

Prevalence of diabetes mellitus among Bahrainis attending primary health care centres

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انتشار السكري بين البحرينيين المترددين على مراكز الرعاية الصحية الأولية
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خلاصة : تم اختيار عينة عشوائية مكونة من 573 بحرينيا يبلغون من العمر 20 سنة فأكثر ، من بين المترددين على أربعة مراكز صحية . وتم قياس مستوى الغلوكوز في دم الشعيرات باستعمال مقياس الانعكاس بعد ساعتين من إعطاء 75 غرام من الغلوكوز بالفم للأفراد الذين لم يكن لديهم تاريخ إصابة بالسكري . ولوحظ أن المعدل الإجمالي لعدم تحمل الغلوكوز كان مرتفعاً بدرجة تدعو للقلق . فقد وجد أن معدل الانتشار كان 25,5% ، مع وجود 14,7% آخرين يعانون من عدم تحمل الغلوكوز . كما وجد أن ارتفاع ضغط الدم كان موجوداً لدى 27,6% من المصابين بالسكري ، وأن 41,7% منهم ذكروا أن بعض أفراد عائلاتهم كانوا مصابين بالسكري . وكان متوسط منسب كتلة الجسم بينهم $27,9 \pm 5,2$. ويتطلب الأمر اتباع استراتيجيات فعالة للوقاية الأولية ، على أن تكون مكثفة بين الفئات المعرضة للخطر . ويعين زيادة الوعي بهذا الداء .

ABSTRACT A sample of 573 subjects from a Bahraini population aged 20 years and above was randomly selected from persons attending four health centres. The capillary blood glucose level was measured with reflectance meter 2 hours after administering 75 g oral glucose in people with negative history for diabetes. An alarmingly high prevalence of total glucose intolerance was found. The observed prevalence rate of diabetes mellitus was 25.5%, with a further 14.7% prevalence for glucose intolerance. Hypertension and positive family history of diabetes among diabetic subjects were 27.6% and 41.7%, respectively, and mean body mass index was 27.9 ± 5.2 . Effective primary prevention strategies are needed, to be intensified among high risk groups. Awareness of the disease needs to be promoted.

Prévalence du diabète sucré chez les Bahreïnites venant consulter dans les centres de soins de santé primaires

RESUME Un échantillon de 573 sujets a été choisi au hasard dans une population de Bahreïnites âgés de 20 ans et plus venant consulter dans quatre centres de santé. Le taux de glycémie capillaire a été mesuré à l'aide d'un photomètre de réflectance deux heures après l'administration d'une charge orale de 75 g de glucose à des sujets n'ayant pas d'antécédents de diabète. On a trouvé un taux d'intolérance globale au glucose élevé, à un niveau alarmant. Le taux de prévalence observé pour le diabète sucré était de 25,5% avec, en outre, une prévalence de 14,7%, pour l'abaissement de la tolérance au glucose. On a retrouvé des antécédents familiaux de diabète chez 41,7% des sujets diabétiques et une hypertension artérielle dans 27,6% des cas. L'indice moyen de masse corporelle était de $27,9 \pm 5,2$. Des stratégies efficaces pour la prévention primaire sont nécessaires et elles doivent être intensifiées dans les groupes à risque. Il faut promouvoir une action de sensibilisation à l'égard de cette maladie.

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Introduction

The World Health Organization has declared that the number of people with diabetes is rapidly increasing worldwide and has become of major public health concern [1-5]. Many countries in the Eastern Mediterranean Region, recognizing the magnitude of the problem, have taken active measures by establishing national diabetes control programmes [2,6-10] as a strategy in combating noncommunicable disease. However, to elucidate the magnitude of the problem, more epidemiological studies will be required at country level [1-3,11,12].

In the past two decades, significant demographic changes have taken place in the Region. The population has almost doubled; infant mortality has progressively declined with resulting increased survival, and life expectancy continues to increase [3]. In general, the rapid socioeconomic development which started in the 1970s has led to proliferation of educational establishments, health centres, hospitals and other medical facilities. These social advances have been accompanied by the characteristic cultural changes that are observed in rapidly developing societies. Alterations in lifestyle, unhealthy nutritional habits and a more sedentary life have led to an increase in obesity [3,11,12].

