

## Physical Activity and Reported Barriers to Activity Among Type 2 Diabetic Patients in the United Arab Emirates

Juma Al-Kaabi<sup>1</sup>, Fatma Al-Maskari<sup>2</sup>, Hussein Saadi<sup>1</sup>, Bachar Afandi<sup>3</sup>,  
Hasratali Parkar<sup>3</sup> and Nicolaas Nagelkerke<sup>2</sup>

<sup>1</sup> Department of Internal Medicine, Faculty of Medicine and Health Sciences, UAE University, United Arab Emirates. <sup>2</sup> Department of Community Medicine, Faculty of Medicine and Health Sciences, UAE University, United Arab Emirates. <sup>3</sup> John Hopkins Medicine International Tawam Hospital, United Arab Emirates. Address correspondence to: Fatma Al-Maskari, e-mail: fatma.am@uaeu.ac.ae

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### ■ Abstract

**OBJECTIVES:** This study was designed to assess the physical activity practice among type 2 diabetic patients in the United Arab Emirates (UAE). **METHODS:** This is a cross-sectional study of type 2 diabetic patients who participated in the outpatient clinics in Al-Ain District, during 2006. The patients completed an interviewer-administered questionnaire, and measurements of blood pressure, body mass index, body fat, abdominal circumference, glycemic control (HbA1c), and fasting lipid profile. **RESULTS:** Of the 390 patients recruited, only 25% reported an increase in their physical activity levels following the diagnosis of diabetes, and only 3% reported physical activity levels that meet the recommended guidelines. More than half of the study sub-

jects had uncontrolled hypertension (53%) and unacceptable lipid profiles; 71% had a high low-density lipoprotein (LDL), 73% had low high-density lipoprotein (HDL), and 59% had hypertriglyceridemia. Forty-four percent were obese and a further 34% were overweight. Abdominal obesity was also common (59%). Only 32% had an acceptable glycemic control. **CONCLUSIONS:** The physical activity practice of type 2 diabetic patients in the UAE is largely inadequate to meet the recommended level necessary to prevent or ameliorate diabetic complications. Interventions aiming at overcoming the barriers to physical activity are urgently needed.

**Keywords:** type 2 diabetes · physical activity · obesity · glycemic control · exercise · risk factors · cardiovascular disease · metabolic syndrome

### Introduction

Physical activity is a cornerstone of type 2 diabetes management, but is often underutilized [1]. The overall beneficial effects of exercise in type 2 diabetes mellitus are well documented with regard to glucose control and multiple cardiovascular risk factors [2]. Studies have reported that regular physical exercises have positive effects on metabolic control—measured by HbA1c, blood glucose, or insulin sensitivity—and reduces the risk to develop diabetes [2-4]. Exercise improves cardio-respiratory fitness, muscular

strength, endurance, body mass and fat composition [2-5]. It is also assumed to reduce cardiovascular risk by positive effects on hypertension, dyslipidemia, obesity, and blood lipid profile [2-7]. It has been estimated that regular physical activity may reduce the risk of coronary heart disease in people with diabetes by 35%-55% [8], and protect against the development of the metabolic syndrome [4, 5, 9-13].

The American Heart Association (AHA) and the American Diabetes Association (ADA) recommend carrying out at least 150 minutes of moderate-intensity aerobic activity, or at least 90 min-

utes of vigorous aerobic exercise per week [14]. The activity should be distributed over at least three days per week, with no more than 2 consecutive days of inactivity. While physical activity may be contraindicated for some patients, the new guidelines recommend moderate intensity of physical activity (i.e., 30 min of moderate-intensity physical activity  $\geq 5$  days/week) for most patients, particularly those with type 2 diabetes [9, 10].

#### Abbreviations:

ADA - American Diabetes Association  
 AHA - American Heart Association  
 BMI - body mass index  
 BP - blood pressure  
 Dh - Dirham (UAE currency)  
 HbA1c - glycated hemoglobin  
 HDL - high-density lipoprotein  
 LDL - low-density lipoprotein  
 M-H trend test - Mantel-Haenszel trend test  
 SD - standard deviation  
 SPSS - statistical package for the social sciences  
 UAE - United Arab Emirates  
 UK - United Kingdom  
 $VO_2$  max - maximal oxygen consumption (or aerobic capacity)

