Epidemiology of hypertension and other cardiovascular disease risk factors in the urban population of Soussa, Tunisia

H. Ghannem [1] and A. Hadj Fredj [1]

وبائيات ارتفاع ضغط الدم وعوامل الاختطار الأخرى للأمراض القلبية الوعائية، في المجتمع الحضري بمدينة سوسة، تونس

حسن غنام وعبد الكريم حاج فرج

خلاصة: من أجل إيضاح توزُّع ارتفاع ضغط الدم في المجتمع، أجري استقصاء وبائي على عينة ممثلة شملت 957 من البالغين من العمر 20 سنة أو أكثر، ممن كانوا يقيمون في سوسة بتونس عام 1995. وتبيَّن أن معدل انتشار ارتفاع ضغط الدم، وفقاً للمعايير الجديدة لمنظمة الصحة العالمية (ضغط الدم الانقباضي أكثر من 140 ميليمتر زئبق أو ضغط الدم الانبساطي أكثر من 90 ميليمتر زئبق أو كلاهما) كان يبلغ 28.9%. وكان ارتفاع ضغط الدم أعلى بدرجة ملحوظة في حالات السِّمنة، وفي السمنة الذكرية، وفي من تزيد أعمارهم على أربعين سنة. ولقد وجد في قصة المرض سوابق الإصابة بالسكّري في 10.2% من الحالات، والسمنة في 27.7%، وزيادة الوزن في 56.7%، والسمنة الذكرية في 36.0%، وممارسة التدخين في 61.4% من الرجال و4.2% من النساء.

ABSTRACT To illustrate the distribution of hypertension in the community, an epidemiological survey was conducted based on a representative sample of 957 adults aged ≥20 years resident in Soussa, Tunisia in 1995. The prevalence of hypertension according to the new World Health Organization criteria (systolic blood pressure >140 mmHg and/or diastolic blood pressure >90 mmHg) was 28.9%. Hypertension was significantly higher in cases with obesity, android obesity and for persons aged >40 years. History of diabetes was found in 10.2% of cases, obesity in 27.7%, overweight in 56.7%, android obesity in 36.0% and smoking in 61.4% of men and 4.2% of women.

Epidémiologie de l'hypertension et des autres facteurs de risque de maladies cardio-vasculaires dans la population urbaine de Sousse (Tunisie)

RESUME Afin d'illustrer la distribution des cas d'hypertension dans la communauté, une enquête épidémiologique a été réalisée en 1995 sur la base d'un échantillon représentatif composé de 957 adultes âgés de 20 ans et plus et résidents à Sousse (Tunisie). La prévalence de l'hypertension selon les nouveaux critères de l'Organisation mondiale de la Santé (PAS > 140 mmHg et/ou PAD >90 mmHg) s'élevait à 28,9%. L'hypertension était considérablement plus élevée dans les cas associés à une obésité et une obésité androïde ainsi que chez les personnes âgées de plus de 40 ans. Des antécédents de diabète ont été trouvés dans 10,2% des cas, une obésité dans 27,7% des cas. une surcharge pondérale dans 56.7% des cas. une obésité androïde dans 36% des cas et le tabagisme dans 61,4% des cas chez les hommes et 4,2% chez les femmes.

[1]*Department of Community Medicine, Faculty of Medicine, University of Soussa, Soussa, Tunisia.*
Received: 27/05/97; accepted: 29/07/97

Introduction

Hypertension is a major risk factor for cardiovascular diseases (CVD) [*1,2*] which are still the leading causes of death in European and North American societies [*3,4*] despite the downward trend observed during the past three decades [*5–8*]. Furthermore, hypertension is a very common disease and its prevalence varies greatly within and between countries [*9–11*].

The epidemiological transition being observed in developing countries [*12*], will lead to an increase in the prevalence of hypertension as a result of increased life expectancy and the stress of urbanization, which is growing rapidly in almost all developing countries [*13*].

In Tunisia, little is known about the hypertension distribution in the urban population; a few studies have been undertaken in rural or semiurban populations [*14*] or designed particulary to assess other CVD risk factors such as diabetes in the community [*15*].

In order to assess the magnitude of the problem of hypertension in the community and to establish a CVD risk-factor profile, we undertook an epidemiological survey in the urban population of Soussa as the first step of a comprehensive control programme of chronic diseases.

