

Blood pressure patterns among the Omani population

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أنماط ضغط الدم بين العُمانيين

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خلاصة: كان الهدف من إجراء المسح الوطني لضغط الدم، تحديد مستويات ضغط الدم بين العُمانيين البالغين من العمر 18 عاماً فأكثر، ودراسة العوامل الوبائية الأكثر ارتباطاً بضغط الدم، واقتراح برنامجاً لمعالجة وسكافة ارتفاع ضغط الدم في عُمان. فمن بين 4732 شخصاً تم فحصهم وجد أن 1278 (27.01%) شخصاً كانوا مصابين بارتفاع ضغط الدم. وأظهر تحليل التحيف المتعدد الخطي أن ضغط الدم كان يعتمد على عدة عوامل مجتمعة هي العمر ومنسب كتلة الجسم ومقدار دخل الفرد. وتطبيق معادلة التحيف اللوجستي، وجد أن الاختطارات المصححة كانت زائدة بدرجة جوهرية بين السُمان والبالغين من العمر 45 سنة فأكثر، مقارنة بالفئات المختلفة ذات الصلة. وتناقش هذه الدراسة خطة وطنية توصي بها لمكافحة ارتفاع ضغط الدم ومعالجته.

ABSTRACT The National Blood Pressure Survey aimed to determine blood pressure levels among Omanis ≥ 18 years, study the epidemiological factors most related to blood pressure and suggest a programme for the management and control of hypertension in Oman. Of the 4732 people screened, 1278 (27.01%) had high blood pressure. Multiple regression analysis showed that blood pressure depended on age, body mass index and income per capita simultaneously. In a logistic regression model, adjusted risks associated with obesity and those aged ≥ 45 years were significantly increased compared with the relevant different categories. A national plan of action for hypertension control and management is recommended and discussed.

Les niveaux de pression artérielle dans la population omanaise

RESUME L'enquête nationale sur la pression artérielle avait pour objectifs de déterminer les niveaux de pression artérielle chez les Omanais âgés de 18 ans et plus, d'étudier les facteurs épidémiologiques les plus liés à la pression artérielle et de proposer un programme de prise en charge et de contrôle de l'hypertension à Oman. Sur les 4732 personnes examinées, 1278 (27,01%) avaient une pression artérielle élevée. L'analyse de régression multiple a montré que la pression artérielle dépendait simultanément de l'âge, de l'indice de masse corporelle et du revenu par personne. Dans un modèle de régression logistique, les risques ajustés associés à l'obésité et aux sujets âgés de 45 ans et plus augmentaient de manière significative à comparer avec les différentes catégories correspondantes. Un plan d'action national pour le contrôle et la prise en charge de l'hypertension est recommandé et discuté.

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Introduction

Hypertension, or high blood pressure, is a chronic condition of concern because of its role in the causation of coronary heart disease, stroke and other vascular complications, which have a combined mortality that exceeds 50% of the total deaths in some countries. Moreover, the morbidity and personal and social burden of treatment contribute further to the immense cost of hypertension [1,2]. Raised awareness of public health and the economic implications of hypertension are now directing attention to the need for long-term control programmes that focus on primary prevention, early detection and adequate treatment [3,4].

Most investigators consider high blood pressure to be a quantitative deviation from the norm and this view has fostered the epidemiological approach to hypertension, in which the distribution, determinants and development of hypertension have been investigated [5-7].

The National Blood Pressure Survey aimed to determine the blood pressure pattern in the Omani population (≥ 18 years), to study the epidemiological factors most related to blood pressure and to suggest a programme for the management and control of hypertension in Oman.

Subjects and methods

A cross-sectional study was carried out on a representative sample selected by the multistage stratified random procedure. The sample was distributed in the nine regions by the total size of the Omani population in each region. The first stage of sampling was the selection of 20 health units from the list provided by the Health Information Section. The sample size in each region was

distributed proportionally in the units selected based on the average daily attendance in the outpatient clinic. The second stage of sampling was the systematic selection of the sample within each health unit. The people selected were the index cases for the families included in the survey (≥ 18 years). Household members were asked to come to the health centre for completion of the survey. Those who did not attend were visited in their homes.

