Control of diabetes mellitus in the Eastern province of Saudi Arabia: results of screening campaign

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تضبيط السكري في الولايات الشرقية من المملكة العربية السعودية: نتائج حملة التحري

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الخلاصة: لتقييم وضع تضبيط السكري في الولايات الشرقية من المملكة العربية السعودية، دعا الباحثون جميع السكان السعوديين ممن تزيد أعمارهم عن 30 عاماً للمساهمة في حملة تحري شملت 197 681 شخصاً اتضح أن 15.7٪ منهم كانوا مشخصين على أنهم سكريين. وقد جمع الباحثون المعطيات الاجتماعية والديموغرافية والسريرية من المرضى. واتضح أن 33.8٪ من المرضى قد وصلوا إلى مستوى الغلوكوز المستهدف (أقل من 130 ميلي غرام/ ديسي لتر في دم الأوعية الشعرية على الصيام وأقل من 180 ملي غرام عشوائياً). وأوضح التحوف اللوجستي المتعدد أن تقدُّم العمر والتدخين الحالي وانخفاض مستوى النشاط البدني يترافقون إلى مستوى يُعتد به إحصائياً مع عدم ضبط السكري. ويترافق ارتفاع ضغط الدم ترافقاً إيجابياً مع ضبط السكر. إن المعدل الإجمالي لضبط سكر الدم منخفض لدى عامة السكان في هذه الولايات.

ABSTRACT To assess the status of diabetes mellitus (DM) control in the Eastern province of Saudi Arabia, all Saudi Arabian residents aged 30 years and above were invited to participate in a screening campaign. Of 197 681 participants screened 15.7% had a previous diagnosis of DM. Sociodemographic and clinical data were collected from these patients. Only 33.8% of patients were achieving their glycaemic control target (fasting or random capillary blood glucose < 130 mg/dL or < 180 mg/dL respectively). Multiple logistic regression analysis showed that higher age, current smoking and lower level of physical activity were significantly associated with uncontrolled DM. Hypertension was positively associated with glycaemic control. The overall rate of diabetes control is unacceptably low in the general population of this province.

Contrôle du diabète sucré dans la province orientale d'Arabie saoudite : résultats de la campagne de dépistage

RÉSUMÉ En vue d'évaluer l'état de la lutte contre le diabète sucré dans la province orientale de l'Arabie saoudite, tous les habitants âgés de 30 ans et plus ont été invités à participer à une campagne de dépistage. Sur les 197 681 personnes dépistées, 15,7 % présentaient un diagnostic antérieur de diabète sucré. Les données sociodémographiques et cliniques de ces patients ont été recueillies. Seuls 33,8 % d'entre eux atteignaient leur objectif de contrôle glycémique (glycémie à jeun ou glycémie aléatoire dans le sang capillaire < 130 mg/dl ou < 180 mg/dl, respectivement). Une analyse de régression logistique multiple a montré qu'un âge avancé, le tabagisme au moment de l'étude et une faible activité physique étaient significativement associés à un diabète sucré non contrôlé. Une corrélation positive a également été observée entre hypertension artérielle et contrôle glycémique. La faiblesse du taux global de contrôle du diabète au sein de la population de cette province en général n'est pas acceptable.

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Received: 04/06/08; accepted: 22/07/08

Introduction

Diabetes mellitus (DM) is accompanied by long-term microvascular, neurological and macrovascular complications [*1*]. Glycaemic control is fundamental to the management of diabetes. The United Kingdom Prospective Diabetes Study (UKPDS) [*2,3*] and other randomized controlled trials [*4*] have demonstrated the effectiveness of good control of DM in the reduction of clinically important retinopathy, including vision-threatening lesions, and of nephropathy and neuropathy. Meta-analysis of the evidence similarly supports the potential of glycaemic control in reducing cardiovascular disease (CVD) [*5*]. Additional analysis indicates that therapy to achieve near normalization of blood glucose levels is cost effective compared with other treatments [*6,7*].