Several countries of the Region have lately reported data on the epidemiology of diabetes, giving a prevalence rate that ranged from 2.3% to 13.6% [1,3,8,13]. In Saudi Arabia the prevalence rate was 4.6%; further, in those aged 30 years and above, an additional 10.6% demonstrated impaired glucose tolerance (IGT). The prevalence rate in Oman was 10% and a further 10.9% had IGT (aged 20 years and above). Egypt reported the highest rate of 13.6%. The studies conducted in Bahrain showed a

prevalence rate ranging from 1.8% to 3.1%, but they were done on limited groups of patients and not drawn from population-based samples [11,12,14]. It should be noted that many of the studies mentioned above did not use the recommended WHO criteria for diagnosis [15]. In addition, most of the surveys showed that over 50% of diabetes was undiagnosed [5,7,16,17].

Given that diabetes is a growing regional problem and in response to the recommendations made by WHO and the Arab Group for the Study of Diabetes that epidemiological studies were needed to assess the magnitude of the problem of diabetes, such a study was undertaken in Bahrain. The objective was to define the prevalence rate of diabetes mellitus among the Bahraini population aged 20 years and above. This included classifying cases into known diabetes mellitus (diagnosed prior to survey), unknown diabetes mellitus (detected during the survey), and impaired glucose tolerance (IGT). Additional objectives were to describe the distribution of the associated hypertension, obesity and positive family history of diabetes [1].

Background

Bahrain consists of over 33 islands, with a total area of 706.55 km² and an estimated population (1993) of 540 400, of which 340 000 are Bahrainis (172 000 males and 168 000 females) [18,19]. The Government is committed to the Alma-Ata Declaration and the goal of Health for All by the Year 2000 and has adopted the strategy and policies of primary health care as a means to achieve that goal. Free and comprehensive health care is provided through 21 primary health care centres distributed throughout the country, thus making health services easily accessible to all citi-

zens [18,20]. Health statistics show a decline in communicable diseases and an increase in the prevalence of noncommunicable and chronic diseases, such as metabolic disorders [19,20].

Methods

Target group and sampling (sample size and site of study)

The target group was Bahraini nationals aged 20 years and above attending primary health care centres. Assuming a prevalence rate of $5\% \pm 2\%$ and a population of 340 000 with a confidence level of 95%, the sample size was 455 (*EpiInfo* software statistical programme) [1,3,10]. Since the expected response rate was 80%, 573 subjects were selected from the population attending four health centres for any problem. The four health centres (Region 1: Sh. Salman health centre, Region 2: Naim health centre, Region 3: JidHafs health centre, Region 4: Sitra health centre) are scattered geographically throughout Bahrain, each serving a population of more than 30 000 [23].

Data collected

Data collected were: age, sex, personal past history of diabetes mellitus (first and second degree only) and hypertension, weight and height to calculate the body mass index (BMI), blood pressure (BP) measurement (using standard mercury sphygmomanometers) [1], and estimation of blood glucose levels 2 hours after a 75 g oral glucose tolerance test (OGTT) in non-diabetic subjects. The medical records of all subjects were also inspected in addition to those of non-respondents [10]. Hypertension was defined and classified according to the old as well as the new classifications, that is, a systolic BP 160 mmHg or over, or a dias-

tolic pressure of 95 mmHg or over in the old classification, and a systolic of 140 mmHg or over, or a diastolic of 90 mmHg or over according to the new criteria [22].

Technique and criteria for diagnosis

A computer-generated simple random list was used [1,3,10]. Subjects were interviewed the same day of selection. A blood test was done the following day following an overnight fast. The measurement used was the capillary blood glucose concentration in the morning, two hours after subjecting the cases to an oral glucose tolerance test with a 75 g oral glucose (dextrose monohydrate) load. Subjects known to have diabetes prior to the survey were exempted from the blood testing. Reflolux (Boehringer Mannheim) meters were used to estimate the blood glucose levels [1]. WHO criteria were used to classify the subjects. Diabetes was diagnosed when the blood glucose level was ≥ 20 mg/dl (11.1 mmol/l), and IGT when the level was ≥ 140 mg/dl (7.8 mmol/l) and < 200 mg/dl (11.1 mmol/l) [3,5,7,8,10,15,23]. Non-respondents were re-invited once by telephone. The demographic data of the defaulters were kept for further evaluation.

