Epidemiology of Diabetes Mellitus in Al-Baidha Governorate, Yemen

Ahmed M. Al-Hadrani*, Ismail S. Abuassaf, Mansour A. Ataa and Khaled Al-Surimi

Faculty of Medicine and Faculty of Education, Thamar University, Republic of Yemen

ABSTRACT

Objectives: To identity the magnitude of diabetes and its epidemiological profile at Al-Baidha Governorate, Yemen, and assess the potential role of the inter-family marriage in increasing the risk of diabetes.

Method: This is a descriptive and analytic epidemiological study of 2458 diabetic patients profile reported at Al-Baidha Governorate population in Yemen covering the period (2007-2009). Data sources included reviewing the patients' files and health statistical reports of the governorate Health office. Additional primary data on family history and diabetes treatment types were collected by a group of researchers (medical students) through conducting home visits for the diabetic patients during the study period.

Results: The percentage of diabetes mellitus is estimated to be 14.8% among males and 10.2% of females. The percentage of diabetes appeared to be increasing among urban areas (20.7%) than that of rural areas (4.3%). The overall age-adjusted proportions obtained from the study showed that 564 (23.2%) individuals were less than 30 years of age and the majority1864 (76.8%) were above 30. The study demonstrated that 2071 (84.3%) diabetic individuals are on oral hypoglycemic agents and that 381 (15.7%) were on insulin injections. Tracing the family history of 801 diabetic men and women demonstrated that the father was diabetic in 39.8%, mother in 26.8%, Grandfather 14.8%, grandmother 10.5% and second degree relative 8.4%. Also, the study showed that 58% of diabetic patients have marriage with first degree or second-degree relatives.

Conclusion: The results of this study indicated that diabetes has become a major health problem in Yemen. Further studies are needed to clarify the potential role of interfamily marriage and genetic susceptibility in the aetiology of diabetes.

Keywords: Diabetes, Aetiology, Odds Ratio, Chi-Squares Tests, Yemen

* Correspondence: Professor Ahmed M. Al-Hadrani, MD, FRCS, President of Thamar University, Thamar, Republic of Yemen, Fax:+967 6 509553, E-mail: hadhrani@yahoo.com or hadrani@y.net.ye

INTRODUCTION

Diabetes is defined as a group of metabolic diseases that are characterized by hyperglycemia resulting from defects in insulin secretion, insulin action or both (1). The disease is one of the leading causes of death, blindness and lower limb amputation. Diabetic retinopathy remains a major cause of blindness worldwide (2). Currently, diabetes is responsible for one death every 10 sec, and an amputation every 30 sec with a mortality rate of approximately 4 million per year (3).

The international diabetes federation estimated in 2003 that 194 million people have diabetes, and that by 2025, 333 million people will have this disease (4, 5). In 2007 it was estimated that global health expenditure on diabetes and its complications would be at least $232 billion (6). Treatment and adapting preventive care programs in persons with diabetes can slow the progression of end stage complications and reduce the risk of microvascular and microvascular complications of type 2 diabetic (7, 8). The aims of this study were to examine the prevalence of diabetes in the urban and rural community in Al-Baidha Governorate in Yemen and to highlight on the potential role of the family and cousin marriage in the development of diabetes.

The objective is to examine the proportion of diabetes among urban and rural community in Al-Baidha Governorate, review the treatment lines being used by patients and to assess the potential role of the inter-family marriage in increasing the risk of diabetes.
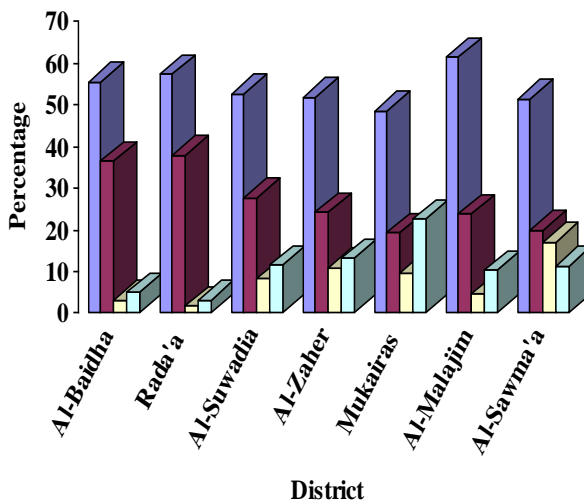
METHOD

