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Assessment of Physical Activity Level among Individuals with Type 2 Diabetes Mellitus at Cheras Health Clinic, Kuala Lumpur

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ABSTRACT

A cross-sectional study was carried out to assess the physical activity levels among patients with type 2 diabetes mellitus (DM) at Cheras Health Clinic in Kuala Lumpur. A total of 132 subjects (62 men and 70 women) aged 30 years and above participated in this study. Data was collected using an interview based questionnaire to obtain socio-demographic and health profile information. Physical activity was assessed using a shortened version of the International Physical Activity Questionnaire (IPAQ). Anthropometric measurements and body fat were also taken. Glycaemic status, that is, HbA1c, fasting blood sugar (FBS) and 2 hours post-prandial (2-HPP) were obtained from medical records. Results showed that the mean age of the patients was 51.9 $\pm$ 5.8 years. The majority of patients had poor glycaemic control based on HbA1c (70.7%), FBS (71.9%) and 2HPP (85.4%). Patients who were unmarried and aged(60 years and above had a lower physical activity level ($p<0.05$). In the older age group, low physical activity was associated with poor glycaemic control ($p<0.05$). Patients in the moderate and high physical activity level were motivated to perform physical activity so as to be healthy (68.1%). Low physical activity level among patients was due to lack of time (54.5%) and lack of energy (21.2%). In conclusion, physical activity levels of the patients were unsatisfactory and associated with poor glycaemic control, especially in the elderly. There is a need to encourage diabetic patients to undertake regular physical activity in order to achieve optimal glycaemic control.

Keywords: Health clinic, physical activity level, Type 2 Diabetes Mellitus

INTRODUCTION

The World Health Organization (2008) has estimated that more than 180 million people around the world suffer from Diabetes Mellitus. In Malaysia, the First National Health and Morbidity Survey (NHMS I) conducted in 1986 reported the prevalence of Diabetes Mellitus to be 6.3%. The figure rose to 8.3% in the Second National Health and Morbidity Survey (NHMS II) in 1996 and to 11.6% in the recent Third National Health and Morbidity Survey (NHMS III) in 2006. Based on NHMS III, there was also a rising trend in the prevalence with increasing age; from 2% in the 18-19 year age group to an alarming 20.8 – 26.2% in the 50 – 64 year age group (IPH, 2008).

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Physical activity is an important factor in reducing morbidity from DM and maintaining quality of life (Egede & Zheng, 2002). Regular physical activity may help to increase the glucose uptake and improve insulin sensitivity in muscle, thus leading to good glycemic control (Frank *et al.*, 2001). Furthermore, vigorous and moderate physical activity such as brisk walking reduces the risk of developing type 2 DM (Frank *et al.*, 2001). Prospective studies with adequate follow-up, showed a strong association between exercise and reduced rates of death from any cause, particularly diabetes (Warbunton, Nicol & Bredin, 2006).

Regular physical activity may help in management of diabetes mellitus, but not all patients are able to sustain consistent exercise (Thomas, Alder & Leese, 2004). The reasons for a decrease in the physical activity among DM patients is due to a feeling of difficulty to exercise, tiredness and spending most of their time watching television. Besides, lack of time, inadequate facilities such as recreation centres and safe places to perform exercise could also influence physical activity among DM patients (Thomas *et al.*, 2004). Based on the Third National Health and Morbidity Survey in 2006, the prevalance of inactivity among Malaysians adults was 43.7% (NHMS III). Women, the elderly, urban dwellers, housewives and unemployed persons were associated with inactivity (NHMS III) (IPH 2008). Little is known about the physical activity level of DM patients in Malaysia. Thus, this study was performed to assess the physical activity level among individuals with DM at Cheras Health Clinic, Kuala Lumpur, Malaysia.

