential to assess the distribution of BP, lipid profile and blood glucose in order to estimate the high-risk population, as well as prevalence, awareness, treatment and control in regard to the aforementioned risk factors [5].

Our previous study showed that the prevalence, awareness, treatment and control of hypertension were 28.2%, 62.3%, 33.1% and 14% respectively, and the awareness of having diabetes was 70% [6]. No figures exist, however, for dyslipidaemia in our community.

The current survey aimed to investigate the prevalence, awareness, treatment and control of hypertension, diabetes and dyslipidaemia in a population of Iranian adult, as part of an ongoing community-based programme for prevention and control of CVD and its risk factors, the Isfahan Healthy Heart Programme.

Methods

The Isfahan Healthy Heart Programme is a comprehensive, integrated, community-based, action-oriented programme for NCD prevention and control. We have previously published the methodology in detail [7]. Briefly, we performed a cross-sectional study in 2000–2001 as the baseline survey of a national programme. Isfahan Cardiovascular Research Centre, a World Health Organization (WHO) Collaborating Centre, and Isfahan Provincial Health Office, both affiliated to Isfahan University of Medical Sciences, are jointly conducting this programme.

Isfahan (population 1 895 856) and Najaf-Abad (population 275 084) were the sites of the survey; Arak (population 668 531) was the reference area. The populations of the 3 cities were studied for major NCD risk factors, as well as behaviours, attitudes, skills and knowledge.

For the baseline survey, 12 514 adults aged ≥ 19 years were randomly selected via a 2-stage random cluster sampling (we doubled the total number owing to our use of the cluster method). Inclusion criteria were: Iranian nationality, mental competence and not being pregnant. The sample was divided it into different age groups (19–25, 25–34, 35–44, 45–54, 55–64 and ≥ 65 years) in both sexes according to the distribution in the community.

Informed written consent was obtained from all participants and they all underwent interview to obtain information on demographic and socioeconomic aspects, and physical examination and laboratory analysis which included: height; weight; waist circumference (WC); BP; serum total cholesterol (TC), triglycerides (TG); fasting blood glucose; serum high-density lipopro-

tein cholesterol (HDL-C); serum LDL-C; and glucose tolerance.

Hypertension was defined as a systolic blood pressure (SBP) ≥ 140 mmHg, or diastolic blood pressure (DBP) ≥ 90 mmHg, or being on antihypertensive therapy. Awareness of hypertension was defined as self-reporting of any prior diagnosis of hypertension by a health-care professional. Treatment rate of hypertension was defined as the proportion of hypertensive participants who reported receiving prescribed antihypertensive medication for the management of high BP at the time of the interview. Control rate was defined as the proportion of hypertensive participants on antihypertensive therapy who had SBP < 140 mmHg and DBP < 90 mmHg [8].

The presence of dyslipidaemia was defined according to the National Cholesterol Education Program Adult Treatment Panel III guideline: LDL-C ≥ 130 mg/dL or HDL-C < 40 mg/dL or TC ≥ 200 mg/dL or TG ≥ 150 mg/dL [9]. Awareness of dyslipidaemia was self-reporting of any prior diagnosis of dyslipidaemia by a health-care professional. Its treatment was defined as the proportion of aware dyslipidaemic individuals who reported receiving prescribed antihyperlipidaemia medication for management of dyslipidaemia at the time of the interview.

Diagnosis of diabetes was based on international criteria recommended by WHO and the Committee on the Diagnosis and Classification of Diabetes Mellitus: fasting blood glucose concentration ≥ 126 mg/dL, or a 2-hour value in an oral glucose tolerance test was ≥ 200 mg/dL [10,11]. The best method to demonstrate control of plasma glucose is measurement of A_1C haemoglobin. Unfortunately this was not measured in the Isfahan Healthy Heart Programme so we could not report on control rate of diabetes.

As our previous study among this population showed that individuals with dyslipidaemia, diabetes and hypertension paid more attention to their diet – frequency of consumption of hydrogenated fat, red meat and sweets was significantly lower than in other individuals (H.A. Javed et al., unpublished data) – we did not assess the association of diet with these disorders.

Statistical analysis

Data were summarized as mean and standard deviation (SD) for continuous variables and as frequency and percentage for categorical variables. We divided the subjects into 3 age groups: 19–29, 30–59 and ≥ 60 years. We also categorized education into 3 levels: illiterate, school education and university education; occupation into 5 categories: government employee, private sector employee, housewife unemployed and retired; and marital status into 2 categories: married and single/divorced/widowed.

We used the chi-squared and Mantel–Haentzel tests for comparison of categorical variables and t-test and analysis of variance for continuous variables. Logistic regression analysis was carried out to calculate the adjusted odds ratio (OR) and 95% confidence interval (CI) for the effect of exposure variables on awareness, treatment and control of hypertension, dyslipidaemia and diabetes.

All statistical analyses were performed with SSPS, version 11.5. The significance level was set at $P < 0.05$.