AL-Baidha Governorate is situated at a distance of 280 km south east of Sana'a and its population is about 680000. This study is a community based study conducted in rural and urban areas of 7 districts of Al-Baidha Governorate in Yemen. The study comes from a sample of 2458 diabetic patients living in these districts. Some of the data were collected from patients' files and documents in the offices of the Ministry of Health in the region. Seven committees, each of 3 students were distributed to Provinces, and visited diabetic patients and their families. Patients and their families were asked about diabetic history in the family and type of the treatment they had received. The students pursued the family history along two correlated lines: first, knowing the father's status and his genealogy up to the grandfather and including the diabetic brothers, sisters, and second degree relatives; and second, knowing the mother's status in the same way. Also, the family history included the cousin marriage in diabetic individuals. Periodic medical examinations were done weekly by doctors in district hospitals and biochemical analysis was done as well. Blood sugar measurements were done twice daily: in the early morning and before bedtime. Diabetes was diagnosed as per WHO criteria, the treatment of each patient (oral hypoglycemic agents or Insulin) recorded and all treatment lines were reviewed. Some diabetic patients that are not registered in the registry of the Ministry of health were traced and recruited in the study. It is estimated that 5-15% of diabetic individuals are not included in the study due to some technical & social difficulties (e.g. refusal of the patient or his family to meet the team and participate in the study). The diabetic men and women were divided according to age and gender into four groups: GI of men with age class 7 to 30 years, GII of males with age class 31 to 70 + years, GIII of females with age class 7 to 30 years and GIV of females with age class 31 to 70 or more years.

2

RESULTS

The total number of subjects examined was 2458, with 1460 males (59.4%) and 998 (40.6%) women. The registered diabetic individuals were 2231 (90.8%) (1373 men and 858 women), 227 patients (9.2%) : 87 men and 140 women were not registered. Table 1.1 and figure (1) shows the distribution of diabetic individuals in the seven districts and shows that the number of unregistered women is almost double   the number of unregistered men. The percentage of diabetes was estimated to be 14.8% among males and 10.2% among females (table 1.2). The percentage of diabetes mellitus appeared to be increasing among urban areas (20.7%) than that of rural areas (4.3%) (Table 1.2).

The overall age-adjusted prevalence obtained from the study showed that 564 (23.2%) individuals were under 30 years of age and the majority 1894 (76.8%) were above 30. Tables 2.1, 2.2 show the distribution of diabetes according to age and sex. The study demonstrated that 2071 (84.3%) diabetic individuals are on oral hypoglycemic agents and that 381 (15.7%) were on insulin injections (table 3).

Tracing the family history for 801 diabetic men and women demonstrated that the father was diabetic in 39.8%, mother in 26.8%, Grandfather in 14.8% grandmother 10.5% and second degree relative 8.4% (tables 4.1, 4.2). Moreover, the study shows that 58% of diabetic patients have marriage with first or second-degree relatives and this might explain the high prevalence of diabetes in some Yemeni community sectors.

Figure (1): Percentage of diabetic patients by district, Al-baidha governorate.

Table (1.1): The distribution of diabetic patients in seven districts of Al-Baidha Governorate

Area	District	Registration				Total
		Registered		Unregistered		
		Males	Females	Males	Females	
Urban	Al-Baidha	581	381	32	53	1047
	Rada'a	565	374	17	31	987
Rural	Al-Suwadia	82	43	13	18	156
	Al-Zaher	43	20	9	11	83
	Mukairas	30	12	6	14	62
	Al-Malajim	54	21	4	9	88
	Al-Sawma'a	18	7	6	4	35
Total		1373	858	87	140	2458

Table (1.2): Test of Significance using Chi-Squares Tests of Gender vs Registration vs Area.