METHODOLOGY

Research design

This was a cross-sectional study to determine physical activity level among individuals with type 2 DM at Cheras Health Clinic. All eligible subjects were invited to participate in the study which was conducted for a month in March 2009, using convenient sampling. The subject inclusion criteria included patients aged 30 years and above, had DM Type II with other co-morbidities and co-existing diabetes complications such as hyperlipidemia, nephropathyand hypertension, able to communicate, was not deafness or mute, had no mental health problems, could take food orally and was living in the community. The exclusion criteria for this study were patients with physical disability, those who had diabetes type 1 or other chronic conditions that may influence physical activity such as stroke and cancer and residents of old folks home. The study was approved by the Wilayah Persekutuan Health Department and Medical Ethical Committee of UKM Medical Centre. Verbal and written consent were obtained from patients and results of the study had been presented to the patients in a post-survey nutrition intervention programme.

Data collection

Subjects were interviewed to obtain information on socio-demographic, health profile, physical activity and factors influencing the physical activity including motivational drivers and barriers. Health profiles were investigated from past medical history records. Biochemical profile included fasting blood sugar (FBS), HbA1c value and 2-hour post-prandial level were obtained from medical records. Only values recorded for the past three months were used for the study.

Physical activity measurement and factors influencing physical activity

Physical activity was assessed through face-to-face interview using IPAQ-short form (IPAQ Research Committee 2005). The short version consisted of three specific activities which were walking activity, moderate-intensity activities and vigorous-intensity activities. Furthermore, there was also a question on sitting activity as an indicator

Table 1. Criteria for physical activity score

Categorical score	*Criteria*
Category 1 (Low)	This is the lowest level of physical activity. Those individuals who do not meet the criteria for Categories 2 or 3 are considered to have a 'low' physical activity level.
Category 2 (Moderate)	The pattern of activity to be classified as 'moderate' is any one of the following criteria: (a) 3 or more days of vigorous-intensity activity of at least 20 minutes per day; **OR** (b) 5 or more days of moderate-intensity activity and / or walking of at least 30 minutes per day; **OR** (c) 5 or more days of any combination of walking, moderate-intensity or vigorous intensity activities achieving a minimum Total Physical Activity of at least 600 MET-minutes / week.
Category 3 (High)	The two criteria for classification as 'high' are: (a) vigorous-intensity activity on at least 3 days achieving a minimum Total Physical Activity of at least 1500 MET-minutes / week **OR** (b) 7 or more days of any combination of walking, moderate-intensity or vigorous-intensity activities achieving a minimumTotal Physical Activity of at least 3000 MET-minutes / week.

for the time that was used for sedentary activities but it was not included in the calculation of the total physical activity score. The IPAQ incorporates a scoring mechanism whereby each activity is assigned an intensity code expressed in terms of Metabolic Equivalent (METs). The MET is the ratio of metabolic rate during the activity as compared to the metabolic rate during rest. For each type of activity, the weighted MET minute per week is calculated as follows (IPAQ Research Committee 2005) :

- Walking MET-min / week = 3.3 x walking minutes x walking days.
- Moderate MET-min / week = 4.0 x moderate intensity activity minutes x moderate activity days
- Vigorous MET-min / week = 8.0 x vigorous intensity activity minutes x vigorous activity days

The total physical activity MET-minute / week was then computed by summing the walking, moderate and vigorous MET-minute / week scores. The scores were then categorised into low, moderate and vigorous physical activity level according to the IPAQ categorical score (Table 1).

In addition, questions on factors influencing physical activity were also modified based on an early study by Searle & Ready (1991). The questions consisted of purposes and barriers to doing exercise, duration and type of exercise as well as activities during the patient's free time.