Results

The study included 12 514 participants; 6391 women and 6123 men. The mean age was 38.9 (SD 14.9) years, 72.7% were urban residents and 80% were married. The mean values for lipid profile, blood glucose and blood pressure are shown in Table 1.

Table 1 **Mean of paraclinical parameters: Isfahan Healthy Heart Programme study**

Parameter	Mean	Standard deviation
Total cholesterol (mg/dL)	198.7	55.9
Triglycerides	169.6	109.6
LDL-C (mg/dL)	118.0	40.0
HDL-C (mg/dL)	47.0	12.5
Fasting blood glucose (mg/dL)	83.7	31.6
Systolic BP (mmHg)	115.7	19.1
Diastolic BP (mmHg)	75.5	11.0

LDL-C = low-density lipoprotein cholesterol.
HDL-C = high-density lipoprotein cholesterol.
BP = blood pressure.

The prevalence of hypertension, dyslipidaemia and diabetes were 17.3%, 66.3% and 5.6% respectively (Table 2). Awareness, treatment and control of hypertension, dyslipidaemia and diabetes are also presented in Table 2.

As shown in Table 3, increasing age and certain occupations were significantly associated with awareness of hypertension. Awareness in patients ≥ 60 years was 8-times more than those aged < 30 years, and awareness of hypertension in housewife and retired individuals was higher than other jobs. Older patients were more likely to be having treatment than younger patients: OR = 4, 95% CI: 1.32–12.15 for 30–59-year-old age group and OR = 7.5, 95% CI: 2.39–23.46 for those aged ≥ 60 years. In addition, housewives had more success in treatment than those who were unemployed

(OR = 4.19, 95% CI: 1.03–17.00). In contrast, hypertension was controlled more in younger subjects (< 30 years) than those aged > 30 years (OR = 0.12, 95% CI: 0.03–0.48 for 30–59 years and OR = 0.11, 95% CI: 0.03–0.46 for those aged ≥ 60 years. Living in urban areas was also significantly associated with control of hypertension (OR = 1.71, 95% CI: 1.13–2.58).

For dyslipidaemia, while older age and urban residence were significantly associated with awareness, having a job in the private sector and being unemployed increased the odds of being unaware. These subjects had lower awareness about their dyslipidaemia than other job groups (Table 3). The likelihood of treatment of dyslipidaemia was higher in participants with school education compared with those with a university education (OR = 1.76, 95% CI: 1.01–3.7) and in retired persons compared with employed individuals (OR = 2.17, 95% CI: 1.13–4.15). We did not find any factors significantly associated with the control of dyslipidaemia.

Similar to hypertension and dyslipidaemia, logistic regression analysis determined that age > 30 years was significantly associated with awareness of diabetes (Table 3). However, we found no factors significantly associated with treatment of diabetes.

Discussion

In this study, the first in its kind in the Islamic Republic of Iran, and to the best of our

Table 2 **Prevalence, awareness, treatment, and control rate of hypertension, dyslipidaemia and diabetes: Isfahan Healthy Heart Programme study**

Condition	Prevalence %	% awareness	% treatment (% total)	% control (% total)
Hypertension	17.3	40.3	87.7 (35.3)	25.8 (9.1)
Dyslipidaemia	66.3	14.4	49.7 (7.1)	90.9 (6.5)
Diabetes mellitus	5.6	54.6	84.7 (46.2)	–

Table 3 **Factors influencing the awareness of hypertension, dyslipidaemia and diabetes: Isfahan Healthy Heart Programme study**

Variable	Hypertension OR (95% CI)	Dyslipidaemia OR (95% CI)	Diabetes mellitus OR (95% CI)
Sex			
Male	1	1	1
Female	1.23 (0.64–2.36)	1.10 (0.75–1.70)	2.15 (0.53–8.74)
Age (years)			
19–29	1	1	1
30–59	4.05 (2.32–7.08)	7.26 (5.34–9.90)	4.90 (1.72–13.93)
≥ 60	8.63 (4.89–15.22)	11.34 (8.10–15.90)	6.23 (2.14–18.11)
Education			
Illiterate	1 (0.60–1.67)	0.79 (0.61–1.03)	1.4 (0.56–3.5)
School	0.72 (0.44–2.27)	0.85 (0.63–1.16)	1.3 (0.49–3.42)
University	1	1	1
Job			
Government sector	1	1	1
Private sector	1.12 (0.71–1.78)	0.77 (0.60–0.97)	0.63 (0.3–1.31)
Housewife	2.30 (1.16–4.56)	1.22 (0.80–1.86)	0.38 (0.09–1.60)
Unemployed	1.13 (0.64–1.97)	0.57 (0.38–0.85)	0.92 (0.37–2.30)
Retired	2.10 (1.24–3.55)	1.14 (0.78–1.65)	1.06 (0.46–2.44)
Residence			
Urban	1.23 (0.99–1.52)	1.34 (1.15–1.57)	0.96 (0.66–1.40)
Rural	1	1	1
Marital status			
Married	1.15 (0.87–1.51)	1.08 (0.87–1.33)	1.26 (0.77–2.06)
Single/widowed/divorced	1	1	1