Subjects and methods

The study population was composed of adults aged 20 years and over who were resident in the city of Soussa during the year 1995/1996. We used a two-stage cluster sampling using the lists of districts and households of Soussa given by the 1994 Census. The sample size required (n = 1225) was calculated according to an estimated prevalence of hypertension of 15% [*13*], with a precision of 2% and a confidence level of 95%. The sample size corresponded approximately to 409 households if we considered an average of three persons aged ≥ 20 years per household. We added about 60 households to compensate for any refusal to participate, anticipated to be around 10%–15%. The sampling of 465 households was systematic (1/4) from the list of districts already chosen systematically (1/15) in the city of Soussa and was done by the Regional Office of the Tunisan National Institute of Statistics. The survey was carried out in Soussa from September to November 1995.

The study team was composed of a social worker to sensitize people to the aims of the study and to encourage their participation, two physicians for the physical examination and a dietician to assess food consumption by a 24-hour recall and frequency questionnaire. The study variables in the questionnaire included sociodemographic data, medical history, dietary habits, drinking and smoking habits, and data from the physical examination. Measurement of blood pressure was done using an auto-inflate digital electronic monitor (Spengler, Mistral). The first measurement was taken after a 15-minute rest in a sitting position and was followed by two subsequent measurements in the middle and at the end of the interview. The average of the three measurements was used to assess the presence or absence of hypertension according to two criteria (systolic blood pressure ≥ 160 mmHg and/or diastolic blood pressure ≥ 95 mmHg and systolic blood pressure ≥ 140 mmgHg and/ or diastolic blood pressure ≥ 90 mmHg). Those with high blood pressure were referred to ambulatory clinics for confirmation of the diagnosis. Diabetes was assessed according to a previous medical history of diabetes: serum lipids were not measured in this study.

Weight was measured bare-foot and expressed in kilograms (kg) and the height expressed in centimetres; waist and hip measurements were also expressed in centimetres. The body mass index (BMI) (kg/m^2) was used to define obesity (BMI > 30 kg/m^2), overweight (BMI > 25 kg/m^2) and the waist to hip ratio (WHR) was used to define android obesity (WHR > 0.9). Smoking was assessed using a set of questions about current and previous tobacco consumption. Current smokers were those who smoked regularly and had smoked during the previous week of the study.

Data analysis was done by *Systat* (system for statistics, version 3). We used the chi-squared test, *t*-test and ANOVA for subgroup comparison, using the 5% level of significance.

Results

Among the 465 households sampled, 1346 persons were aged ≥ 20 years. Women represented 52. 8% and men 47.2% of the total sample size. We examined 957 persons with an overall participation rate of 71.1%. Table 1 gives the sample size, the number of people examined by age and sex and the participation rate by sex.

Table 1 **Distribution of persons examined by age and sex**

Age (years)	Sex					
	Males		Females		Total	
	No.	%	No.	%	No.	%
20–29	64	22.1	154	23.1	218	22.8
30–39	56	19.3	180	27.0	236	24.7
40–49	55	19.0	121	18.1	176	18.4
50–59	39	13.4	72	10.8	111	11.6
60–69	37	12.8	79	11.8	116	12.1
≥ 70	39	13.4	61	9.1	100	10.4
Total examined	290		667		957	
Total sampled	635		711		1346	
Participation		45.7		93.8		71.1

Of the people examined, 180 had blood pressure levels of 160/95 or higher. The prevalence of hypertension, as defined by the cut-off points 160/95, was 18.8% (Table 2). There was no statistically significant difference between men (18.6%) and women (18.9%) ($\chi^2 = 0.004$, $P = 0.95$). The age adjusted prevalence for the whole Tunisian

Table 2 **Prevalence (%) of hypertension by age and sex according to two blood pressure criteria**

Sex	Age (years)						
	20–29	30–39	40–49	50–59	60–69	≥70	Total
Blood pressure = 160/95							
Males	4.7	8.9	16.4	20.5	40.5	35.9	18.6
Females	2.6	8.9	21.5	33.3	36.7	44.2	18.9
Total	3.2	8.9	19.9	28.8	37.9	41.0	18.8
Blood pressure = 140/90							
Males	7.8	19.6	29.0	30.7	56.7	56.4	30.0
Females	5.2	16.1	32.2	52.8	51.9	57.4	28.4
Total	5.9	16.9	31.2	45.0	53.4	57.0	28.9