Anthropometric measurements

Anthropometric measurements that were taken included weight, height, waist and hip circumferences. SECA 703 High-Capacity Digital Column Scale (SECA, Germany) was used to measure body weight and height. The reading of the weight was recorded to the nearest 0.1 kg whereas the height was recorded to the nearest 0.1 cm (Fidanza & Kelley, 1991). A non-elastic measuring tape was used to measure waist and hip circumferences and recorded to the nearest 0.1 cm (SENECA, 1996). Body fat percent was taken using Omron body fat monitor HBF 302 (Omron, Japan). Body mass index

Table 2. Cut-off point for glycemic control and waist circumferance

Parameters	*Normal range*
*Glycemic control	
Fasting blood sugar	4.4-6.1
HbA1c (%)	< 6.5
2-hours post-prandial	4.4-8.0
**Waist hip ratio	
Men	< 0.95
Women	< 0.85

* *Source*: Asian-Pacific Diabetes Type 2 Policy Group (2002).
** *Source*: WHO (1998).

(BMI) was calculated using the following formula: weight (kg) / height (m2) and classified accordingly based on WHO (2004). The cut-off point for waist hip ratio was compared to normal range according to WHO (1998) (Table 2).

Statistical analysis

The collected data was analysed using the SPSS programme version 12.00. The results are presented as mean and standard deviation. Independent *t*-test was used to determine differences between sex for anthropometric measurements and the glycaemic profile. Chi-square was carried out to examine the relationship between physical activity and glycaemic control (HbA1c) as well as sosiodemographic factors. The Chi-square test was also used to determine the relationship between glycaemic controls with socio-demographic information. Besides, the Pearson correlation-coefficient test was also used to look at the association between total physical activity with anthropometry profile, sedentary activity (sitting activity) and glycemic control (HbA1c value).

RESULTS

Demography

A total of 132 patients (62 men and 70 women) participated in the study. Ethnic distribution of subjects was 36.4% Malays, 45.5% Chinese and 18.2% Indians as shown in Table 3. The majority of the men (53.2%) were Chinese whereas in the case of women, the majority were Malays (42.9%). The mean age for the subjects was 67.9 $\pm$ 6.8 years old. The mean age for men and women were 60.2 $\pm$ 11.2 years and 59.3 $\pm$ 9.3 respectively. Most of the subjects were married (86.4%) and had completed secondary education (46.2%) and were unemployed (51.6%) or housewives (82.6%). Of these patients, 65.9% had other comorbidities and pre-existing DM complications (i.e., hypertension (50.0%), hyperlipidemia (14.3%) and nephropathy (45.0%).

Biochemical profile

The mean and range for the biochemical profile were compared by sex and the mean values were also compared with the normal range that was used by Asia-Pacific Type 2 Diabetes Policy Group (2002). The mean fasting blood glucose level (FBS) for women (9.2 $\pm$ 3.8 mmol / l) was higher than for men (7.8 $\pm$ 3.3 mmol / l) ($p<0.05$) (Table 4). All the means for the glycaemic profile of the patients exceeded the normal range used by Asia-Pacific Type 2 Diabetes Policy Group (2002) (Table 2). Referring to the normal range, about 71.9% of patients had high FBS whereas 70.7% and 85.4% of the subjects had high HbA1c and high 2-hours postprandial values respectively.

Table 3. Socio-demographic characteristics of the subjects by sex [presented as number (%)]

Socio-demographic characteristics	*Men (n=62)*	*Women (n=70)*	*Total (n=132)*
Race			
Malay	18 (29.0)	30 (42.9)	48 (36.4)
Chinese	33 (53.2)	27 (38.6)	60 (45.5)
Indian	11 (17.7)	13 (18.6)	24 (18.2)
Age			
30-59	29 (46.8)	38 (54.3)	67 (50.8)
≥ 60	33 (53.2)	32 (45.7)	65 (49.2)
Marital status			
Single	4 (6.5)	1 (1.4)	5 (3.8)
Married	55 (84.3)	59 (88.7)	114(86.4)
Divorcee	1 (1.6)	1 (1.4)	2 (1.5)
Widow / widower	2 (3.2)	9 (12.9)	11 (8.3)
Education			
No formal education	2 (3.2)	8 (11.4)	10 (7.6)
Religion school	1 (1.6)	0 (0.0)	1 (0.8)
Primary school	23 (37.1)	32 (45.7)	55 (41.7)
Secondary school	32 (51.6)	29 (41.4)	61 (46.2)
University level	4 (6.5)	1 (1.4)	5 (3.8)
Occupational status			
Not working / housewives	32 (51.6)	57 (82.6)	89 (67.9)
Working	30 (48.4)	12 (17.4)	42 (32.1)