Results

Of the 573 subjects selected, 498 (86.9%) completed the study. The 2-hour post-75 g oral glucose blood sugar was estimated. Diabetes mellitus was defined according to the WHO criteria or if the person had a previous history of diabetes.

The age and sex distribution of all subjects including the non-respondents, are shown in Table 1. The age range was between 20 and 90 years with a mean of 43.9 ± 15.3 (s); for men it was 44.9 ± 17.3

(s) and women 43.2 ± 14.1 (s). The non-respondents were mostly from the younger age group. The ratios of female to male were 1.7:1 and 1.8:1 in all subjects selected and diabetic subjects, respectively.

The number of diabetic subjects and rates of diabetes and IGT among different age groups and gender is shown in Table 2. The prevalence rate of known diabetes (previously diagnosed) was found to be 17.3% (95% CI, 13.9%–20.6%), males 18.4%, females 16.7%. The prevalence rate of unknown diabetes (newly diagnosed) was 8.2% (95% CI, 6.0%–11%), males 8%, females 8.3%; making the total rate of dia-

betes 25.5% (95% CI, 21.7%–29.3%), males 26.4%, females 25%. The prevalence rate of IGT was 14.7% (95% CI, 11.6%–17.8%), males 10.9%, females 12.7%.

There was a variation in prevalence rates among different regions in the previously diagnosed diabetes, while the difference in the rate disappeared in the newly detected diabetics and was small in subjects with IGT (Table 3).

Considering people aged 30 years and above alone, the prevalence rate of previously diagnosed diabetes was 21.1% (95% CI, 17.1%–25.1%), and for newly detected

Table 1 Surveyed population by age and sex

Age (years)	Studied subjects (n = 498)			Defaulters (n = 75)			All subjects (n = 573)		
	M	F	T ^a	M	F	T	M	F	T ^b
20–29	39	60	99	15	16	31	54	76	130
%			76.2						22.7
30–39	39	73	112	7	7	14	46	80	126
%			88.9						22.0
40–49	19	69	88	6	5	11	25	74	99
%			88.0						17.3
50–59	28	69	97	5	5	10	33	74	107
%			90.7						18.7
60–69	31	39	70	4	2	6	35	41	76
%			92.1						13.3
70+	18	14	32	2	1	3	20	15	35
%			91.4						6.0
Total No.	174	324	498	39	36	75	213	360	573
%	81.7	90.0	86.9				37.2	62.8	100

T = total

Age of selected population (n = 573) ranged from 20 years to 90 years with a mean of 43.9 ± 15.3 (s) (men 44.9 ± 17.3 (s); women 43.2 ± 14.1 (s))

Age of the studied group (n = 498) ranged from 20 years to 90 years with a mean of 44.7 ± 15.2 (s) (men 46.0 ± 17.2 (s); women 44.0 ± 14.0 (s))

^aTotal and percentage out of all selected subjects

^bTotal and percentage in each age group

Table 2 Prevalence of diabetes and impaired glucose tolerance in studied subjects ($n = 498$) by age and sex

Age (years)	All subjects			Previously diagnosed			Newly diagnosed			Total diabetic			IGT			Non-diabetic		
	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T
20-29	39	60	99	0	2	2	4	3	7	4	5	9	4	10	14	31	45	76
30-39	39	73	112	3	3	6	2	4	6	5	7	12	4	13	17	30	53	83
40-49	19	69	88	5	17	22	1	10	11	6	27	33	2	9	11	11	33	44
50-59	28	69	97	8	20	28	4	4	8	12	24	36	3	10	13	13	35	48
60-69	31	39	70	12	9	21	0	3	3	12	12	24	3	8	11	16	19	35
70+	18	14	32	4	3	7	3	3	6	7	6	13	3	4	7	8	4	12
Total	174	324	498	32	54	86	14	27	41	46	81	127	19	54	73	109	189	298
%	34.9	65.1	100	8.4	16.7	17.3	8.0	8.3	8.2	26.4	25.0	25.5	10.9	16.7	14.7	62.6	58.3	59.8