On the other hand, it has been found that, while tight glycaemic control decreases the risk of microvascular complications, it carries the risk of developing hypoglycaemia and weight gain [*8*]. Hence the goal of therapy is to achieve blood glucose as close to normal as possible while avoiding hypoglycaemia.

The recent recommendations of the American Diabetes Association for glycaemic control targets in adults are a glycosylated haemoglobin (HbA1c) level < 7.0%, pre-prandial capillary plasma glucose (CPG) 70–130 mg/dL (3.9–7.2 mmol/L) and a peak postprandial CPG < 180 mg/dL (< 10.0 mmol/L) [*9*].

In Saudi Arabia, there is a scarcity of published epidemiological data on glycaemic control in DM and the factors associated with it. The aim of this study was to assess the pattern of follow-up and status of glycaemic control in patients with a previous diagnosis of DM according to their sociodemographic and clinical risk factors.

Methods

This study was part of a larger screening campaign conducted in the Eastern province of Saudi Arabia between 28 August 2004 and 18 February 2005. The methodology has been described previously [*10*]. A scientific committee established the detailed procedures for the campaign, including the standards for running the campaign, validation of instruments and health education materials to be used, staff training, financial supervision and data processing and entry. A media campaign was organized in each health sector (district) of the province using written and audiovisual materials, and posters on billboards in the streets and other public places.

Sample

The target population was all Saudi Arabian residents of the Eastern province of Saudi Arabia, aged 30 years and above, excluding pregnant women (650 000 subjects). They were invited to participate in a screening campaign for the early detection of DM and hypertension by attending one of the 300+ examination centres distributed in all primary health care centres, all government hospitals and most private hospitals and dispensaries, in addition to mobile teams in public venues.

The analysis described in this paper included only those participants who were previously diagnosed diabetics being managed by dietary methods or antidiabetic drugs; those who were newly diagnosed with DM during the campaign were excluded.

Data collection

A structured questionnaire for data collection was developed using information obtained from focus groups and was validated by experts in the fields of DM and hypertension. Specially trained members of health teams interviewed the participants and completed the questionnaire. Information was recorded about age, sex, place of residence, marital status, occupation, education, family income, physical activity and smoking. Current smoking was defined by subjects' self-reports as having ever smoked > 100 cigarettes and currently smoking, every day or occasionally, for 1 month or more before the campaign any tobacco products including waterpipe (*shisha*). This group was compared with nonsmokers (ex- and never smokers). Physical activity at work or leisure was grouped into 4 categories: no physical activity (completely sedentary lifestyle, e.g. reading, watching TV); mild physical activity (< 3 hours per week, e.g. ordinary housework, walking), moderate exercise (3+ hours exercise per week, e.g. cycling or walking); and strenuous physical activity (5+ hours per week, e.g. jogging or swimming).

Clinical data were also obtained. Participants were asked if they had been previously diagnosed with DM and were being treated for high blood glucose and, if so, the place of treatment. The participants underwent measurements of weight, height, blood pressure and CPG. Body mass index (BMI) was calculated as weight in kilograms divided by height in metres squared. BMI 25.0–29.9 kg/m^2 was classified as overweight, BMI ≥ 30.0 kg/m^2 as obese, and BMI 18.5–24.9 kg/m^2 as normal. Blood pressure (BP) was measured and hypertension was diagnosed based on the recommendations of the 7th report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC-VII) [*11*]. Whole blood glucose concentration was measured using a portable glucometer, based on reflectance photometry. Glycaemic control targets were defined as preprandial CPG < 130 mg/dL after fasting for > 8 hours or random postprandial CPG < 180 mg/dL. Patients with CPG levels above those readings were defined as having uncontrolled glycaemia. Family

history of DM and personal history of CVD were also recorded.