Anthropometry

Men were heavier and taller than woman (p<0.05) (Table 4). The normal range for waist: hip ratio for women and men were less than 0.85 and less than 0.95 respectively (WHO 1998). Based on these criteria, 57.1% of women and 24.2% of men had abdominal obesity. According to the BMI category (WHO, 2004), most of the subjects (41.5%), were pre-obese (Figure 1). Mean body fat percent for women (36.9%) was significantly higher than for men (29.4%) (p<0.05). Independent *t*-test showed that a significantly higher percentage of men (77.4%) were classified as having excessive percentage of body fat as compared to women (61.4%) (p<0.05) (Figure 2).

Physical activity profile

According to IPAQ category (IPAQ Research Committee, 2005) 47.0% of patients had moderate physical activity level followed by 33.3% of the subjects who fell into the low physical activity. Only 26 of the subjects (20.0%) fell into the high physical activity group. A total of 55.3% subjects had taken up the recommendation of exercise and performed it for more than 3 days per week with durations of 30 to 40 minutes per session (Pate *et al.*, 1995) (table not shown).

Realtionship between physical activity level with glycaemic control and socio-demographic profile

A higher percentage of subjects from the older age group (41.5%) and those unmarried (55.6%) hada low physical activity level as compared to the young age group (25.3%) and married (30.0%) respectively (p<0.05) (Table 5). In the older age group, a higher percentage of patients with low physical activity level (50.0%) had poor glycaemic control as compared to the patients with moderate and high physical

Table 4. Mean for biochemical and anthropometry profile of the subject by sex (Presented as mean ± SD) (n=132)

Parameters	*Men (n=62)*	*Women (n=70)*
Biochemical values		
Fasting blood sugar (mmol/l) (n=123)	7.8 ± 3.3	9.2 ± 3.8*
HbA1c (%) (n=90)	8.0 ± 2.6	8.4 ± 3.3
2 hours post-prandial (mmol/l) (n=92)	12.8 ± 4.1	11.9 ± 4.4
Anthropometry profile		
Weight (kg)	71.6 ± 13.7	65.6 ± 12.9 *
Height (cm)	163.1 ± 8.8	152.4 ± 5.6 *
BMI (kg/m^2)	26.5 ± 4.6	28.2 ± 5.4
Waist circumferences (cm)	93.1 ± 11.8	91.4 ± 12.6
Hip circumferances (cm)	98.9 ± 12.0	101.2 ± 10.5
Waist hip ratio (cm)	0.9 ± 0.1	0.9 ± 0.2
Body fat percent(%)	29.4 ± 4.7	36.9 ± 5.4 *

* Significant differences ($p<0.05$) based on independent t test
BMI- Body Mass Index

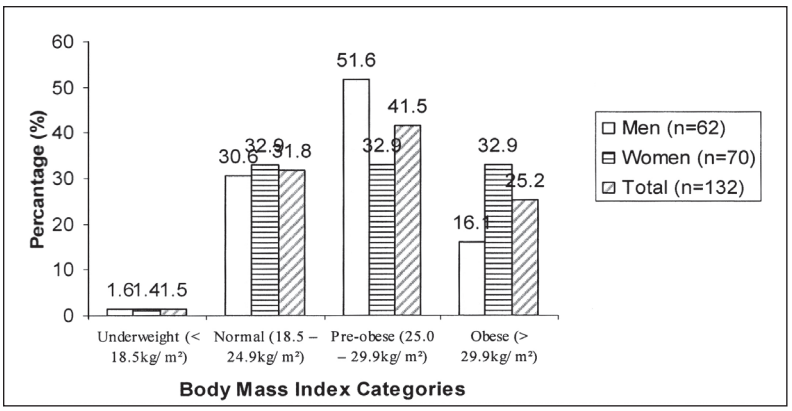

Figure 1. Percentage of subjects according to body mass index categories by sex

activity level (20.0%) ($p<0.05$) (Not shown in table).

