PREVALENCE OF DIABETES MELLITUS IN BAHRAIN

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Background: Diabetes mellitus (DM) is an important health problem because of its high morbidity and mortality even though its complications are partially preventable. Diabetes has not been previously studied on a population-wide scale in Bahrain.

Objective: Provide an estimate of the prevalence of diabetes, and associated risk factors.

Research Design and Methods: Population-based sample of 573 subjects from Bahraini population aged 20 years and above randomly selected as seen attending four health centres for any problem, with 79.9 % participation rate. The capillary blood glucose level was measured after two-hour post 75 g oral glucose in cases with no history of diabetes.

Results: By WHO diagnostic criteria, the observed prevalence of DM was 25.5 % (95 % CI, 21.7 % - 29.3 %), with further 14.7 % (95 % CI, 11.6 % - 17.8 %) as having glucose intolerance. Hypertension and positive family history of diabetes among diabetes cases were 27.6 % and 41.7 % respectively. The mean Body Mass Index in diabetic subjects was 27.9 ± 5.2 SD. The age standardised prevalence of diabetes in age-group 30-64 years was 27.6 % and for IGT was 14.7 %.

Conclusion: An alarming high prevalence of total glucose intolerance was found. Effective primary prevention strategies are needed urgently, and these efforts need to be intensified among high risk groups. Promoting awareness of the disease is needed to improve the competency of the health-care team and to utilise the existing screening programmes to detect more of the unknown cases.
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The World Health Organization has declared that the number of people with diabetes is rapidly increasing and has become a problem of great magnitude and a major public health concern[1-13]. Many countries have recognised the magnitude of the problem and have taken active measures by establishing national diabetic programmes[1-8,14,15].

The prevalence rates of diabetes in the Gulf Region ranges from 2.3 % to 13.6 %[1,5,8,14,15]. In Saudi Arabia the prevalence was 4.6 % with a further 10.6 % with impaired glucose tolerance (IGT) among those aged 30 and above. In Oman it was 10 % with a further 10.9 % with IGT (aged 20 years and above). In many communities, over 50 % of diabetes was undiagnosed prior to the survey[4,12,13,16,17]. A few studies were conducted in Bahrain, with a prevalence rate ranging from 1.8 to 3.1 %. However the studies were not done on population based samples[9,10,18]; and none used the recommended WHO criteria for diagnosis[19].

Recognising diabetes as a growing problem, and as a response to the recommendations made by WHO and the Arab Group for the Study of Diabetes, an epidemiological study was needed to assess the magnitude of the problem of diabetes in Bahrain in order to guide organisational activities and to monitor the progress of the national plan[2,4,8].

The objective of this study was to estimate the prevalence rate of diabetes mellitus in Bahrain among Bahraini population aged 20 years and above. This included classifying the cases into known diabetes mellitus (diagnosed prior to survey), unknown diabetes mellitus (detected during the survey) and impaired glucose tolerance. Additional objectives were to describe the distribution of the associated hypertension, obesity and positive family history of diabetes[14].

The Ministry of Health in Bahrain provides free and comprehensive health care to all citizens and residents of Bahrain through 19 primary care health centres and 2 clinics distributed throughout the country to minimise problems of accessibility[20,22].

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METHODS

Target Group and Sampling (Sample Size and Site of Study)

The target group was all Bahraini nationals aged 20 years and above. Assuming that the prevalence rate is 5 % (±2) and a population of 340,000 with a confidence level of 95 %, the sample size is 455 (Epi Info Software statistical programme)[7,8,13,14]. Since the expected response rate was 80 %, 573 cases were selected from the population attending four health centres (HCs) for any problem. A computer generated simple random list was used to ensure obtaining the required sample randomly[7,8,13,14]. The daily registers of the four health centres were marked according to the random list. The four HCs (Region I: Shaikh Salman HC, Region II: Naim HC, Region III: Jidhafs HC, Region IV: Sitra HC) are scattered geographically throughout Bahrain, each dealing with > 30,000 population[23].