T = total

Table 3 Prevalence rates of diabetes and impaired glucose tolerance in different regions by sex

Item	Region 1			Region 2			Region 3			Region 4			Total		
	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T
Total subjects	64	89	153	71	80	151	43	89	132	35	102	137	213	360	573
Defaulters	15	16	31	10	8	18	7	5	12	7	7	14	39	36	75
Response	No. 49	73	122	61	72	133	36	84	120	28	95	123	174	324	498
	% 76.6	82.0	79.9	85.9	95.0	88.1	83.7	94.5	90.9	80.0	93.1	89.8	81.7	90.0	86.9
Previously diagnosed	No. 20	23	43	8	16	24	4	11	15	0	4	4	32	54	86
	% 40.8	31.5	35.2	13.1	22.2	16.0	11.1	13.1	12.5	0.0	4.2	3.0	18.4	16.7	17.3
Newly diagnosed	No. 4	5	9	4	7	11	4	5	9	2	10	12	14	27	41
	% 8.2	6.8	7.4	6.6	9.7	8.3	11.1	6.6	7.5	7.1	10.5	9.8	8.0	8.3	8.2
Total diabetic	No. 24	28	52	12	23	35	8	16	24	2	14	16	46	81	127
	% 49.0	38.4	42.6	19.7	31.9	26.3	22.2	19.0	20.0	7.1	14.7	13.0	26.4	25.0	25.5
IGT	No. 2	12	14	10	9	19	5	8	13	2	25	27	19	54	73
	% 4.1	16.4	11.5	16.4	12.5	14.3	13.9	9.5	10.8	7.1	26.3	22.0	10.9	16.7	14.7
Total abnormal glucose	No. 26	40	66	22	32	54	13	24	37	4	39	43	65	105	200
	% 53.1	54.8	54.0	36.1	44.4	40.6	36.1	28.6	30.8	14.3	41.1	34.9	37.4	41.7	40.2

T = total

Table 4 Proportion of associated hypertension in the surveyed population in relation to diagnostic criteria of diabetes and sex

Status on diabetes	Hypertension ^a			Hypertension ^b		
	M	F	Total	M	F	Total
Previously diagnosed	No. 20	34	54	11	13	24
(n = 86; 32 M, 54 F)	% 62.5	63.0	62.8	34.4	24.1	27.9
Newly diagnosed	No. 8	12	20	4	7	11
(n = 41; 14 M, 27 F)	% 57.1	44.4	48.8	28.6	25.9	26.8
Total diabetic	No. 28	46	74	15	20	35
(n = 127; 46 M, 81 F)	% 60.9	56.8	58.3	32.6	24.7	27.6
IGT	No. 11	28	39	7	13	20
(n = 73; 19 M, 54 F)	% 57.9	51.9	53.4	36.8	24.1	27.4
Total abnormal glucose	No. 39	74	113	22	33	55
(n = 200; 65 M, 135 F)	% 60.0	54.8	56.5	33.8	24.4	27.5
Normal subjects	No. 42	63	105	12	27	39
(n = 298; 109 M, 189 F)	% 38.5	33.3	35.5	11.0	14.3	13.1
Defaulters	No. 11	12	23	4	3	7
(n = 75; 39 M, 36 F)	% 28.2	33.3	30.7	10.3	8.3	9.3
Total subjects	No. 92	149	241	38	63	101
(n = 573; 213 M, 360 F)	% 43.2	41.4	42.1	17.8	17.5	17.6

^aSystolic blood pressure ≥ 140 and/or diastolic blood pressure ≥ 90 mmHg^bSystolic blood pressure ≥ 160 and/or diastolic blood pressure ≥ 95 mmHg

diabetes 8.5% (95% CI, 6.0%–11.7%), with a further 14.8% prevalence (95% CI, 11.3%–18.3%) for IGT.