Data were collected using a structured questionnaire interview and some measurements. Basic data such as age, address, level of education, occupation, family size and income per month were also collected. Personal habits such as smoking, including the number of cigarettes smoked per day and age at starting smoking, were recorded. Usual and leisure physical activity was determined and a family history of diabetes, stroke and hypertension was recorded. Participants were asked whether they had been told by a doctor that they had high blood pressure and at what age. Certain anthropometric measurements, such as height and weight were taken. Blood pressure was measured using a mercury sphygmomanometer and the auscultatory method. The technique to be used in measuring blood pressure was described in a systematic way in order to standardize the method as much as possible in all health institutions. Systolic and diastolic blood pressures were measured at least twice and the mean of each was calculated and recorded.

Results

The total Omani population examined was 4732 people; 2210 (46.70%) males and 2522 (53.30%) females. Table 1 shows some characteristics of the participants. A significant difference was observed be-

Table 1 Characteristics of the studied sample of the Omani population by sex, Oman, 1994

Characteristic	Males n = 2210	Females n = 2522
Age (years) (mean \pm s)	37.11 \pm 15.15	36.38 \pm 13.3
Literate (%)	64.18*	35.37
Smoking (%)	23.47*	1.62
Median age at starting smoking (years)	18.5	15.0
Median duration of smoking (years)	11.37	7.49
Obesity (%) (BMI \geq 30 kg/m ²)	8.89	17.74*
Occupational physical activity (% sedentary)	39.21*	21.18
Leisure physical activity (% doing aerobic sports)	22.46*	3.05
Systolic blood pressure (mmHg) (mean \pm s)	121.18 \pm 23.3	120.47 \pm 22.81
Diastolic blood pressure (mmHg) (mean \pm s)	77.48 \pm 14.03	76.99 \pm 13.26

*Significant at $P < 0.001$

s = standard deviation

BMI = body mass index

tween males and females regarding literacy, smoking, obesity, and occupational and leisure physical activity.

The mean systolic blood pressure (SBP) was 120.82 \pm 23.01 mmHg; 121.47 \pm 23.30 mmHg for males and 120.47 \pm 22.81 mmHg for females. This difference was not significant. The mean diastolic blood pressure (DBP) was 77.22 \pm 3.06 mmHg; 77.48 \pm 14.03 mmHg for males and 76.99 \pm 13.27 mmHg for females, with no significant difference. A significant positive correlation between both systolic and diastolic blood pressures was observed ($r = 0.81$). There was also a positive correlation between both systolic and diastolic blood pressures with age and body mass index (BMI) (Table 2). To show how much systolic and diastolic blood pressure levels depend on these factors simultaneously, multiple regression analysis was used. For SBP, the coefficient of multiple determination for the regression model was 0.588 and the multiple linear regression function was:

$$18.01 + 0.67 x_1 + 0.237 x_2 + 0.36 x_3 + 0.029 x_4$$

Table 2 Correlation of systolic and diastolic blood pressure with some epidemiological variables among the Omani population, Oman, 1994

Variable	Systolic r	Diastolic r
Age	0.3524*	0.2105*
Body mass index	0.0702*	0.0474*
Income per capita	-0.0024	0.03
Family size	0.0091	0.016

*Significant

 r = correlation coefficient

where: x_1 , x_2 , x_3 and x_4 represent DBP, age, BMI and income per capita (IPC) (Table 3).

For DBP, the coefficient of multiple determination of the regression model was 0.537 and the multiple linear regression function was:

$$26.918 + 0.75 x_1 - 0.06 x_2 - 0.0065 x_3 + 0.5 x_4$$

Table 3 Regression model fitted to systolic blood pressure among the Omani population, Oman, 1994

Variable	Unstandardized coefficient (B)	Standardized coefficient (Beta)	t
Body mass index	0.00887	0.36	3.561
Age	0.3339	0.237	22.57
Diastolic blood pressure	1.176	0.67	64.215
Income per capita	-0.13	-0.029	-2.879
Constant	18.01	-	12.691

Multiple r = 0.76

Adjusted R² = 0.588

Table 4 Regression model fitted to diastolic blood pressure among the Omani population, Oman, 1994

Variable	Unstandardized coefficient (B)	Standardized coefficient (Beta)	t
Body mass index	-0.004	-0.0065	-0.6
Age	-0.0484	-0.06	-0.5
Systolic blood pressure	0.4313	0.75	64.2
Income per capita	0.013	0.5	4.7
Constant	26.918	-	35.12

Multiple r = 0.537

Adjusted R² = 0.537

where: x_1, x_2, x_3 and x_4 represent SBP, age, BMI and IPC (Table 4).