Data collected

Age, sex, personal past history and family history of diabetes mellitus (first and second degree blood relatives only) and hypertension, weight and height to calculate the Body Mass Index (BMI), blood pressure measurement (using standard mercury sphegnomanometers)[14], and estimation of blood glucose levels 2-hour post-75 g oral glucose (OGTT) in non diabetic subjects. The medical records of all cases were also examined in addition to those of non-responders[7]. Hypertension was defined and classified if the systolic blood pressure was over 160 or 140 mmHg or the diastolic blood pressure over 95 or 90 mmHg or the subject was on treatment for hypertension[24].

Technique and Criteria for Diagnosis

Cases selected were interviewed on the same day of selection. A blood test was done the next day after an overnight fast. The measurement used was the capillary blood glucose concentration in the morning, two hours after subjecting the persons to a 75 gm oral glucose (dextrose monohydrate) load (OGTT). Cases known to have been diagnosed as diabetics prior to the survey were exempted from the blood testing. Reflolux (Boehringer Mannheim) meters were used to estimate the blood glucose levels[14]. WHO criteria were used to classify the subjects. Diabetes was diagnosed when the blood glucose level was ≥ 200 mg/dl (11.1 mmol/l); and when the impaired glucose tolerance (IGT) was ≥ 140 mg/dl (7.8 mmol/l) and < 200 mg/dl (11.1 mmol/l)[4,5,7,8,12,19,25]. Non-responders were re-invited once by telephone. The demographic data of the defaulters were kept for further evaluation.

RESULTS

A total of 573 cases were selected with 498 (79.9 %) completing the study.

Demographic Data

The age and gender distribution of all selected cases including the non-responders are shown in Table 1. The age of the selected population (n=573) ranged between 20 and 90 years with a mean age 43.9 (SD 15.3). The mean age for men was 44.9 (SD 17.3) and for women 43.2 (SD 14.1). The non-responders were mostly from the younger age group. The ratio of female to male were 1.9:1 and 1.8:1 in all selected and diabetes cases respectively.

The prevalence rate of different proportion of diabetes and IGT among different age groups and gender is shown in Table 2. 27.6 % of all cases were found to have positive history of diabetes in their family.

Epidemiology

Prevalence of known diabetes (previously diagnosed) was found to be 17.3 % (95 % CI, 13.9 % - 20.6 %), (Male; 18.4 %, Female; 16.7 %). Prevalence of unknown diabetes (newly diagnosed) was 8.2 % (95 % CI, 6.0 % - 11.0 %), (M: 8 %, F: 8.3 %) making the total diabetes among cases as 25.5 % (95 % CI, 21.7 % - 29.3 %), (M: 26.4 %, F: 25 %). The prevalence rate of impaired glucose tolerance (IGT) was 14.7 % (95 % CI, 11.6 % - 17.8 %), (M: 10.9, F: 16.7 %). There was a variation in prevalence rates among different regions in Bahrain in the previously diagnosed diabetes, while the difference in rate disappeared in the newly detected subjects as well as IGT cases (Table 3).

The prevalence of diabetes among people aged 30 years and above was 21.2 % (95 % CI, 17.1 % - 25.1 %) and 8.5 % (95 % CI, 6.0 % - 11.7 %) in previously and newly detected subjects respectively, with further 14.8 % (95 % CI, 11.3 % - 18.3 %) as IGT. This gives a prevalence rate of 44.4 % (95 % CI, 39.5 % - 49.2 %) as total glucose intolerance.