Gender	Registration	Area	Number of Cases	Chi-Squares Value	P-value
Male	Registered	Urban	1146	1373	P<0.0001
		Rural	227		
	Unregistered	Urban	49	87	P<0.0001
		Rural	38		
Female	Registered	Urban	755	858	P<0.0001
		Rural	103		
	Unregistered	Urban	84	140	P<0.0001
		Rural	56		
Overall			2458	125.03	P<0.0001

Ratios of diabetes estimation			
Ratio of diabetes among gender		Ratio of diabetes by Area	
Males	14.8	Urban	20.7
Females	10.2	Rural	4.3

Table (2.1): Diabetic Patients according to age class and Gender

| Sex
Group | \multicolumn{4}{c}{Diabetic Patients' Age classes} | Total |
| | 7 - 30 | 31 - 70 | 7 - 30 | 30 - 70 | |
	\multicolumn{2}{c}{Males}	\multicolumn{2}{c}{Female}	
I	365	-	-	-	365
II	-	1065	-	-	1065
III	-	-	199	-	199
IV	-	-	-	799	799
Total %	15.5	44.5	8.01	31.99	2428

Table (2.2): Diabetic Patients according to age class and Gender

| Gender | \multicolumn{2}{c}{Age class (years)} | Total | | \multicolumn{2}{c}{Chi-Squares Test for any variation} |
	< 30	≥ 30			Chi-Square value	p-value
Male	365	1065	1430			
Female	199	799	998			
Total	564	1864	2428		10.26	P<0.05

Table (3): Anti-diabetic Agents

	Type	of taken	Percent
Insulin (Intermediate acting) 100 Iu/m / vial		30	0.6
Insulin Human mixtared (30/70) 100 Iu/m /vial	I	153	2.8
Insulin Human R (Actnapid) 100 Iu/m /vials		195	3.6
Glibenclamide 2.5 and 5mg Smg Tablets		979	18.0
Glimepiride 1 and 3mg		380	7.0
Gliclazide 80 mg Tablets		210	3.9
Metformin HCL 500 mg Tablets	II	194	3.6
Insulin Human mixtared (30/70) 100 Iu/m /vial		131	2.4
Insulin Human R (Actnapid) 100 Iu/m /vials		176	3.2
\multirow{2}{*}{Chi-Square goodness-of-fit tests}	\multicolumn{2}{c}{Chi-squares}	P-value
	\multicolumn{2}{c}{730.5}	P<0.0001

Table (4.1): Distribution of the family's history of 808 Diabetic Patients

Group	No. of diabetic patients	Family's history demonstrated that the following family members are associated with a diabetic disease:				
		Percent of Fathers	Percent of Mother	Percent of Grand-father	Percent of Grand-mothers	Percent of Second degree Relatives
I	321	+	-	-	-	-
II	214	-	+	-	-	-
III	121	-	-	+	-	-
IV	85	-	-	-	+	-
V	67	-	-	-	-	+
Total	808	39.8	26.5	14.8	10.5	8.4
		Overall Test of Significance				
P-value		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001

Table (4.2): Analysis of Odds ratios for testing the relationship between the diabetes mellitus occurrence among fathers, mothers, grand-fathers, grand-mothers, second-degree relatives and offspring's.

Groups	Fathers	Mothers	Grand Fathers	Grand Mothers	Second degree relatives
I	1.0 (**)	1.5 (***)	2.7 (***)	3.8 (***)	4.8 (***)
II		1.0 (**)	1.8 (***)	2.5 (***)	3.2 (***)
III			1.0 (**)	1.4 (**)	1.8 (***)
IV				1.0 (**)	1.3 (**)
V					1.0 (**)
NB: $(**) = P < 0.001$ and $(***) = P < 0.0001$					

Statistical analysis

Table 1.1 shows the distribution of registered and unregistered diabetic males and females patients by the district of Al-Baidha governorate. The right column of Table 1 displays the test of significance resulted from testing for any significant difference among diabetic patients in the seventh districts. The multiple comparisons test yielded significant results as implied by their p-values ($p \ll 0.05$). Figure 1 also confirms this conclusion.