Table 5 shows that of the 4732 people screened, 1278 (27.01%) had high blood pressure. The rate was 27.83% for males and 26.89% for females, a non-significant difference. Diastolic hypertension (≥ 90 mmHg) accounted for 19.95% of hypertension and systolic hypertension (≥ 140 mmHg when DBP < 90 mmHg) for only 7.06%.

Table 6 shows that there was an increased risk of hypertension among males, people aged ≥ 45 years and those of seden-

tary occupational and leisure physical activity. Higher risks were also observed among widows and divorced women and those with less than preparatory education. When the epidemiological variables related to hypertension were assessed simultaneously in a logistic regression model, adjusted risks associated with obesity and those aged ≥ 45 years were significantly increased compared with the other relevant categories. Adjusted risks were also greater among males, widows and divorced women, those with less than preparatory education and people with a sedentary lifestyle.

Table 5 Prevalence of hypertension among the Omani population by sex, Oman, 1994

Systolic	Diastolic				Total	
	Normotensive (< 90 mmHg)		Hypertensive (≥ 90 mmHg)		No.	%
	No.	%	No.	%		
<i>Normotensive (< 140 mmHg)</i>						
Male	1595	33.71	219	4.62	1814	38.33
Female	1859	39.29	163	3.44	2022	42.73
Total	3454	73.00	382	8.06	3836	81.06
<i>Hypertensive (≥ 140 mmHg)</i>						
Male	150	3.17	246	5.20	396	8.37
Female	184	3.89	316	6.68	500	10.57
Total	334	7.06	562	11.88	896	18.94
<i>Total</i>						
Male	1745	36.88	465	9.82	2210	46.70
Female	2043	43.18	479	10.12	2522	53.30
Grand total	3788	80.06	944	19.95	4732	100.00

Table 6 Crude and adjusted odds ratios of hypertension according to certain epidemiological variables, Oman, 1994

Variable	Crude odds ratio (95% CI)	χ^2_{MH} (P)	Adjusted odds ratio (95% CI)
Sex	1.09 (0.96–1.75)	1.75 (0.185)	1.43 (0.91–1.36)
Age (< 45 years versus ≥ 45 years)	4.74 (4.12–5.45)	515.6 (0.000000)*	4.31 (3.67–5.05)*
Occupational physical activity (sedentary versus active)	1.65 (1.32–2.08)	19.3 (0.000017)*	1.05 (0.88–1.28)
Leisure physical activity (moderate and vigorous versus sedentary and light)	1.90 (1.5–2.4)	29.7 (0.000000)*	1.12 (0.95–1.32)
Marital status (widowed and divorced versus others)	2.47 (2.0–3.05)	72.79 (0.000000)*	1.28 (1.06–1.55)
Literacy (below preparatory versus preparatory and above)	1.97 (1.65–2.35)	57.53 (0.000000)*	1.11 (0.92–1.36)
Obesity (BMI ≥ 30 kg/m ²)	2.24 (1.87–2.67)	81.24 (0.000000)	2.51 (2.06–3.05)

*Significant

CI = confidence interval

BMI = body mass index

Discussion

Hypertension is the commonest cardiovascular disorder and is a major public health challenge to societies in socioeconomic and epidemiological transition. It is one of the major risk factors for cardiovascular mortality, which accounts for 20%–50% of all deaths worldwide [1,4]. Epidemiological studies have consistently identified an important and independent link between high blood pressure and various disorders, especially coronary heart disease, stroke, congestive heart failure and impaired renal function [8–10].

Although it is obviously better to prevent than to treat a disease, interest has focused on primary prevention of high blood pressure only in very recent years. Hypertension is of importance mainly as a risk factor for heart and brain diseases and, to date, efforts have been made to reduce high blood pressure levels rather than to prevent their occurrence. Therapy for high blood pressure, whether with drugs or in other ways, is a primary preventive measure for cardiovascular or coronary heart disease. However, it should be remembered that in many countries half the people with high blood pressure are not known, half of those who are known are not treated and half of those treated are not controlled. Thus, the need for primary prevention is clear, but for it to have an adequate impact on a population, both high risk and mass strategies must be implemented [11–13].