A positive family history of diabetes among diabetic cases were 41.7 %, (47.7 % and 29.3 % in

Table 1. Stratification of the surveyed population by gender and age (into 10-year age groups)

Age Cohort	Studied Cases (n = 498)			Defaulters (n = 75)			All Selected Cases (n = 573)		
	M	F	T	M	F	T	M	F	T
20-29	39	60	99 76.2%	15	16	31 23.8%	54	76	130 22.7%
30-39	39	73	112 88.9%	7	7	14 11.1%	46	80	126 22.0%
40-49	19	69	88 88.9%	6	5	11 11.1%	25	74	99 17.3%
50-59	28	69	97 90.7%	5	5	10 9.3%	33	74	107 18.7%
60-69	31	39	70 92.1%	4	2	6 7.9%	35	41	76 13.3%
70+	18	14	32 91.4%	2	1	3 8.6%	20	15	35 6.0%
TOTAL	174 81.7%	324 90.0%	498 86.9%	39 18.3%	36 10.0%	75 13.1%	213 37.2%	360 62.8%	573 100.0%

Age of the selected population (n = 573) ranged from 20 ± 90 years with a mean age 43.9 ± 15.3 SD (Men: 44.9 ± 17.3 SD and for women: 43.2 ± 14.1 SD)

Age of the studied group (n = 498) ranged from 20 ± 90 years with a mean age 44.7 ± 15.2 SD (Men: 46 ± 17.2 SD and for women: 44 ± 14 SD)

Table 2. Prevalence of diabetes and impaired glucose tolerance (IGT) in studied cases (n = 498) by different age groups and gender

AGE COHORTS	All Cases			Old Diagnosed			Newly Diagnosed			Total Diabetics			IGT			Normal Cases		
	M	F	Total	M	F	Total	M	F	Total	M	F	Total	M	F	Total	M	F	Total
20 - 29	39	60	99 76.2%	0	2	2 2.0%	4	3	7 7.1%	4	5	9 9.1%	4	10	14 14.1%	31	45	76 76.8%
30 - 39	39	73	112 88.9%	3	3	6 5.4%	2	4	6 5.4%	5	7	12 10.7%	4	13	17 15.2	30	53	83 74.1%
40 - 49	19	69	88 88.9%	5	17	22 25%	1	10	11 12.5%	6	27	33 37.5%	2	9	11 12.5%	11	33	44 50.0%
50-59	28	69	97 90.7%	8	20	28 28.9%	4	4	8 4.2%	12	24	36 37.1%	3	10	13 13.4%	13	35	48 49.5%
60 - 69	31	39	70 92.1%	12	9	21 30.0%	0	3	3 4.3%	12	12	24 34.3%	3	8	11 15.7%	16	19	35 50.0%
70+	18	14	32 91.4%	4	3	7 21.9%	3	3	6 18.8%	7	6	13 40.4%	3	4	7 21.9%	8	4	12 37.5%
TOTAL	174 81.7%	324 90.0%	498 89.9%	32 18.4%	54 16.7%	86 17.3%	14 8.0%	27 8.3%	41 8.2%	46 26.4%	81 25.0%	127 25.5%	19 10.9%	54 16.7%	73 14.7%	109 62.6%	189 58.3%	298 59.8%

Table 3. Prevalence of diabetes and impaired glucose tolerance (IGT) in different health centres of Bahrain by sex and proportions of diabetes