Coordinators were assigned for each sector to supervise the examination centres, to ensure all forms were completed, to follow up defaulters and to liaise with coordinators in other health sectors and the main supervision committees. The forms were collected from each sector and were double-checked for completeness. Ineligible people were excluded and forms with incomplete data or unconfirmed results were sent back to the health sectors with a covering letter for corrections to be made.

The participants were assured of the confidentiality of the information collected, after explaining the purpose of the campaign. In addition, health education materials were distributed to high-risk groups.

Data analysis

The differences between previously diagnosed diabetics with controlled and uncontrolled glycaemia were assessed using analysis of variance (ANOVA). The chi-squared test was used to assess the relationship between glycaemic control and socioeconomic and clinical risk factors. Cardiovascular risk factors found to be associated with uncontrolled DM were included in the multiple logistic regression and age and sex were included in the model. Age was treated as a continuous measure and the other variables as categorical measures. The odds ratios (ORs) and 95% confidence intervals (CIs) were calculated. P value < 0.05 was considered statistically significant.

Results

Prevalence of DM and patients' background characteristics

Data were missing for 912 people (0.5%) out of the total of 197 681 participants in the campaign. The prevalence of previously diagnosed DM was 15.7% (n = 30 798), constituting 30.4% of the target population. A higher proportion of the women were diagnosed with DM (16 307, 16.9%) than the men (14 486, 14.4%), P < 0.001).

Among these previously diagnosed diabetics, 97.5% were receiving treatment through different health care facilities, most commonly Ministry of Health (MOH) facilities (65.0%), followed by other government hospitals (17.9%) or private facilities (11.8%), while (2.8%) were treated in multiple health care facilities; for 1214 subjects the place of treatment was unknown.

CPG values were obtained for 30 749 (99.8%) of these patients with previously diagnosed DM. Of these, 10 384 (33.8%) were achieving the glycaemic control target. Random CPG was obtained for 22 348 patients, 37.1% of whom had controlled glycaemia (< 180 mg/dL). Fasting CPG level was obtained for 8401 patients and 24.9% had controlled fasting CPG levels (< 130 mg/dL).

Table 1 shows the mean fasting CPG and random CPG levels according to age and sex. In men the mean fasting CPG did not vary significantly with age, whereas random CPG increased with age and reached its peak in the age group 60–69 years (P < 0.001). For women the fasting CPG levels increased significantly with age, peaking in the age group 50–59 years (P < 0.001), while random CPG reached its peak in the age group 60–69 years. Women in general had higher mean fasting CPG

Table 1 Mean fasting and random capillary blood glucose (CBG) levels by age in men and women with previously diagnosed diabetes mellitus

Sex/age (years)	No.	Fasting CBG (mg/dL) Mean (SD)	*P*-value	No.	Random CBG (mg/dL) Mean (SD)	*P*-value
Men						
30–39	344	180.9 (81.8)	0.265	1 878	223.9 (110.4)	< 0.001
40–49	696	181.9 (73.8)		3 657	232.1 (106.3)	
50–59	701	183.8 (74.3)		3 059	236.4 (107.0)	
60–69	703	185.2 (77.6)		1 941	240.4 (105.7)	
70+	394	174.8 (73.2)		1 005	239.1 (108.1)	
Total	2 838	182.1 (75.8)		11 540	233.9 (107.3)	
Women						
30–39	608	185.0 (90.0)	< 0.001	1 868	213.1 (106.6)	< 0.001
40–49	1 688	194.7 (82.2)		3 866	231.9 (110.4)	
50–59	1 689	197.5 (81.1)		2 781	239.4 (110.0)	
60–69	1 025	188.4 (75.2)		1 502	239.5 (107.5)	
70+	508	183.4 (77.6)		641	239.4 (108.7)	
Total	5 518	192.3 (81.2)		10 658	232.1 (109.5)	

SD = standard deviation.

levels but lower mean random CPG levels than men ($P < 0.001$).