The results in Table 1.2 reveal that the mean difference of patients with diabetes in urban and rural areas is significant at the 0.05 level. The percentage of diabetes mellitus appeared to be increasing among urban areas (20.7 %) than that of rural areas (4.3 %). Similarly, the diabetes mellitus occurrence among males is clearly much more than that among females. Table 1.2 shows that percentage of diabetes mellitus is estimated to be 14.8 % among males and 10.2 % of females. Table 2.1, displays the statistical test results produced to the diabetic patients as distributed by age class and gender. The last column (to

the right) of Table 2.1 shows the probability values which indicate highly significant results with respect to group differences of their counts.

Table 2.2 displays the statistical test results produced to the diabetic patients as distributed as a 2×2 contingency table. The obtained results indicated that the diabetes occurred among males and female varies significantly (P<<0.05) according to the age class and gender of the patient's. Across the age class and gender of the patients, the estimated proportions (P) of diabetes are summarized as follows: For males and females with age class under 30 years, the proportions of being diabetics are, respectively, given by 25.5 % for males and 19.9 % for females. Furthermore, for combined sex, the proportion is given by 23.2%. Similarly, for males and females with age class 30 years and more, the respective proportions of being diabetics are given by 44 % for males and 81% for females. For combined sex, the overall proportion is given by 76.8% as well.

In Table 3, the types of Antidiabetic agents were tested for any significant difference. As can be seen from the corresponding probability values in the last column (to the right) of Table 3, the test of between subject effects is clearly significant at the 0.05 level. Meanwhile, the two types of Antidiabetic agents were also compared using Pairwise comparisons test. The two types of Antidiabetic agents were found to differ significantly. Table 4.1 shows the overall test to the family's history of diabetic disease factors across the five groups of diabetic patients. The Chi-Squares test was used to check for any significant relationships of diabetic fathers, mothers, grand-fathers, grand-mothers and second degree relatives. The Chi-Squares test yielded that these factors are significantly associated (P<<0.05). Moreover, the odds ratios test results displayed in Table 4.2 show that the occurrence of diabetic disease among fathers, mothers, grand-fathers, grand-mothers and second-degree relatives are not statistically independent. This might be due to inheritance factors. The coefficient (termed as Kappa) representing the similarity between factors was found to be -0.25.

DISCUSSION

This study showed a male predominance, but this might be explained by the under-registration of diabetic women for social, cultural and religious reasons. This opinion is supported by the result in this paper which showed that the number of unregistered women almost double the number of unregistered men. In this study, type 2 diabetes in Yemeni was diagnosed in 564 (23.2%) patients under the age of 31 years. Gunaid and others reported type 2 diabetes in 16% under the age of 40 years (9). Several authors showed that in Asia the age at which type 2 diabetes development has decreased and the prevalence of the disease has risen in children and adolescents (10).

This study has shown that the onset of type 2 diabetes in younger age-groups was similar to that reported in developing countries but different from that reported in developed countries (11, 12, 13). Moreover, the current study showed that among 801 patients having diabetes the father was diabetic in 39.8%, mother in 26.8%, grandfather in14.8%, grandmother 10.5% and 58% of diabetic patients had interfamily marriage.

These results might support evidence that the genetic factors play an important role in the pathogenesis of diabetes mellitus in some Yemeni patients. Gunaid in a study on 191 Yemeni patients with type II diabetes showed a considerable familial clustering of type II DM (14). Bone-Tamir and others reported that Yemeni Jews who have unusually high

incidence of diabetes differ by gene clustering from all other Jews (15). On the other hand, we believe that environmental factors play an important role in the development of diabetes. This includes the change in life-style of Yemeni individuals; mainly sedentary life and consuming diet rich in fat and carbohydrates and low in fibers even in rural areas in Yemen. Another environmental factor might play a role in the development of diabetes in Yemeni population is the Yemeni habit of chronic chewing of khat sprayed with pesticides. In a study conducted by Mancioli and Parinello on 27410 Yemeni subjects, they found that 60% of males and 35% of females were chronic daily khat chewers and that 30% of males and 24% of females chew khat in weekends and special occasions (16).

It is estimated that 70% of pesticides imported or smuggled to Yemen are used on qat (17). The study showed high ratio of diabetes in Yemeni sampled society, reaching 20.7% in urban areas and 4.3% in rural areas. The prevalence of diabetes is increasing in developing countries more than the developed countries, for example, the prevalence rates of type 2 diabetes in Korea, Indonesia and Malaysia have increased three fold to five-fold during the past 30 years (12, 18, 19). In the countries of the Gulf Co-operation Council, the prevalence is also increasing; reaching 10% to 20% of the population. In Saudi Arabia the prevalence rates have increased from 12.3% in the mid 1990 to 24% in 2004 (20, 21, 22).