Table 3 **Prevalence of hypertension (blood pressure > 160/95) according to other CVD risk factors**

Variable	Total *n*	Hypertensive No.	Prevalence (%)	χ^2	*P*
Age (years)					
< 40	454	28	6.2		
≥ 40	503	152	30.2	90.0	< 0.00001
Obesity					
Yes	265	92	34.7		
No	692	88	12.7	60.0	< 0.00001
Android obesity					
Yes	345	94	27.2		
No	612	88	12.7	25.5	< 0.0001
History of diabetes					
Yes	98	36	36.7		
No	859	144	16.8	22.9	< 0.0001

CVD = cardiovascular disease

population (≥ 20 years) was 15.6%. Prevalence of hypertension increased with age from 3.2% for 20–30 year olds to 41.0% for those over 70 years. This trend was statistically significant (χ^2 = 115.42, P < 0.000001). According to the criterion blood pressure 140/90, the prevalence of hypertension was 28.9% with no statistical difference between men (30.0%) and women (28.4%) (Table 2).

The prevalence of hypertension was significantly higher in people aged 40 years and over, people with obesity, people with android obesity and for people with a history of diabetes (Table 3).

Before the age of 40 years, the mean systolic blood pressure was significantly higher for men (127.3 ± 13.7 mmHg) than for women (122.5 ± 14.1 mmHg) (t = 3.28, P = 0.001). At or after the age of 40 years, women had a slightly higher mean systolic blood pressure (144.0 ± 19.1 mmHg) than men (142.2 ± 20.2 mmHg). This difference was not statistically significant (t = 0.939, P = 0.348). For diastolic blood pressure before 40 years, there was no statistically significant difference between men (75.8 ± 13.3 mmHg) and women (75.3 ± 12.4 mmHg). However, at or after 40 years, women had significantly higher diastolic blood pressure (86.3 ± 15.9 mmHg) than men (82.9 ± 14.4 mmHg) (t = 2.25, P = 0.025) (Table 4).

The mean systolic and diastolic blood pressure increased with weight. The difference was statistically significant (Table 5). For people with android obesity, the mean systolic blood pressure was significantly higher (139.5 ± 20.3 mmHg) than for those with no android obesity (129.9 ± 18.3 mmHg) (t = 7.45, P < 0.0001). The mean diastolic blood pressure was also significantly higher in cases with android obesity (84.0 ± 15.8 mmHg versus 78.0 ± 13.6 mmHg) (t = 6.06, P < 0.0001).

History of diabetes was found in 10.2% of the study population. It was significantly higher for women (11.5%) than for men

Table 4 **Variation of systolic and diastolic blood pressure with age and sex**

Blood pressure (mmHg)	<40 years		≥40 years	
	Male	Female	Male	Female
Mean SBD ± *s*	127.3 ± 13.7	122.5*± 14.1	142.2 ± 20.2	144.0 ± 19.1
Mean DBP ± *s*	75.8 ± 13.3	75.3 ± 12.4	82.9*± 14.4	86.3 ± 15.9

**Statistically significant, P < 0.05*
SBP = systolic blood pressure
DBP = diastolic blood preassure
s = standard deviation

Table 5 **Variation of systolic and diastolic blood pressure with weight**

Blood pressure (mmHg)	Normal weight BMI < 25	Overweight 25 < BMI < 30	Obese BMI ≥ 30	ANOVA *F*	*P*
Mean SBD	126.7	134.7*	142.6	60.8	< 0.0001
± *s*	±17.4	±18.4	±19.9		
Mean DBP	74.8	80.2	88.5	80.0	< 0.00001
± *s*	±12.0	±13.7	±15.7		

BMI = body mass index
SBP = systolic blood pressure
DBP = diastolic blood preassure
s = standard deviation

(7.2%) (P = 0.044) (Table 6). It was also higher in cases with obesity (17.0% versus 7.7%) (P < 0.0001) and in cases with android obesity (15.0% versus 7.5%) (P < 0.0001)

Obesity (BMI ≥ 30 kg/m^2) was found in 27.7% of the study population. It was significantly higher for women (34.3%) than for men (12.4%) (P < 0.00001) (Table 6). Overweight (BMI > 25 kg/m^2) was found in 56.7% of the study population. Android obesity (WHR > 0.9) was found in 36.0% of the study population. It was significantly higher for men (49.7%) than for women (30.1%) (P < 0.00001) (Table 6).