Although diabetic patients are encouraged to perform physical exercises, long-term compliance is a major problem with physical activity programs. Many patients fail to maintain self-motivation. Personal and environmental barriers are associated with failure to stay active [15]. In the USA, approximately two-thirds of the diabetics do not exercise sufficiently [16, 17]. In the UK, 68% of type 2 diabetic patients were categorized as inactive [15]. High failure rate is also reported in other nations, e.g. Hungary 34% [18] and Malaysia 54% [19]. In the Arabian Gulf, in countries such as Saudi Arabia and Kuwait, the situation appears to be even worse [20, 21]. In diverse migrant groups in western societies, the main limiting factors to physical activity reported, include: cultural and religious beliefs, issues with social relationships, socioeconomic challenges, environmental barriers, and fear of injury [22]. In the UK, the main reasons reported for inactivity were perceived difficulty to take part in exercise, feelings of tiredness, and being distracted by television. Lack of time and lack of local exercise facilities also contributed to inactivity [15]. Whereas, in the Gulf region, the most frequently reported barriers to exercise were lack of time, coexisting diseases, hot weather conditions, abundance of housemaids, and tendency to use cars excessively [21].

Here, we report on compliance to physical activity recommendations, and on barriers among diabetic patients in the UAE. To the best of our knowledge, there are no other studies addressing these important issues in the UAE. Previously, we have reported that in the UAE, diabetic patients' compliance to dietary practices was inadequate and needed improvement [23].

## Methods and subjects

Ethical approval was obtained from the Al-Ain Medical District Human Research Ethics Committee. A random selection of patients was made from consecutive attendees at the diabetes center of Tawam Hospital, and five primary health care centers, in the Al-Ain District of Abu Dhabi Emirate. Patient selections were made during the period May to October 2006 [23]. All were interviewed using a questionnaire.

Sociodemographic patient characteristics were collected. They included age, sex, nationality, marital status, level of education, employment, and income. The following disease characteristics were recorded: duration and current management of diabetes, way of diagnosis, smoking status, and presence of diabetes complications.

Physical activity was estimated as the average over the "usual week" of recalled physical activity based on a series of questions validated for the assessment of customary activity in the elderly [24]. These questions were chosen because UAE citizens are rarely involved in organized sports activities. Three indicators investigated for current activity were:

1. Time spent in outdoor walking.
2. Time spent in practicing sports/exercise.
3. Contribution to domestic chores.

Initially, patients were characterized as physically active if they accumulated at least 150 minutes of moderate activity per week, according to the AHA and ADA guidelines. As the number of subjects achieving this target was very small, "physically active" was redefined by less strict criteria, including regular sport's practice, engagement in household chores (household activities and/or gardening), or walking 3 times a week  $\geq 30$  minutes (either strenuously or not). Indicators of physical inactivity were 1. time spent at work and 2. time spent in watching TV. The information was classified on a scale of 1 to 4, with 1 being least active and 4 most active. The data was also compared with classification according to AHA and ADA recommendations [12].

Additionally, information on family support and barriers to physical activities were added to the information collected on physical activity. Patients were asked to select from a list of possible reasons for inactivity. Amongst these reasons were: lack of local facilities, cost of exercise facilities, family responsibilities, lack of family support, fear of injury from practicing sports, disease (e.g. osteoarthritis), self belief that exercise makes diabetes difficult to control, lack of time, weather conditions, and tiredness. If the patient mentioned a non-listed factor, then it was recorded under 'other' reasons.

Perceived importance of physical activity was assessed using 5-point Likert scales. Three-point scales (increased, remain the same, or decrease) were used to assess the level of physical activity following diagnosis of diabetes. Subjects were also asked if they had received counseling by diabetic educators, and what they considered was the best source of advice regarding physical activity.

Weight and height were measured using portable digital scales, and a portable stadiometer. Abdominal circumference was assessed using a flexible tape over loose thin clothing. Percentage body fat was assessed using Tanita Body Composition Analyzer TBF-300. Blood pressure (BP) (systolic and phase-V diastolic) recordings were made using a calibrated electronic sphygmomanometer, after the patients had rested in sitting position for 10 minutes. Three separate readings were made and their mean was recorded. Most recent investigations such as HbA1c and fasting lipid profile measured using an auto-analyzer Beckman Coulter DXC800 (Beckman Instruments, Inc., Fullerton, California) were obtained from patients' medical records.