For Yemen and other developing countries, prevention of diabetes must take first priority, because it is more cost-effective to start prevention policies than the treatment of diabetes and its complications. Strong public actions and well-planned government policies are crucial to control the epidemic of diabetes.

CONCLUSION

The results of this study indicate that diabetes is an increasing health problem in Yemeni society and affects young age groups. Further studies are needed to clarify the potential role of interfamily marriage and genetic susceptibility in the aetiology of diabetes. It is strongly recommended that Yemen and developing counties start to implement prevention policies against the diabetic epidemic.

ACKNOWLEDGEMENTS

REFERENCES

[1] Report of the expert committee on the diagnosis and classification of diabetes mellitus, diabetes care 1997, 20:1183.

[2] Moss SE, Klein BE, (1998), the 14-year incidence of visual loss in a diabetic population. Ophthalmology, 105:998-1003.

[3] Silink M, (2007), United Nations resolution 61/225- what does it mean to the diabetes world?, Int J Clin Pract, Blackwell Publishing Ltd, 61.

[4] King H, at al, (1998), Global burden of diabetes, 1995-2025: Prevalence, numerical estimates, and projections. Diabetes care: 21, 1414-31.

[5] Wild S, at al, (May 2004), Global Prevalence of diabetes, Estimates for the year 2000 and projections for 2030, Diabetes care, V 27, N 5, P:1047-1053.

[6] International diabetes Federation, (2006), Diabetes atlas. 3rd edn. Brussels.

[7] Bertoni AG., (2001), Achieving control of diabetic risk factors in primary care settings. American journal of managed care, 7(4):411-21.

[8] UK Prospective Diabetes study Group (UKPDS), (1988), Tight blood pressure control and risk of macrovascular and microvascular complications in type 2 diabetes. British medical journal, 317(7160):703-13.

[9] Gunaid A, at al, (1997), Demographic and clinical features of diabetes mellitus in 1095 Yemeni patients, Annals of Saudi Medicine, 17:402-409.

[10] Alberti G, at al, (2004), Type 2 diabetes in the young: the evolving epidemic: the International Diabetes Federation consensus workshop. Diabetes Care; 27:1798-811.

[11] Feng. Hwa Lu., at al, (1998), A population-based study of the prevalence and associated factors of diabetes mellitus in southern Taiwan. Diabet Med; 15:564-72.

[12] Cockram CS, Woo J, Lau E, et al, (1993), The prevalence of diabetes mellitus and impaired glucose tolerance among Hong Kong Chinese adults of working age. Diabetes Res Clin Pract; 21:67-73.

[13] Takahashi Y., at al, (2000), Prevalence of diabetes estimated by plasma glucose criteria combined participants on Miyako Island, Japan. Diabetes Care; 23:1092-96.

[14] Gunaid A, (1999), Familial clustering of type II diabetes mellitus (DM) diagnosed under the age of 40 years in Yemen: is it early-onset type II DM or maturity-onset diabetes of the young?, Annals of Saudi Medicine, 19:308-316.

[15] Bonne-Tamir B, Johnson M, Natali A, (1986), tochondrial DNA types in two Israeli populations: a comparative study at the DNA level. Am J Hum Genet 38:341-351.

[16] Mancioli M., and Parrinello A., (1967), II qat (Catha edulis). La Clinica Terapeutica; 43/2: 103-172.

[17] Al-Gahashm My, Mogaahed AA., (1988), Pesticides on Khat; A danger threatens the society health. Dirasat Yamaniyyah: A Journal of Yemen Centre for studies and Research, Sana'a, Yemen Republic Republic; 32.

[18] Yoon K, at al, (2006), Epidemic obesity and type 2 diabetes in Asia, The Lancet, 368: 1681-1688.

[19] Duc Son LN, Kusama K, Hung NT, et al, (2004), Prevalence and risk factors for diabetes in Ho Chi Minh City, Vietnam. Diabet Med; 21:371-76.