Blood pressure measurements showed that 14 423 (46.9%) patients had systolic blood pressure < 130 mmHg, 8794 (28.6%) had diastolic blood pressure < 80 mmHg and 6926 (22.5%) had blood pressure within the range currently recommended by the American Diabetes Association (systolic < 130 mmHg and diastolic < 80 mmHg).

Relationship between glycaemic control and patients' characteristics

The proportion of patients with controlled glycaemia was generally higher in the younger age groups (Table 2). More men that women had glycaemic control ($P < 0.001$). The highest rate of glycaemic control was found in patients managed at private health facilities and the lowest among those managed in multiple health care facilities, followed by those managed in MOH health care facilities ($P < 0.001$).

The highest rate of glycaemic control was recorded among patients whose marital status was single and those with professional employment, while the lowest was noted among the widowed and self-employed ($P < 0.001$) (Table 3). The proportion of patients with controlled glycaemia increased as the level of education and income increased ($P < 0.001$).

Table 4 shows the distribution of glycaemic control in relation to geographic sectors of the Eastern province. The highest rate of glycaemic control was among patients in Khober and the lowest was in Qaria Olaya. Lower rates of glycaemic control were recorded in rural than in urban areas [588 (22.7%) versus 9795 (34.8%) ($P < 0.001$)].

Risk factors for poor glycaemic control

Table 5 shows the comorbidity risk factors for patients diagnosed with DM compared with the total screened participants. The most prevalent associated risk factors for previous diagnosis of DM were positive family history of DM (19.0%), positive history of CVD (47.0%), hypertension (41.0%), obesity (19.4%) and low physical activity (18.5%), while those diagnosed with DM were less likely to be current smokers than subjects without a previous diagnosis of DM (12.1%) ($P < 0.001$).

The distribution of glycaemic control in patients with previously diagnosed DM in relation to the same risk factors is shown in Table 6. Significantly more patients who were hypertensive had controlled CPG level than those who were pre-hypertensive or non-hypertensive. Regarding BMI, the highest rate of glycaemic control was among patients who were obese, followed by those who were overweight ($P < 0.002$). On the other hand, no significant association was observed in the rate of glycaemic control comparing those with and without a history of CVD or comparing current smokers with non-smokers.

Multiple logistic regression analysis, with blood glucose control as the dependent variable, was performed to evaluate which factors were independently associated with glycaemic control in patients with diagnosed DM (Table 7). Increasing age was significantly associated with uncontrolled DM (OR = 1.02; 95% CI: 1.01–1.02, $P < 0.001$),

Table 2 Distribution of patients with controlled and uncontrolled glycaemia by age, sex and place of follow up

Variable	Total no.	Controlled glycaemia		Uncontrolled glycaemia		*P*-value
		No.	%	No.	%	
Age (years)						
30–39	4 697	1 954	41.6	2 743	58.4	< 0.001
40–49	9 904	3 433	34.7	6 471	65.3	
50–59	8 229	2 594	31.5	5 635	68.5	
60–69	5 170	1 541	29.8	3 629	70.2	
70+	2 547	801	31.4	1 746	68.6	
Sex[a]						0.022
Male	14 461	4 980	34.4	9 481	65.6	
Female	16 270	5 401	33.2	10 869	66.8	
Place of follow-up						
MOH facility	19 192	5 739	29.9	13 483	70.1	< 0.001
Other government hospital	5 302	1 983	37.4	3 319	62.6	
Private facility	3481	1 439	41.3	2 042	58.7	
Multiple places	825	245	29.7	580	70.3	

[a]*Data missing for some patients.*
SD = standard deviation; MOH = Ministry of Health

Table 3 Distribution of patients with controlled and uncontrolled glycaemia by socioeconomic status