Smoking was reported in 21.5% of the study population. It was significantly higher for men (61.4%) than for women (4.2%) (P < 0.000001) (Table 6).

Discussion

Hypertension is a major CVD risk factor, but there is a scarcity of data on its epidemiology in an urban population that is shifting from communicable to noncommunicable diseases. Urbanization is expected to raise the morbidity related to unhealthy lifestyles such as cardiovascular diseases and their risk factors [*3,16*].

The participation rate in this study (71.1%) was acceptable for a household survey, when people need to be at home to be examined. This explains why the participation rate was lower for men (45.7%) than for women (93.8%); men are more likely to work outside the home and are less able to take time off work in order to participate in a study. However, the sample examined was

Table 6 **Prevalence (%) of cardiovascular disease risk factors by age group and sex**

Age group (years)	Sex	Risk factors				
		Hypertension ≥160/95	Diabetes	Obesity	Android obesity	Smoking
20–29	M	4.7	3.1	4.7	26.5	60.9
	F	2.6	2.6	11	11.7	2.6
	Total	3.2	2.7	9.2	16	19.7
30–39	M	8.9	1.8	14.3	41	73.2
	F	8.9	6.1	27.8	25	8.3
	Total	8.9	5.0	24.6	28.8	23.7
40–49	M	16.4	9.0	12.7	60.0	63.6
	F	21.5	12.4	44.6	26.4	2.5
	Total	19.9	11.3	34.7	36.9	21.6
50–59	M	20.5	7.7	17.9	61.5	69.2
	F	33.3	16.6	61.1	44.4	1.4
	Total	28.8	13.5	45.9	50.4	25.2
60–69	M	40.5	21.6	24.3	70.3	45.9
	F	36.7	22.8	53.1	50.6	2.5
	Total	37.9	22.4	43.9	56.9	16.4
≥ 70	M	35.9	5.1	5.1	53.8	48.7
	F	44.2	27.9	36.0	55.7	4.9
	Total	41.0	19.0	24.0	55.0	22.0
	M	18.6	7.2	12.4	49.7	61.4
Total		NS	S	S	S	S
	F	18.9	11.5	34.3	30.1	4.2
	Total	18.8	10.2	27.7	36.0	21.5

S = significant NS = not significant

homogeneous for age group and sex (Table 1) and the distribution of those who were not examined was similar to that of those who participated in the study.

The study showed that the Tunisian urban population had a hypertension prevalence of 18.8% (criterion limit 160/95) or 28.0% (criterion limit 140/80). Hypertension prevalence was significantly higher for people with obesity and android obesity. In fact, there is overwhelming evidence that obesity and hypertension are linked [*17–20*]. The high level of obesity (27.7%) and android obesity (36.0%) found in our study might explain the high prevalence of hypertension. Furthermore, many screened hypertensive patients were unaware of their condition. This emphasizes the need for hypertension screening in primary health care, which is now very accessible in Tunisia, even in rural areas.

Since hypertension is a major risk factor for CVD, its control in the community should be integrated into a comprehensive preventive programme for CVD control, as has been done in countries with high CVD mortality [*21,22*]. The basic principle is that diseases with common risk factors require common preventive strategies. The preventive strategies should be based on a

health education programme that promotes healthy lifestyles, by improvement of dietary habits, eradication of tobacco use, increased physical activity and alleviation of deleterious psychosocial factors related to cardiovascular disease [*23,24*].

The results of the present study indicate the need to plan and implement actions on prevention, detection and treatment of hypertension as a part of a comprehensive programme of CVD control in the community. Only a comprehensive strategy based upon the public health approach described in the Victoria Declaration [*23*] will we be able to stem the increasing prevalence of CVD risk factors in Tunisia.