### Statistical analysis

Frequency, mean, standard deviation, and 95% confidence interval, were used for univariate descriptive statistics. Bivariate associations were analyzed using Pearson's chi-squared test, independent sample t-tests, and Spearman's non-parametric correlation coefficient ( $\rho$ ). As a trend test in contingency tables, the Mantel-Haenszel (M-H) trend test was used. For multivariate analysis, multiple linear regression or analysis of covariance was used. Variables either statistically significant (i.e.  $p < 0.05$ ) univariately, or considered potentially important predictors, were included as covariables in multiple linear regression. The SPSS 17.0 software package was used for all analyses. Ordinal independent variables were

**Table 1.** Demographic data of the participants (n = 390)

Variable	n	Percent
Place of interview		
Tawam Hospital	189	48.5
Primary Health clinics	201	51.5
Gender & nationality		
Female	241	61.8
UAE	334	85.6
Level of education		
Illiterate	199	51.0
Completed primary school	115	29.5
Completed secondary school	52	13.3
Completed university	20	5.1
Income		
<5000 Dh per month	185	47.4
>5000 Dh per month	205	52.6
Age group (yr)		
40 or less	47	12.1
41 - 49	91	23.3
50 - 59	134	34.4
60 or above	116	29.7
Currently smoking		
Yes	16	4.1
BMI group (kg/m <sup>2</sup> )		
Under weight (< 18.5)	2	0.5
Healthy weight (18.5-24.9)	66	16.9
Overweight (25-29.9)	134	34.4
Obese $\geq 30$	174	44.6

treated as continuous, after graphically examining that the assumption of a linear relationship was reasonable. Otherwise those variables were converted into a dummy (i.e. indicator) corresponding to the number of levels of that variable minus one. Each of these was then included as an independent variable.

## Results

### General

A sample of 390 patients (mean age  $52 \pm 9.9$  SD) was interviewed. 62% were females. The sample group had a literacy level of 49% (Table 1).

### Risk profile and glycaemic control

The overall risk profile, including obesity, dyslipidemia, and hypertension was high. More than half of the study sample had uncontrolled hypertension and unacceptable lipid profiles (Table 2). According to the body mass index (BMI), the majority were either overweight (34%) or

**Table 2.** Clinical characteristics of the participants (n = 390)

Variable	n	Percent
Diabetes duration		
1- 5 yr	129	33.2
5-10 yr	160	41.1
> 10 yr	100	25.7
Way of diagnosis		
Incidental	58	14.9
Screening	203	52.2
Symptomatic	128	32.9
Family history of diabetes		
Yes	187	47.9
HbA1c (glycemic control)		
< 7% (good control)	116	31.7
7-8% (sub-optimal control)	73	19.9
8-9% (insufficient control)	58	15.8
> 9% (uncontrolled)	119	32.5
Blood pressure		
Uncontrolled (> 130/80 mmHg)	206	52.8
LDL cholesterol		
High (> 2.5 mmol/l)	279	71.5
HDL cholesterol		
Low (<1 mmol/l)	285	73.1
Total chol./HDL chol. ratio		
High (> 4)	243	62.3
Triglycerides		
High (> 1.7 mmol/l)	231	59.2
Waist circumference (abdominal)		
High (female >88 cm; male >102 cm)	229	58.7
Body fat composition		
High (body fat >35%)	347	89.0
Physical activity		
Met recommended guidelines	11	3.0
Walking as most common activity	304	78.0
Walking for 30 mins 3 times a week	133	34.0

obese (44%). Abdominal obesity was found in 78% of females and 29% of males. Only 32% had HbA1c of less than 7%. Self-monitoring of blood glucose was practiced by 58% of the patients. Surprisingly, 73% reported that they have not seen a diabetic educator since their diabetes diagnosis.

### Physical activity

The reported levels of physical activity were low and only 3% of the studied population (11 patients) met the recommended guidelines for physical activity. Walking for the purpose of exercise was the most popular activity (78%). However, only 34% (30% females and 39% males,  $p = 0.06$  by chi-square test) reported normal regular walking

for at least 30 minutes at least 3 times per week. There was a weak, but statistically significant, association between walking ("3 times/week for 30 minutes") and income. Patients from higher income groups reported more walking than those from lower income groups ( $p = 0.01$  by M-H trend test).

Regarding physical inactivity, there was no statistically significant association between the number of hours watching TV and age, sex, duration of diabetes, or level of education, with the exception of those with post-graduate education who watched more TV than other groups. Time spent sitting at work was only influenced by income (positive association) and having an education level of at least university (positive association).

Multiple regression analysis of HbA1c in relation to age, sex, education, duration of diabetes, and physical activity (either walking or regular sports) did not reveal any significant effect of physical activity on HbA1c levels. Multiple linear regression analysis of BMI in relation to sex, age, education, and various nutritional and physical activity variables showed that BMI was mainly related to gender. Women had a 4.2 kg/m<sup>2</sup> higher BMI.