There was a positive family history of diabetes in 41.7% of diabetics, and in 32.9% of individuals within IGT. The frequency of hypertension, as defined above, was 27.6% (95% CI, 19.8%–35.3%) among diabetics compared to 13.1% (95% CI, 9.3–16.9%) among non-diabetics. Among those with IGT, the frequency was almost similar (27.4%). Using the new criteria for the diagnosis of hypertension, i.e. systolic blood pressure ≥ 140 mmHg and/or diastolic blood pressure ≥ 90 mmHg, this study showed a frequency of hypertension

of 58.3% (95% CI, 49.7%–66.8%) among all diabetics, and 53.4% (95% CI, 41.4%–65.2%) among those with IGT (Table 4). Of individuals with diabetes or IGT, 74% were overweight (BMI ≥ 25). Gross obesity (BMI ≥ 30) was found in 31.5% and 34.2% of individuals with diabetes and IGT, respectively, compared with 56.4% and 24.52% as overweight and gross obesity among non-diabetics, respectively.

Discussion

Although the sample was drawn from persons attending the primary health care cen-

tres, given the high rate of coverage of Bahrain's health services the sample fairly represents the population. In many studies, over 50% of diabetes was undiagnosed prior to the survey [3,5,7,17]. In one of the Saudi Arabia studies, 86% of diabetics were diagnosed prior to the survey [3]. In this study 67.7% of people with diabetes were diagnosed as having diabetes prior to the survey, with a variation in different regions, ranging from 25.0% to 82.7%. The high prevalence rate of known to unknown diabetes may be attributed to several factors, such as awareness among qualified family physicians in the primary health care centres, awareness of those people with positive family history of diabetes concerning the disease, easy accessibility of health care services to all people free of charge, and the high frequency of visits to health services per year per capita.

The prevalence of diabetes rose with age. It was observed that there was a sharp increase in the overall prevalence of known diabetes after 40 years of age (36.9% as compared with 10.0% above 40 years of age) and in the total glucose intolerance in general (51.6% compared with 24.2% below 40 years of age). The prevalence of IGT fluctuated throughout the different age groups. Contrary to other studies [1,3,17], the prevalence of IGT was less than one-half of that of all diabetes, except in the age groups below 40 years (1.5 times).

It was observed that the prevalence rate of diabetes among men and women was almost equal in this survey, similar to results from other surveys [3], but that that of IGT was more in women, as also shown in other studies [7]. In general, the prevalence rates for diabetes mellitus and IGT for those subjects aged 40 years and above were 36.9% and 14.6%, respectively.

Diabetes was highly associated with the risk factors of diabetes mellitus, such as

age, obesity, hypertension and family history, as in other studies [3]. The proportion of diabetics with positive family history of diabetes was high (41.7%). The high frequency of positive family history in previously known diabetes subjects (47.7%) compared to 29.3% in newly diagnosed diabetics may be attributed to awareness of the problem among those with positive history of diabetes and to the higher percentage of intermarriage in Bahrain. The non-diabetic subjects had a lower frequency of positive family history (only 23.3%) while the non-respondents had an even lower positive family history (16%).

The frequency of hypertension in diabetic subjects was found to be similar to that found in other studies [14,24]. The prevalence of hypertension among diabetic subjects was twice that of non-diabetic subjects, which is similar to other studies. Obesity was observed to be high among subjects with abnormal glucose metabolism (mean BMI 28.1 ± 5.1 (s)) compared to non-diabetic subjects (mean BMI 26.2 ± 5.3 (s)).

Analysis of high-risk groups showed a strong association with high prevalence rate of glucose intolerance. Thus, 46.9% of the hypertensive subjects (new criterion) and 52.7% of subjects having positive family history of diabetes mellitus were found to have glucose intolerance. This prevalence increased to 67.2% when hypertension was associated with positive history of diabetes.

Conclusion

An alarming 40.2% of the total sample had an abnormal glucose tolerance, although this may not reflect the true prevalence of diabetes among the Bahraini population, since the individuals subjected to testing

may have a higher prevalence of diabetes than those not tested. However, effective primary prevention strategies are needed and these efforts need to be intensified among high risk groups. Since diabetes frequency is relatively high, promotion of

awareness of the disease is needed in order to improve the competency of the health care team and to utilize the existing screening programmes to detect more of the unknown cases.