Relationship between total physical activity level with anthropometry profile, sedentary activity (sitting activity) and glycaemic control (HbA1c value)

This study did not find any significant difference between physical activity and anthropometry profiles, body fat percent as well as glycaemic control ($p>0.05$). However, it was found that an increase in minutes for sitting activity (sedentary lifestyle) leads to a decrease in total physical activity (r= -0.175, $p<0.05$) (Table 6).

Factors that influence physical activity level

As shown in Table 7, this study found that most reported barriers to physical activity among patients with low physical activity

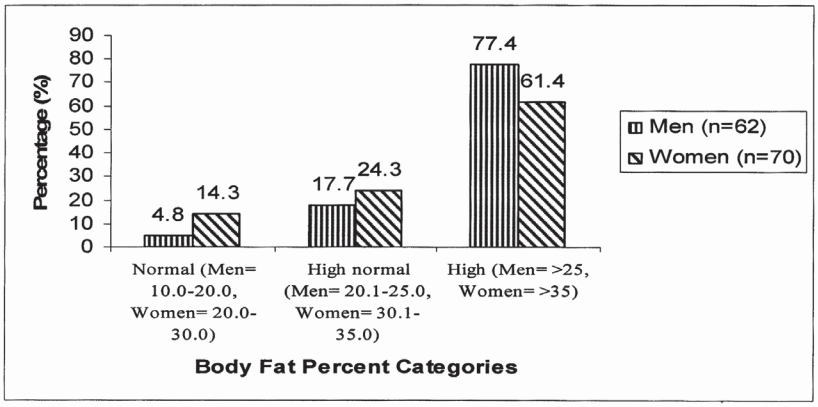

Figure 2. Percentage of subjects according to body fat percent categories by sex

Table 5. Relationship between physical activity level with glycaemic control and socio-demographic profile [presented as number (%)]

Parameters	*Physical Activity Level*			
	N	*Low*	*Moderate and High*	*P value*
Sex				
Men	62	35 (56.4)	27 (43.5)	0.745
Women	70	9 (12.9)	61 (87.1)	
Age group				
30-59	67	17 (25.3)	50 (74.6)	0.002*
≥ 60	65	27 (41.5)	38 (58.5)	
Occupational status				
Not working / housewife /	89	19 (21.3)	70 (78.7)	0.471
Working / working retirees	43	25 (58.1)	18 (41.9)	
Educational level				
Uneducated	10	5 (50.0)	5 (50.0)	0.376**
Educated	122	39 (32.0)	83 (68.0)	
Marital status				
Single / divorcee / widow	18	10 (55.6)	8 (44.4)	0.015*
Married	114	34 (30.0)	80 (70.2)	
Glycemic control	90			
Good HbA1c value (< 6.5%)	25	14 (56.0)	11 (44.0)	0.609
Poor HbA1c value (> 6.5%)	65	33 (50.7)	32 (50.0)	

*Significant differences ($p<0.05$) based on Chi -square test
** No significance found based on Fisher Exact test

Table 6. Relationships between total physical activity (METs / minutes / week) with anthropometry profile and sedentary activity (sitting activity).

	Total physical activity (METs / minutes / week)	
Parameters	r	p value
Body Mass Index (kg / m²)	0.113	0.197
Abdominal obesity	-0.044	0.614
Body fat percent (%)	-0.012	0.896
Sedentary activity (sitting activity)	-0.175	0.046*
Glyceamic control (HbA1c value)	-0.041	0.70

*Significant differences ($p<0.05$), Pearson correlation test.