[20] Al-Lawati JA, at al, (2002), Increasing prevalence of diabetes mellitus in Oman. Diabet Med; 19:954-957.

[21] Al-Nozha MM, et al, (2004), Diabetes mellitus in Saudi Arabia. Saudi Med J; 25: 1603-1610.

[22]   تقرير المكتب التنفيذي لمجلس وزراء الصحة لدول مجلس التعاون، الرياض، (2006)، ص151−165.

دراسة وبائية عن داء السكّري في محافظةِ البيضاء، اليمن

أحمد محمد الحضراني، إسماعيل أبو عساف ، منصور على عطاء و خالد الصريمي

كليّة الطبِّ وكليّةِ التربية، جامعة ذمار، اليمن

ملخص

الأهداف: التعرف على حجم مشكلة مرض داء السكّر ومدى انتشاره في محافظةِ البيضاء، اليمن، وتقييم الدور الوراثي المحتمل في زيَّادَة خطرِ مرض السكّر نتيجة للزواج بين الأقارب.

الطريقة: هذه دراسة عبارة عن دراسة وبائية وصفية وتحليلية لـ 2458 حالة من مرضى السكر المسجلة بين سكان محافظة البيضاء، للفترةِ (2007-2009). تَضمّنتْ مصادرُ البيانات مُرَاجَعَة ملفاتِ المرضى والتقاريرَ الإحصائية لمكتبِ الصحة في المحافظة. كما تم جمع بيانات أساسية إضافية عن التاريخ العائلي وأنواع المعالجات لحالات مرض السكّر بوسطة مجموعةٍ من الباحثين (طُلاب كلية الطب بجامعة ذمار) من خلال إجْراء الزيارةِ المنزلية للمرضى بالسكر أثناء فترةِ الدراسة.

النَتائج: وجد أن النسبة المئوية لانتشار مرض داء السكّري تقدر بـ 14.8 % بين الذكور و 10.2 % بين الإناث. كما لُوحظَ أن النسبة المئويةُ لانتشار مرض السكّر تتزايد بين سكان المناطق الحضريةِ (20.7 %) بينما تقل نسبة انتشار داء السكر في المناطق الريفية البعيدةِ (4.3 %). كما أظهرت الدراسة أن عدد و نسبة المصابين وفقاً للفئة العُمرية كما يلي: 564 (23.2 %) كانوا من الفئة العمرية أقل من 30 سنةً والأغلبيةِ 1864 (76.8 %) كانوا من الفئة العمرية فوق 30 سنةٍ. بَيّنتْ الدراسةُ أيضاً بأنَّ 2071 (84.3 %) من مرضى بالسكر كانوا يتلقون Oral hypoglycemic agents وأن 381 (15.7 %) كانوا يتلقون العلاج عن طريق حُقَنِ الأنسولين. كما تم في الدراسة تتبع العلاقات الوراثية باقتفاء التأريخ العائلي لـ 801 رجلٍ وامرأة مرضى بالسكري وتبيّن بأنَّ الأبَّ كَانَ مريض بالسكرَ في 39.8 %، والأمَّ في 26.8 %، والجَدَّ في 14.8 %، والجدة في 10.5 % والقريب من الدرجة ثانية في 8.4 %. ووجد أن هناك دلالة إحصائية معنوية لهذه النتائج (P <0.05). كما بينت الدراسة أيضاً بأنّ 58 % مِنْ المرضى بمرض السكرِ لديهم حالات زواجُ من الأقارب.

الاستنتاج: نَتائِج هذه الدراسةِ أشارتْ بأنّ مرض السكّر أصْبَحَ مشكلة صحيةٍ رئيسيةٍ في اليمن خصوصا في المناطق الريفية. وتوصي هذه الدراسة بعمل دِراساتٍ أخرى وذلك لتَوضيح الدور المحتمَلِ للعوامل الوراثية للزواج من الأقارب ودورها كمسببات في انتقال الأمراض الوراثية وبصورة خاصة مرض داء السكّرِ.

الكلمات الدليلية: مرض السكّر ، عِلْم أسباب المرض، نسبة الاحتمال، اختبارات مربع كاي