OR = odds ratio; CI = confidence interval.

knowledge in the WHO Eastern Mediterranean Region, we found a high prevalence of CVD risk factors, with a low rate of awareness, treatment and control. The prevalence of hypertension was 17.3%, dyslipidaemia 66.3%, and diabetes 5.6%. Our previous study in Isfahan showed corresponding figures of 25.5%, 18.5% and 4.6% [*12*]. Prevalence of hypertension in the present study was lower than in many countries other than the United States of America (USA) [*13–21*]. Awareness of hypertension was similar to that in China, Portugal and Egypt [*22–26*], but was greater than in Malaysia [*27*]. Many studies in different countries have reported success in increasing awareness of hypertension in the population [*13–*

21]. The treatment rate f hypertension in our study was higher than in some of the above studies but lower than others; for example, the USA, Greece, France and Brazil have reported higher rates [*14–28*]. We should acknowledge that, as in many previous surveys, the BP levels in our study were based on the average of 2 measurements at a single visit, and the definition we used for high BP might overestimate the prevalence. Nonetheless, we documented a lower prevalence of hypertension than other studies.

The "rule of halves" predicts that only half of all those with hypertension are detected; half of those detected are treated and half of those treated are adequately controlled [*29*]. Our finding did not follow

this rule, i.e. among the aware subjects, the treatment rate was greater than 50%.

Multivariable analysis demonstrated that the factor that most predicted awareness, treatment and control of hypertension was age. Increase in age was a positive factor in increasing awareness and treatment rates. However, age > 30 years was a risk factors for uncontrolled of hypertension.

In contrast to hypertension, dyslipidaemia was more prevalent in our country than in many others [22–28]. Our finding was only similar to the Brazilian study [30]. This may be because of the high intake of hydrogenated solid fats rich in saturated and trans fatty acids, as well as the high intake of carbohydrates as the main food in the Iranian diet. In addition, the existing sedentary lifestyle may be another contributing factor to this high prevalence of dyslipidaemia.

In a study in China, the awareness, treatment and control rates of hypercholesterolaemia were 8%, 3.5% and 1.5% respectively [31]. Frontini et al. demonstrated that in the USA, awareness about dyslipidaemia and its treatment were 21% and 4% respectively. Consistent with our results, they found that older people had greater knowledge and awareness than younger people [32]. Other findings from the USA showed an increasing trend in awareness, treatment and control of hyperlipidaemia in recent years. They showed an increase of 35% for awareness, 12% for treatment and 5.4% for control [33].

The incidence of diabetes has increased in the past decade: prevalence is estimated to be 4.1% worldwide [34]. It is rapidly increasing in the developing countries, and Asians are suggested to have an ethnic predisposition to the metabolic syndrome and diabetes [35]. In our study, more than half the diabetes patients were aware of their disease (54.6%) and most of those were under treatment (84.7%). As we did

not check the HbA_1C in this study, we could not assess the control. However, previous studies in Isfahan have shown that 75% of patients aged < 30 years had an acceptable level of HbA_1c and those aged > 30 years had a higher control rate of 82% [36,37].

There were some limitations to our study. First, as in many surveys, BP were based on the average of 2 measurements at a single visit; a more precise estimate of BP levels would be obtained by multiple measurements over several visits. Other potential sources of bias include the self-reported hypertensive treatment by the participants. For instance, participants who wrongly reported not receiving antihypertensive therapy and had their BP below 140/90 mmHg were considered as normotensive. We did not divide diabetic individuals according to the diabetes type; however only 0.3% (7 out of 2310) of individuals aged 19–25 years had diabetes, and this small number would not change the results obtained for all diabetic patients. A further limitation was that control of diabetes was not examined because we had not measured HbA_1C.

In recent decades, WHO has warned about NCDs, notably CVD and stroke. It has noted that these diseases have emerged as a public health problem in the developing countries. The Isfahan Healthy Heart Programme is an ongoing community-based intervention programme, with one of its objectives being to reduce CVD and CVD-related mortality and morbidity in the Iranian community. Our findings therefore provide important information on the prevalence, awareness, treatment and control of hypertension, dyslipidaemia, and diabetes, which are major CVD risk factors. They suggest that public health measures are necessary to increase the awareness, treatment and control of these conditions, particularly as they are likely to increase in the near future.

Acknowledgements

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World Diabetes Day is celebrated every year on November 14

The World Diabetes Day campaign is led by the International Diabetes Federation and its member associations. The theme for the period 2009–2013 is "Diabetes Education and Prevention".

The campaign draws attention to issues of paramount importance to the diabetes world and keeps diabetes firmly in the public spotlight. This year sees the first of a five-year campaign that will address the growing need for diabetes education and prevention programmes.

More information is available on the World Diabetes Day web site at: http://www.worlddiabetesday.org/