We compared the risk profiles of those who were physically active with those who were not (Table 3). We assumed physical activity for all those who reported either to do sports, to be a regular gardener, to be regularly involved in household chores, or to walk at least 3 times a week  $\geq 30$  minutes (either strenuously or not). All others who fell short of these non-stringent criteria were regarded as being physically inactive. The most surprising difference between these two groups is the significantly higher waist circumference of patients characterized as physically active ( $99.4 \pm 15.5$  vs.  $88.4 \pm 22.9$ ,  $p < 0.01$ ).

The majority of the subjects (95%) recognized the importance of physical activity. However, only 25% reported that their physical activity had increased following the diagnosis of diabetes. The majority of reported barriers to physical activity were disease (e.g. arthritis), lack of time, cultural issues, lack of interest, and family responsibilities (Table 4). Physicians were reported to be the best source of advice regarding physical activity by the majority of patients (95%), while diabetic educators were rarely reported as the main source of advice.

The total number of barriers reported was positively correlated with BMI (Spearman's  $r = 0.196$ ,  $p < 0.01$ ), and with systolic blood pressure (Spear-

**Table 3.** Clinical characteristics of study participants categorized by gender and physical activity

Variable	Physically active		Physically inactive		p
	Male (n = 52)	Female (n = 78)	Male (n = 97)	Female (n = 155)	
Age (yr)	54.3 ± 12.2	52.3 ± 10.8	54.5 ± 9.4	50.4 ± 8.5	NS
Diabetes duration (yr)	9.0 ± 6.3	9.3 ± 7.7	7.7 ± 5.2	7.5 ± 5.1	NS
Income >5000 Dh per mo (%)	39.0	47.3	61.3	65.5	< 0.01
Systolic BP	133.5 ± 18.4	135.2 ± 18.6	133.0 ± 18.0	131.0 ± 15.4	NS
Diastolic BP	78.7 ± 8.2	78.4 ± 11.7	79.0 ± 10.5	78.2 ± 11.6	NS
Waist circumference (cm)	84.6 ± 19.5	90.1 ± 24.3	98.6 ± 16.5	100.0 ± 15.0	< 0.01
HbA1c (%)	8.19 ± 2.49	7.69 ± 1.97	7.92 ± 2.28	8.28 ± 2.30	NS
Triglycerides (mmol/l)	2.43 ± 2.80	1.82 ± 1.42	2.99 ± 1.75	2.87 ± 2.43	NS
LDL cholesterol (mmol/l)	2.76 ± 0.84	2.85 ± 0.82	2.75 ± 0.92	3.09 ± 1.07	NS
HDL cholesterol (mmol/l)	0.94 ± 0.27	1.05 ± 0.26	1.00 ± 0.32	1.11 ± 0.31	< 0.05
BMI (kg/m <sup>2</sup> )	27.3 ± 4.9	32.9 ± 5.9	27.8 ± 4.7	31.7 ± 7.2	NS
Body fat (%)	32.84 ± 9.71	40.29 ± 9.58	32.37 ± 8.16	38.69 ± 7.39	NS

**Legend:** P-values represent the difference between physically active and physically inactive type 2 diabetes patients. They are adjusted for age and gender using covariance analysis. NS: not significant ( $p > 0.05$ ).

man's  $r = 0.154$ ,  $p < 0.01$ ). In contrast, the number of reported barriers was negatively correlated with HbA1c (Spearman's  $r = -0.1$ ,  $p = 0.05$ ), and with triglycerides (Spearman's  $r = -0.32$ ,  $p < 0.01$ ).

## Discussion

Our study revealed that the levels of physical activity are low in the UAE diabetic population, with only 3% of subjects (11 patients) meeting the recommended guidelines for physical activity. These findings were consistent with studies performed in other parts of the world [18, 25-27]. In our study population, outdoor walking was the most commonly reported physical activity, and is consistent with previous reports [28, 29]. The major factors in our population were the high level of illiteracy (51%) and the impact of the recent modern lifestyle changes.

The reported barriers to physical activity in our study were similar to findings from neighboring countries such as Kuwait [21], South Asians residing in the UK [30], and Mexican Americans with type 2 diabetes [28]. Surprisingly, although our study was mostly conducted during the summer months, the weather was not reported to be a major barrier to physical activity. The same applies for unavailability of nearby parks and gyms, costs, safety, and fear of metabolic disturbances (i.e. loss of diabetes control). In contrast, reported barriers to physical activity were cultural issues, especially pertaining to women, which make it dif-

icult to attend public gyms, sport clubs or recreational centers. Only few facilities in Al Ain are exclusively available to women. Furthermore, traditional clothes, for both genders, while hiding excess weight, hinder physical activity. Daily household activities are mostly carried out by domestic helpers, and the main mode of transportation is by car (door to door). Lack of past experience with exercise is a major problem, since physical activity is not given adequate attention in schools. In addition, in popular culture physical fitness is not considered important and is rarely discussed in daily life.