Rapid socioeconomic development in Oman, accompanied by a proliferation of educational establishments, hospitals and other medical facilities, and improved sanitation have led to a reduction in communicable diseases. Infectious and parasitic diseases in 1993 constituted only 9.7% of all hospital discharges with a rate of 10.8 per 10 000 population [14]. Hence, the in-

creasing public health importance of non communicable diseases, such as hypertension.

The prevalence rate of hypertension (27.01%) detected in our study in Oman is approaching that of industrialized countries [12,13,15,16]. Similar rates have been reported in Egypt. The Egyptian National Hypertension Survey reported an estimated prevalence of 26.3% (systolic pressure ≥ 140 mmHg, and/or diastolic pressure ≥ 90 mmHg, and/or reported treatment with one or more antihypertensive drug) [17,18]. Lower rates have been reported in India [19–21] and China [22,23].

Estimates of the prevalence of hypertension depend on the cut-off point by which it is defined. Since there is a direct relation between blood pressure and the risk of complications, the decision is arbitrary as to who is at risk and who is healthy. Cross-sectional surveys and prospective cohort studies have consistently demonstrated a positive relation between age and blood pressure in most populations with diverse geographical, cultural and socioeconomic characteristics [23]. There is substantial evidence to suggest that regular physical activity reduces the risk of heart disease. Less clear is the extent to which this is caused by blood pressure reduction [15,16,24,25]. Evidence for a direct, strong and consistent relationship between weight and blood pressure has emerged from cross-sectional and prospective observational studies. In most studies, being overweight is associated with a twofold to sixfold increase in the risk of developing hypertension [26,27].

There is a need to develop and implement a national plan of action for the management and control of hypertension in Oman. The plan should be a component of the national health care system designed for the health protection and promotion of the general population. A plan should be pre-

pared with specific objectives, targets should be set and detailed activities planned with a time frame. Process and outcome measures should be developed. However, certain essential requirements are needed before a plan can be established. These include public awareness about the increasing problem of hypertension and the need for intervention, political will and commitment, and availability of resources [1]. The Cardiovascular Disease Committee should be charged with the planning, implementation and evaluation of the plan. Activities should be planned in coordination with similar integrated efforts directed against other noncommunicable diseases. Implementation of the programme can be achieved by strengthening human resources development and by integrating it fully into the existing health care system. The activities of the health services at primary, secondary and tertiary levels should be specified. Primary health care should take the major load of providing health care for hypertensive people as the majority of them live in rural areas. Primary health care personnel should be trained in the health care and special needs of this vulnerable segment of the population. Guidelines for prevention, identification of risk factors and high risk groups, early detection of cases and clinical management should be prepared.

Conclusion and recommendations

The results of the National Blood Pressure and Coronary Heart Disease Surveys show that the prevalence rate of hypertension in Oman is approaching that of industrialized countries. Obese Omani people and those aged ≥ 45 years are at an increased risk of developing hypertension. There is a need to develop and implement a national plan of action for the management and control of hypertension in Oman. The plan should be a component of the national health care system designed for health protection and promotion of the general population and should operate within the primary health care system.

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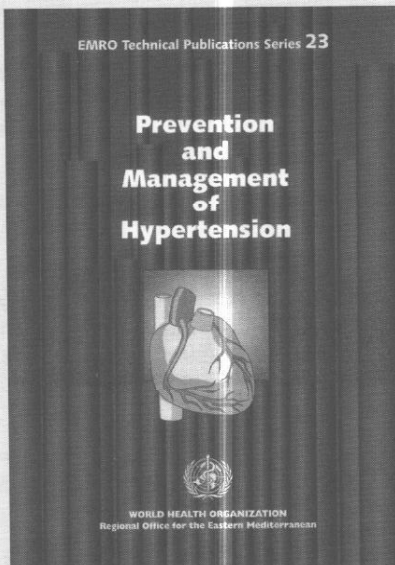
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Why has this book been written

Hypertension is a major health problem in the Eastern Mediterranean Region. It causes considerable human suffering and enormous health care costs. It is associated with the development of serious and potentially fatal complications, such as cardiovascular and renal diseases. This publication reviews strategies for the prevention of hypertension in the Eastern Mediterranean populations and provides clinical practice guidelines for the management of high blood pressure with special emphasis on the role of primary health care.

Who is the target audience?

This publication is aimed at government health planning departments, health managers, physicians and health personnel at all levels of the health-care system.

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