	Sh. Salman HC			Naim HC			Jid Hafs HC			Sitra HC			TOTAL		
	M	F	Total	M	F	Total	M	F	Total	M	F	Total	M	F	Total
Total cases selected	64	89	153	71	80	151	43	89	132	35	102	137	213	360	573
Defaulters	15 23.4%	16 18.0%	31 20.3%	10 14.1%	8 10.0%	18 11.9%	7 16.3%	5 5.6%	12 9.1%	7 20.0%	7 6.9%	14 10.2%	39 18.3%	36 10.0%	75 13.1%
Response	49 76.6%	73 82.0%	122 79.7%	61 85.9%	72 95.0%	133 88.1%	36 83.7%	84 94.5%	120 90.9%	28 80.0%	95 93.1%	123 89.8%	174 81.7%	324 90.0%	498 86.9%
Newly diagnosed	4 8.2%	5 6.8%	9 7.4%	4 6.6%	7 9.7%	11 8.3%	4 11.1%	5 6.6%	9 7.5%	2 7.1%	10 10.5%	12 9.8%	14 8.0%	27 8.3%	41 8.2%
Previously diagnosed	20 40.8%	23 31.5%	43 35.2%	8 13.1%	16 22.2%	24 18.0%	4 11.1%	11 13.1%	15 12.5%	0 0.0%	4 4.2%	4 3.0%	32 18.4%	54 16.7%	86 17.3%
Total diabetics	24 49.0%	28 38.4%	52 42.6%	12 19.7%	23 31.9%	35 26.3%	8 22.2%	16 19.0%	24 20.0%	2 7.1%	14 14.7%	16 13.0%	46 26.4%	81 25.0%	127 25.5%
Impaired glucose intolerance (IGT)	2 4.1%	12 16.4%	14 11.5%	10 16.4%	9 12.5%	19 14.3%	5 13.9%	8 9.5%	13 10.8%	2 7.1%	25 26.3%	27 22.0%	19 10.9%	54 16.7%	73 14.7%
Total abnormal glucose metabolism	26 53.1%	40 54.8%	66 54.0%	22 36.1%	32 44.4%	54 40.6%	13 36.1%	24 28.6%	37 30.8%	4 14.3%	39 41.1%	43 34.9%	65 37.4%	135 41.7%	200 40.2%

Table 4. Prevalence of glucose intolerance and its association with high risk groups

Associated Risk Factor	Defaulters	Old Diabetes	New Diabetes	Diabetes	Igt	Glucose Intolerance	Normal
Hypertension* Positive (n = 241)	23	54 24.8%	20 9.2%	74 33.9%	39 17.9%	113 51.8%	105 48.2%
Hypertension* Negative (n = 332)	52	32 11.4%	21 7.5%	53 18.9%	34 12.1%	87 31.1%	193 68.9%
Hypertension** Positive (n = 101)	7	24 25.5%	11 11.7%	35 37.2%	20 21.3%	55 58.5%	39 41.5%
Hypertension** Negative (n = 472)	68	62 15.3%	30 7.4%	92 27.8%	53 13.1%	145 35.9%	259 64.1%
Family History Positive (n = 158)	12	41 28.1%	12 8.2%	53 36.3%	24 16.4%	77 52.7%	69 47.3%
Family History Negative (n = 415)	63	45 12.8%	29 8.2%	74 21.0%	49 13.9%	123 34.9%	229 65.1%
Positive Hypertension* and Family History (n = 67)	6	25 41.0%	5 8.2%	30 49.2%	11 18.0%	41 67.2%	20 32.8%
Positive Hypertension** and Family History (n = 30)	2	12 42.9%	3 10.7%	15 53.6%	6 21.4%	21 75.0%	7 25.5%

*   Systolic blood pressure ≥ 140 and/or diastolic blood pressure ≥ 90 mm Hg.

**   Systolic blood pressure ≥ 160 and/or diastolic blood pressure ≥ 95 mm Hg.

known DM and unknown DM respectively) and 32.9 % in IGT.

The frequency of increased blood pressure among diabetic subjects was 27.6 % (95 % CI, 19.8 % - 35.3 %) compared to non-diabetic subjects - 13.1 % (95 % CI, 9.3 % - 16.9 %). In IGT the frequency of increased blood pressure was almost similar - 27.4 %. While using another criteria for the diagnosis of hypertension as reviewed by the WHO expert group in Geneva in 1994, as systolic blood pressure ≥ 140 mmHg and/or diastolic blood pressure ≥ 90 mmHg. This study showed a frequency of increased blood pressure in 58.3 % (95 % CI, 49.7 % - 66.8 %) of all diabetic cases, and 53.4 % (95 % CI, 41.4 % - 65.2 %) in IGT cases. The prevalence of increased blood pressure among the selected cases was 17.6 %, and 42.1 % when using the new criteria.