It seems that patients with elevated BMI who need to be more active, perceived the greatest number of obstacles. However, the causality of this relationship is unclear. It is possible that initially, individuals became overweight due to their experience of barriers to exercise. On the other hand, it is also possible that the reported barriers are an excuse for inactivity and thus a propensity to be overweight. More puzzling is the paradoxical relationship between barriers to exercise and HbA1c. Women characterized as physically active had higher levels of HbA1c than inactive women (Table 3).

Glycemic control was not related to types of reported barrier to physical activity (Table 4), except for those reporting "family responsibilities" as a barrier, who had relatively low HbA1c. Perhaps, family responsibilities involve some degree of physical activity as well. An interesting finding

**Table 4.** The most common barriers that contributed to physical inactivity among the study participants (n =390)

Reported barrier	Percentage	HbA1c	p
Disease (e.g. osteoarthritis)	32.1	7.88	NS
Lack of time	29.7	7.92	NS
Cultural reasons	29.2	8.20	NS
Family responsibilities	20.8	7.55	p < 0.05
Exercise is boring	20.3	8.06	NS
Weather condition	7.9	7.45	NS
Fear of injury from practicing sports	4.9	7.16	NS
Lack of family support	4.1	8.92	NS
Cost of joining the gym	2.8	7.94	NS
Inavailability of nearby parks	1.5	6.87	NS
Laziness	1.0	7.06	NS
Lack of safe places to walk	0.8	9.06	NS
Exercise makes diabetes difficult to control	0.5	6.05	NS
Self-belief (embarrassed to wear sportswear)	0.5	8.03	NS
Others	3.8	8.02	NS

**Legend:** P-values represent the difference in HbA1c between those reporting barriers and those reporting no barriers. The values are adjusted for age and sex using covariance analysis. NS: not significant ( $p > 0.05$ ).

was the fact that those reporting some physical exercise were more overweight than inactive patients. Presumably, physical exercise was recognized as a means to reduce weight by patients being overweight, but exercise was not sufficiently effective to reduce weight to normal levels at the time of survey. Similarly, many active patients with diabetes exercise at suboptimal level. This could explain why such patients had no improved glycemic control compared with inactive patients.

The information on physical activities was mainly offered by treating physicians, and partially by family and social circle. A further possible step to improve compliance to physical activity would be the involvement of relatives or friends. Continuity of physical activity needs a partner and the majority of the patients live with their extended family. There is opportunity for improvement, as only 32% reported that their family members were involved in the diabetes education consultation. This is supported by various studies showing that involvement of the family in patient care was strongly associated with diet, physical activity, and medication compliance [28, 31-36].

Clearly, care of type 2 diabetics in the UAE is currently unbalanced. While the latest diagnostics and medications are available, lifestyle changes and basic physical activity fall short of recommended levels. Physical activity prescriptions

should begin by determining the patient's physical activity preference patterns, social support, education level, time constraints, and other challenges. It is important to tailor physical activity counseling to the individual, since standardized routine counseling fails to empower patients to self-manage their disease. It is expectable that the more recommendations deviate from patients' preferences the less likely is their adherence.

Discussing all steps to improve the infrastructure of diabetes care by physical activity programs in the community is beyond the scope of this article. Perhaps most important is the involvement of dedicated multidisciplinary teams consisting of physicians, diabetic educators, and other health care providers. Together, they can reinforce the message of the value of physical activity to their patients. At the individual level, it is important to identify and overcome personal and family barriers to physical activity [37].

Our study had some limitations. Firstly, physical activity assessment was based on self-reporting, instead of diary keeping and measurement of physical fitness such as  $VO_2$  max. Secondly, all subjects in our study were from the city of Al Ain. Therefore, the results are not universal to the UAE. Thirdly, this is a cross-sectional study, which makes it difficult to draw conclusions about causation. Nevertheless, it clearly snapshots the current situation, and may help to improve diabetic care and the design of future studies on the effectiveness of diabetes care.

In conclusion, physical activity practices of type 2 diabetic patients in the UAE are grossly inadequate. Several barriers to physical activity were reported. Therefore, strategies aiming at overcoming these barriers and improving motivators are urgently needed.

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