Variable	No.	Controlled glycaemia		Uncontrolled glycaemia	
		No.	%	No.	%
Marital status***					
Single	468	209	43.0	277	57.0
Married	26 439	9 009	34.1	17 430	65.9
Widowed	3 004	915	30.5	2 089	69.5
Divorced	536	166	31.0	370	69.0
Occupation***					
Self-employed	3 029	924	30.5	2 105	69.5
Housewife	13 964	4 595	32.9	9 369	67.1
Military	1 889	692	36.1	1 207	63.9
Professional	1 722	687	39.8	1 040	60.2
Technical	924	358	38.7	566	61.3
Non-technical	1 036	306	29.6	730	70.5
Administrative	3 557	1 392	39.1	2 165	60.9
Unemployed	3 765	1 173	31.2	2 592	68.8
Education***					
Illiterate	13 186	3 807	28.9	9 379	71.1
Read & write	3 082	1 007	32.7	2 075	75.3
Primary	4 411	1 534	34.8	2 877	65.2
Intermediate	3 080	1 174	38.1	1 906	61.9
Secondary	3 810	1 543	40.5	2 267	59.5
University	2 218	987	44.5	1 231	55.5
Higher degree	182	90	49.5	92	50.5
Income (Saudi riyals per month)***					
< 2000	7 764	2 367	30.5	5 397	69.5
2000–< 5000	7 612	2 411	31.7	5 201	68.3
5000–< 7000	4 120	1 455	35.3	2 665	64.7
> 7000	6 083	2 471	40.6	3 612	59.4

***P < *0.001*

and glycaemic control was also less common among patients who were current smokers (OR = 1.11; 95% CI: 1.02–1.20, $P = 0.018$) or who had a sedentary level of physical activity. On the other hand, being hypertensive was positively associated with glycaemic control (OR = 0.80; 95% CI: 0.76–0.85, $P < 0.001$).

Moderate or strenuous physical activity, sex, BMI, being pre-hypertensive or having a history of CVD did not show any significant association with glycaemic control.

Discussion

The importance of glycaemic control in the management of DM has been highlighted by the Diabetes Control and Complications Trial [*12*], which found an approximately 50% to 70% reduction in the risk for retinopathy, nephropathy and neuropathy when there was intensive therapy for type 1 DM. Similar dramatic reductions in the risk of microvascular complications in type 2 DM were found in the United Kingdom Prospective Diabetes Study [*3*]. However, the standard of care for DM is suboptimal in most clinical settings [*13–15*]. In our study only one-third of diabetic patients achieved the recommended glycaemic level and less than one-quarter of them had blood pressure control. Data from the National Health and Nutrition Examination Survey in 1999–2000 showed that 35.8% of diabetics had achieved their glycaemic target, and 35.8% had achieved the target blood pressure of < 130/80 mmHg [*16*], which are better rates of control than in our study. This could be related to the inclusion of younger subjects (20 years and above) than in our study of over 30-year-olds.

The management of DM provides an excellent model for the quality of health care administered in different clinical settings and the health disparities in different regions, as illustrated by our finding that certain districts and rural populations experienced a disproportionate disease burden due to DM. This was also true for patients receiving management through MOH facilities than in other settings. Our study also provided a benchmark for quality of diabetes care across different groups, such as age, sex and socioeconomic subgroups.

The level of glycaemic control in our DM patients increased as their level of education and income increased. Populations of lower socioeconomic status have been shown to have a higher rate of diabetes-related complications and this has been attributed to a lower quality of care for these patients [*15,17*]. However, health care in Saudi Arabia is accessible to all and provided free of charge for the citizen population so the poor control of DM may be due to risk factors other than disparities in health care. Failure to achieve the glycaemic target in spite of the availability of efficacious treatment has been studied before, and is influenced by different factors related to the patient, provider and health care system and may be explained by a breakdown

Table 4 Distribution of patients with controlled and uncontrolled glycaemia by health sectors (districts) of the Eastern province