Obesity (BMI ≥ 25) was found to be 74 % in both diabetes as well as IGT cases; and the gross obesity (BMI ≥ 30) was 31.5 % and 34.2 % in diabetes and IGT cases respectively, compared to 56.4 % and 24.5 % obesity and gross obesity among normal cases respectively.

DISCUSSION

In many communities, over 50 % of diabetic cases were undiagnosed prior to the survey[4,8,12,13,17]. In one of the Saudi Arabian studies, 86 % of cases were diagnosed prior to the survey[8]. In this paper 67.7 % of cases were detected as having diabetes prior to the survey, with a variation in different regions ranging from 62.5 % to 82.7 %.

The high prevalence rate of known to unknown diabetes could be attributed to different factors, such as the awareness of the qualified family physicians in the primary care set up, awareness of the population with positive family history of diabetes, the easy accessibility of free health care services to all people, and high frequency of visits to health services per year per capita.

A sharp increase in the prevalence of known diabetes was observed after the age of 40 years and in the total glucose intolerance in general. The prevalence of diabetes rose with age. The prevalence of IGT was fluctuating throughout the different age groups. Contrary to other studies[1,8,17], the prevalence of IGT was one-half of that of diabetes except in the below 35 age group.

It was, also, observed that prevalence rate of diabetes among men and women was equal in this survey, and was similar to other results from other surveys[8], and that of IGT was more in women as in other studies[4]. In general, the prevalence rates for DM and IGT for those cases aged 40 and above were 36.9 % and 14.6 % respectively.

Diabetes was highly associated with the risk factors of DM such as age, obesity, hypertension and family history of DM as in other studies[8]. The proportion of diabetics with positive family history was high (41.7 %). The high frequency of positive family history in known diabetic subjects (47.7 %) compared to 29.3 % in newly diagnosed diabetics could be attributed to the increased awareness among cases with positive history of diabetes. The Normal subjects had a positive family history in 23.2% only. Non-responders had even lower positive family history in 16% only.

The frequency of increased blood pressure in diabetic patients was found to be similar to other studies[18,26]. The prevalence of increased blood pressure among diabetic subjects was twice that of non-diabetic subjects and the same applies to diabetics with history of diabetes in close relatives[27].

Obesity was observed to be high among subjects with abnormal glucose metabolism (BMI: 28.1 ± 5.1 SD).

Studies on high risk groups showed a strong association with high prevalence rate of glucose intolerance (Table 4). 51.8 % of the hypertensive subjects (new criterion) and 52.7 % of subjects having positive family history of DM were found to have glucose intolerance. But this prevalence of diabetes was increased to 67.2 % when increased blood pressure was associated with positive history of diabetes.

CONCLUSION

An alarming 40.2 % of the total sample had an abnormal glucose tolerance, though it may not reflect the true prevalence of diabetes among Bahraini population, since one may argue that the individuals subjected to testing may have a higher prevalence of diabetes than those not tested. However, effective primary prevention strategies are needed urgently, and these efforts need to be intensified among high risk groups. Since diabetes frequency is relatively high, promoting awareness of the disease is needed to

improve the competency of the health-care team and
to utilise the existing screening programmes to detect
more of the unknown cases.

REFERENCES

1   Alwan A. Diabetes prevention and control. A call for
     action. In: Epidemiological considerations. WHO
     1993:5-12.

2.   Alwan A. The WHO Eastern Mediterranean program on
     diabetes prevention and control. The Bulletin of the Arab
     Group for Study of Diabetes 1993;2:38-40.

3   Alwan AAS. Management of diabetes mellitus, standards
     of care and clinical practice guidelines. WHO, EMRO:
     1994.