References

1. Castelli WP. Epidemiology of coronary heart disease. The Framinghan Study. *American journal of medicine*, 1984, 76:4 12.
2. Rosenfeld JB, Silverberg DS, Viskoper R. *Hypertension control in the community*. London, Libbey (John) and Company Ltd, 1985.
3. Uemura K, Piza Z. Trends in cardiovascular disease mortality in industrialized countries since 1950. *World health statistics quarterly*, 1988, 41:155–78.
4. Thom TJ. International mortality from heart disease: rates and trends. *International journal of epidemiology*, 1989, 18 (suppl. 1):520–9.
5. Uemura K, Piza Z. Recent trends in cardiovasular disease mortality in industrialized countries. *World health statistics quarterly*, 1985, 38:142–62.
6. Tuomilehto J. Decline in mortality from coronary heart disease in North Karelia and other parts of Finland. *British medical journal*, 1986, 293:1068–71.
7. Waller WJ. Changing US lifestyle and declining vascular mortality: a retrospective. *New England journal of medicine*, 1983, 308:649–51.
8. Stamler J. The marked decline in coronary heart disease mortality rates in the US, 1968–1981: summary of findings and possible explanations. *Cardiology*, 1985, 72:11–22.
9. Groupe Coopératif Lyonnais de lutte contre l'hypertension. Evaluation portant sur les sujets initialement hypertendus. [Lyon Cooperative group for the control of hypertension. Evaluation of individuals with hypertension]. *Archives des maladies du coeur et des vaisseaux*, 1962, 75:31–6.
10. Founiaud C et al. Influence of socioprofessional conditions on blood pressure levels and hypertension control. Epidemiologic study of 6665 subjects in the Paris district. *American journal of epidemiology*, 1984, 120:72–86.
11. The fifth report of the Joint National Committee on Detection, Evaluation and Treatment of High Blood Pressure (JNC V). *Archives of internal medicine*, 1993, 153:152–83.
12. Omran AR. The epidemiological transition: a theory of the epidemiology of population change. *Milbank quarterly*, 1971, 75:509–38.
13. Harpham T, Stephens C. Urbanization and health in developing countries. *World health statistics quarterly*, 1991, 44:62–9.

14. Ghannem H et al. Facteurs de risque des maladies cardiovasculaires dans une communauté semi-urbaine du Sahel Tunisien. [Risk factors in cardiovascular diseases in a semi-urban community in the Tunisian Sahel]. *Revue d'épidémiologie et santé publique*, 1992, 40:108–12.

15. Papoz L et al. Diabetes mellitus in Tunisia: description in rural and urban populations. *International journal of epidemiology*, 1988, 17:419–22.

16. Demonstration projects for the integrated prevention and control of noncommunicable diseases (Interhealth programme): epidemiological background and rationale. Interhealth Steering Committee. *World health statistics quarterly*, 1991, 44:48–54.

17. Ghannem H et al. La triade obésité, hypertension et troubles de la glycoregulation dans une population semi-urbaine du Sahel Tunisien. [The triad obesity, hypertension and glycoregulation in a semi-urban population of Tunisia's Sahel]. *Diabetes et métabolisme*, 1993, 19:310–4.

18. Manson JE et al. A prospective study of obesity and risk of coronary heart disease in women. *New England journal of medicine*, 1990, 322:88–9.

19. Schmieder RE, Messerli FH. Obesity hypertension. *Medical clinics of North America*, 1987, 71:991–1001.

20. Cambien F. Relation entre l'excès de poids et l'hypertension artérielle. [Relation between obesity and arterial hypertension]. *Nouvelle presse médicale*, 1982, 11:3641–6.

21. Jousilahti P et al. L'approche communautaire dans la prévention des maladies cardiovasculaires. Bilan de l'expérience Finlandaise en Karelie du Nord (1972–1992). [The community approach in the prevention of cardiovascular diseases: evaluation of the Finnish experience in North Karelia (1972–1992)]. *Union Médicale du Canada*, 1995, 124:7–16.

22. Farquhar JW et al. Effects of community education on cardiovascular risk factors. The Stanford five city project. *Journal of the American Medical Association*, 1990, 264:359–65.

23. *The Victoria Declaration.* The Advisory Board of the International Conferance of Cardiovascular Health, Victoria, Canada, 1992.

24. *The Catalonia Declaration.* The Advisory Board of the Second International Conferance of Cardiovascular Health, Barcelona, Spain, 1995.