Health sector	No.	Controlled glycaemia		Uncontrolled glycaemia		*P*-value
		No.	%	No.	%	
Dammam	4858	1869	38.5	2989	61.5	< 0.001
Khober	4 455	1935	43.4	2520	56.6	
Qateif	3 210	1271	39.6	1939	60.4	
Ras Tanura	732	234	32.0	498	68.0	
Bqaiq	850	201	23.6	649	76.4	
Safwa	600	194	32.3	406	67.7	
Jubail	703	293	41.7	410	58.3	
Khafji	538	148	27.5	390	72.5	
Oraera	198	42	21.2	156	78.8	
Nuaeria	634	147	23.2	487	76.8	
Sarar	441	101	22.9	340	77.1	
Qaria Olaya	296	54	18.2	242	81.8	
Rafeia	176	43	24.4	133	75.6	
Al-Hassa	11 177	3392	30.3	7785	69.7	
Hafr-Albaten	1 867	459	24.6	1408	75.4	

Table 5 Comorbidity risk factors among patients with previously diagnosed diabetes mellitus (DM)

Variable	Total subjects No.	Previously diagnosed DM		*P*-value
		No.	%	
Family history of DM				
Yes	100 109	19 005	19.0	< 0.001
No	96 660	11 793	12.2	
Personal history of CVD				
Yes	5 372	2 526	47.0	< 0.001
No	191 397	28 272	14.8	
Blood pressure				
Hypertensive	30 484	12 492	41.0	< 0.001
Non-hypertensive	166 285	18 306	11.0	
Tobacco smoking				
Current smoker	33 065	4 003	12.1	< 0.001
Nonsmoker	163 164	26 677	16.3	
BMI				
Underweight	2 617	120	4.6	< 0.001
Normal weight	38 651	3 670	9.5	
Overweight	68 720	10 219	14.9	
Obese	85 780	16 633	19.4	
Physical activity				
Sedentary	50 535	9 372	18.5	< 0.001
Mild	104 382	16 379	15.7	
Moderate	35 847	4 384	12.2	
Strenuous	4 623	439	9.5	

CVD = cardiovascular disease; BMI = body mass index.

Table 6 Distribution of patients with controlled and uncontrolled glycaemia by health risk factors

Variable	Total	Controlled glycaemia		Uncontrolled glycaemia		*P*-value
	No.	No.	%	No.	%	
Personal history of CVD						
Yes	2 522	860	34.1	1 662	65.9	0.725
No	28 214	9 524	33.8	860	66.2	
Blood pressure						
Hypertensive	12 468	4 455	35.7	8 013	64.3	< 0.001
Pre-hypertensive	527	158	30.0	369	70.0	
Non-hypertensive	17 738	5 768	32.5	11 970	67.5	
Tobacco smoking						
Current smoker	3 997	1 372	34.3	2 625	65.7	0.44
Nonsmoker	26 622	8 972	33.7	17 650	66.3	
BMI						
Underweight	120	41	34.2	79	65.8	0.002
Normal weight	3 660	1 146	31.3	2 514	68.7	
Overweight	10 198	3 403	33.4	6 795	66.6	
Obese	16 604	5 740	34.6	10 864	65.4	
Physical activity						
Sedentary	9 360	3 220	34.4	6 140	65.5	0.001
Mild	16 347	5 379	32.9	10 968	67.1	
Moderate	4 370	1 525	34.9	2 845	65.1	
Strenuous	438	173	39.5	265	60.5	

CVD = cardiovascular disease; BMI = body mass index.

of communication related to these 3 factors [*18*].

Substantial attention has been focused recently on the organizational and economic aspects of medical care for diabetic patients [*19*] and this is reflected by our findings which suggest that better knowledge and motivation of patients plays a major part in glycaemic control and self-care practice of adults with DM. This has been highlighted by different organizations and shown to have major implications for health care policy [*9,20*]. A meta-analysis that reviewed the efficacy of diabetes education has found that approaches based on diet instruction and social learning were the most effective interventions for achieving glycaemic control [*21,22*]. Naik et al. stressed the importance of patients actively self-monitoring their blood glucose levels, and then communicating these results to their physician, who can then adjust the medication to reach the glycaemic targets [*23*].