4.   King H, Rewers M. Global estimates for prevalence of
     diabetes mellitus and impaired glucose tolerance in
     adults. Diabetes Care 1993;16:157-77.

5.   Arab M. Diabetes mellitus in Egypt. World Health Stat Q
     1992;45:334-7.

6.   Asfour M, et al. Diabetes mellitus in the Sultanate of
     Oman. The Bulletin of the Arab Group for Study of
     Diabetes 1992;1:66-70.

7.   Arab M. The Alexandria protocol for multi-centre
     population surveys to study the prevalence of diabetes
     mellitus in Middle East and African Countries. The
     Bulletin of the Arab Group for Study of Diabetes
     1994;3:38-40.

8.   Alwan A, King H. Diabetes in the Eastern Mediterranean
     Region. World Health Stat Q 1992;45:355-9.

9.   Al Mahroos S. Diabetes mellitus in Bahrain. Bahrain
     Med Bull 1986;8:61-2.

10. Musaiger AO, Abdulaziz SA. Demographic
     characteristics of hospitalised patients with diabetes in
     Bahrain. Bahrain Med Bull 1986;8:73-6.

11. King H, Rewers M. Diabetes in adults is now a third
     world Problem. The WHO ad hoc diabetes reporting
     group, Diabetes and other non-communicable diseases
     unit. Bull World Health Organ 1991;69:643-8.

12. World Health Organization ad hoc diabetes reporting
     group. Diabetes and impaired glucose tolerance in
     women aged 20-39 years. World Health Stat Q
     1992;45:321-7.

13. Phillips M, Salmeron J. Diabetes in Mexico. A serious
     and growing problem.

14. Alwan A. Diabetes prevention and control. In:
     Introduction. WHO 1993:3-4.

15. Dowse GK, Zimmet P. A model protocol for a diabetes
     and other non-communicable disease field survey. World
     Health Stat Q 1992;45:36-72.

16. The American Diabetes Association. Screening for
     diabetes. Diabetes Care 15 1992;[Supply 2]:7-9.

17. Sekikawa A, Tominaga M, Takahashi K, et al.
     Prevalence of diabetes and impaired glucose tolerance
     in Funagata area, Japan. Diabetes Care (United States)
     1993;16:570- 4.

18. Zurba FI. Characteristics and pattern of care of diabetes
     in primary care health centre in Bahrain. The Bulletin of
     the Arab Group for Study of Diabetes 1994;3:9-18.

19. World Health Organization. WHO technical report series
     No. 727, 1985 (Diabetes mellitus: report of a WHO study
     group).

20. Central Statistics Organization. Bahrain in figures.
     Government of Bahrain: Directorate of Statistics,
     1993:12.

21. Central Statistics Organization. The Population,
     housing, buildings and establishments. Government of
     Bahrain: Directorate of Statistics, Census 1991.

22. Ministry of Health. Bahrain child health survey. State of
     Bahrain, MOH: 1989.

23. Ministry of Health. Health statistical abstract. State of
     Bahrain, Bahrain Health Information Centre: 1992.

24. Fuller H, Stevens LK. Diabetes hypertension study
     group. Prevalence of hypertension among diabetic
     patients and its relation to vascular risk. J Hum
     Hypertens 1991;5:237-43.

25. The American Diabetes Association. Office guide to
     diagnosis and classification of diabetes mellitus and
     other categories of glucose intolerance. Diabetes Care
     1991;2[Suppl]:3-4.

26. Swai AB, Lutale J, McLartrty DG. Diabetes in tropical
     Africa: A retrospective study. Characteristics of newly
     presenting patients in Dar es Salaam, Tanzania. Br Med
     J 1990;300:915-24.

27. Tai TY, Chuang LM, Chen CJ, et al. Link between
     hypertension and diabetes mellitus. Epidemiological
     study of Chinese adult in Taiwan. Diabetes Care
     1991;14:1013-8.