References

1. Alwan A. *Diabetes prevention and control—a call for action*. Alexandria, World Health Organization Regional Office for the Eastern Mediterranean, 1993 (WHO-EM/DIA/3/E/G).
2. Alwan A. The WHO Eastern Mediterranean programme on diabetes prevention and control. *Bulletin of the Arab Group for Study of Diabetes*, 1993, 2(1):38–40.
3. Alwan A, King H. Diabetes in the Eastern Mediterranean Region. *World health statistics quarterly*, 1992 45(4):355–9.
4. King H, Rewers M. Diabetes in adults is now a Third World problem. The WHO ad hoc diabetes reporting group, diabetes and other noncommunicable diseases unit. *Bulletin of the World Health Organization*, 1991, 69(6):643–8.
5. World Health Organization, Ad hoc diabetes reporting group. Diabetes and impaired glucose tolerance in women aged 20–39 years. *World health statistics quarterly*, 1992, 45(4):321–7.
6. Alwan A. *Management of diabetes mellitus. Standards of care and clinical practice guidelines*. Alexandria, World Health Organization Regional Office for the Eastern Mediterranean, 1994 (WHO-EM/DIA/6/E/G).
7. King H, Rewers M. Global estimates for prevalence of diabetes mellitus and impaired glucose tolerance in adults. *Diabetes care*, 1993, 16(1):157–77.
8. Arab M. Diabetes mellitus in Egypt. *World health statistics quarterly*, 1992, 45(4):334–337.
9. Asfour M. et al. Diabetes mellitus in the sultanate of Oman. *Bulletin of the Arab Group for Study of Diabetes*, 1992, 1(2):66–70.
10. Arab M. The Alexandria protocol for multi-centre population surveys to study the prevalence of diabetes mellitus in Middle East and African countries. *Bulletin of the Arab Group for Study of Diabetes*, 1994, 3(1):38–40.
11. Al Mahroos S. Diabetes mellitus in Bahrain. *Bahrain medical bulletin*, 1986, 8(2):61–2.
12. Musaiger AO, Abdulaziz SA. Demographic characteristics of hospitalized patients with diabetes in Bahrain. *Bahrain medical bulletin*, 1986, 8(2):73–6.
13. Dowse GK, Zimmet P. A model protocol for a diabetes and other noncommunicable disease field survey. *World health statistics quarterly*, 1992, 45(4):360–72.
14. Zurba FI. Characteristics and pattern of care of diabetes in primary health care centres in Bahrain. *Bulletin of the Arab Group for Study of Diabetes*, 1994, 3(1):9–18.
15. WHO. *Diabetes mellitus: Report of a WHO Study Group*. Geneva, World Health Organization, 1985 (Technical Report Series No.727).

16. American Diabetes Association. Screening for diabetes. *Diabetes care*, 1992, 15 (suppl. 2):7-9.
17. Sekikawa A et al. Prevalence of diabetes and impaired glucose tolerance in Funagata area, Japan. *Diabetes care*, 1993, 16(4):570-4.
18. Central Statistics Organization, Directorate of Statistics, Government of Bahrain. *Bahrain in figures*, 1993, 12.
19. Central Statistics Organization, Directorate of Statistics, Government of Bahrain. *The population, housing, buildings and establishments census*, 1991.
20. Ministry of Health, Bahrain. *Bahrain child health survey*, 1989.
21. Ministry of Health, Bahrain. Bahrain Health Information Centre, *Health statistical abstract*, 1992.
22. Fuller H, Stevens LK. Diabetes Hypertension Study Group. Prevalence of hypertension among diabetic patients and its relation to vascular risk. *Journal of human hypertension*, 1991, 5(4):237-43.
23. American Diabetes Association. Office guide to diagnosis and classification of diabetes mellitus and other categories of glucose intolerance. *Diabetes care*, 1991, 24 (suppl. 2):3-4.
24. Swai AB, Lutale J, McLarty DG. Diabetes in tropical Africa: A retrospective study, characteristics of newly-presenting patients in Dar-es-Salaam, Tanzania. *British medical journal*, 1990, 300:915-24.
25. Tai TY et al. Link between hypertension and diabetes mellitus—epidemiological study of Chinese adults in Taiwan. *Diabetes care*, 1991, 14(11):1013-8.