In univariate analysis, obesity was associated with having glycaemic control, but regression analysis could not show a significant relationship between BMI and glycaemic control. The same was found by other researchers who attributed the anomaly to the type of cross-sectional study in which patients with good glycaemic control gain weight and patients with poor glycaemic control lose weight due to the disease process [*15*]. Our explanation is that this may be due to the greater concern of obese individuals to control their glycaemic level.

Good blood pressure control is a central outcome of high-quality diabetes care. The JNC VII report in 2003 recommended that blood pressure be reduced to less than 130/80 mmHg [*11*], due to consistent evidence that intensive control of blood pressure in adults with type 2 DM prevents both microvascular and macrovascular diseases [*24,25*]. Clinical trials indicated that reducing blood pressure by 10 mmHg would decrease macrovascular and microvascular complications and mortality rates by 35% [*25*]. Our findings revealed that individuals with DM have better control of hypertension, and this may reflect more concern and care among groups at risk than others.

The key finding of this study—that the overall rate of diabetes control in Eastern province of Saudi Arabia is unacceptably low in the general population—has important implications. Improving health care disparities in glycaemic control should be a public health priority in order to reduce diabetes-related morbidity and mortality in the community. Patients need to be empowered with the knowledge and resources to enhance their individual par-

Table 7 Multiple logistic regression model of variables associated with glycaemic control in patients with previously diagnosed diabetes mellitus

Variable	Logistic regression coefficient	Odds ratio	95% CI	*P*-value
Age	0.015	1.00	1.01–1.02	< 0.001
Sex				
Women		1		
Men	–0.10	0.99	0.93–1.05	0.750
Personal history of CVD	0.024	1.02	0.93–1.14	0.644
Blood pressure				
Normal		1		< 0.001
Hypertensive	–0.220	0.80	0.76–0.85	< 0.001
Pre-hypertensive	0.180	1.20	0.94–1.52	0.137
Tobacco smoking				
Current smoker				
Nonsmoker	0.10	1.11	1.02–1.20	0.018
BMI				
Underweight		1		0.078
Normal weight	0.118	1.13	0.71–1.79	0.618
Overweight	–0.005	1.00	0.63–1.58	0.983
Obese	0.003	1.00	0.63–1.59	0.989
Physical activity				
Sedentary		1		0.011
Mild	0.078	1.08	1.02–1.15	0.14
Moderate	–0.005	1.00	0.91–1.09	0.920
Strenuous	–0.162	0.85	0.68–1.06	0.148

CVD = cardiovascular disease; BMI = body mass index; CI = confidence interval.

ticipation in diabetes self-care in order to improve their glycaemic control.

There were some limitations to this study. Details about management regimens and the duration of diagnosed diabetes were not known. HbA1c, which is a strong indicator of glycaemic control and which would give us a more comprehensive picture, was not measured. However, this study had its strengths, including the large sample size. Subjects with undiagnosed DM were excluded from this study, as they were not aware of their disease status and were not in a position to control their blood glucose and related cardiovascular risks. Finally, we reported the distribution of random CBG, fasting CBG level and blood pressure on the basis of clinical examination and not on records.

Acknowledgements

We thank all who participated in the campaign for their enthusiasm in fulfilling the study objectives.

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Second Annual Meeting of the Global Diabetes Alliance (GDA 2), Cairo, Egypt, 26–29 October, 2010

Cairo will host the second Global Diabetes Alliance Congress, a very special event whose goal is to unify protocols for epidemiological surveys and prevention and management of diabetes and its related disorders. This Congress will be dedicated to the presentation of updates on the diabetes epidemic in various parts of the world (including the Middle East and Africa) and workshops designed to initiate collaborative research projects among groups of investigators throughout the world. The programme can be accessed from the conference website at: http://conf.global-diabetes.org/index.htm