Table 7. Factors that influence physical activity [presented as number (%)]

Parameters	*Physical activity level*		
	Low n (73)	*Moderate and high n (59)*	*Total n (132)*
Barriers to physical activity *(n=45)*	*(n=33)*	*(n=12)*	*(n=45)*
Lack of time	18 (54.5)	5 (41.7)	23(51.1)
Lack of facilities	3 (9.0)	1 (8.3)	4 (8.9)
Lack of energy	7(21.2)	5 (41.7)	12 (26.7)
Afraid of being injured / health problem	4 (12.1)	0 (0.0)	4 (8.9)
Laziness	1 (3.0)	1 (8.3)	2 (4.4)
Motivation to physical activity *(n=87)*	*(n=40)*	*(n=47)*	*(n=87)*
Willingness to be healthy	27 (67.5)	32 (68.1)	59 (67.8)
Realise its importance	8 (20.0)	8 (17.0)	16 (18.4)
Love to exercise	3 (7.5)	4 (8.5)	7 (8.0)
Daily routine	2 (5.0)	3 (6.4)	5 (5.7)

level were lack of time (54.5%) and also lack of energy (21.2%). Other barriers that influenced physical activity among the patients were afraid of being injured or health problem s(12.1%), lack of facilities to go to recreation place or lack of interest (9.0%) and laziness (3.0%). Among patients with moderate and high physical activity level, 76.7% reported that willingness to be healthy had motivated them to exercise. This was followed by 17.2% of the subjects who exercised because they realised its importance. Other factors that influenced physical activity among the subjects were desire to exercise (8.5%) and to exercise as a routine affair (6.4%).

DISCUSSION

The majority of patients had moderate (47.0%) physical activity level. Similar results were found among adults with type 2 diabetes which shows that 64.4% of the patients had moderate physical activity and were not participating in regular exercise (Abdel & Abdullah 2007). A study among rural elderly with diabetes in America also showed that half of the subjects (52.5%) had

a moderate physical activity level (Arcury *et al*., 2006)). In the recent study, intensity of physical activity was not investigated but only 55.3% of subjects exercised more than three times per week with a duration of 30 to 40 minutes per session (Bassuk & Manson, 2005).

People with diabetes (63.1%) participated less in physical activity compared to people without diabetes (78.3%) and observed physical activity recommendations (38.5%) less than people without diabetes (46.6%) in meeting ADA recommendations (Zhao *et al*., 2007). This is usually so because those with diabetes often have physical disabilities (Gregg *et al*., 2000), perceive discomfort when exercising or have decreased exercise capacity compared to non-diabetic patients (Le Brasseur & Ruderman, 2005).

As shown in Table 5, physical activity leveldecreased from age 60 years and above. Furthermore, a significantly higher percentage of those aged 60 years and above (41.5%) had low physical activity than those aged less than 60 years (25.3%). Data from the United States also indicate that about 28 to 34 % of elderly people aged 65 to 74 years and 35 to 44 % of elderly aged 75 or older were less active (Center for Disease Control & Prevention, 2002). Similar decline in physical activity with age was also documented in an earlier study among middle-aged adults (Norman *et al.*, 2002). This might be due to the fact that individuals aged above 60 years tend to prefer less intense activity such as walking as they became older (Hirayama *et al*., 2008). Furthermore, the perception that diabetes 'weakened' and 'aged' the body appeared to have a de-motivational effect as far as the uptake or maintenance of physical activity was concerned (Lawton *et al*., 2005).

A higher percentage of those who were married (70.0%) engaged in moderate to high physical activity level as compared to those who were single / widow / widower. An earlier study showed that married men reported higher median levels of exercise participation (487 vs. 256 kcal / wk) while married women reported higher levels of total physical activity (5109 vs. 4086 kcal / wk) when compared to their single counterparts (Kelley, Jennifer & Herman, 2006). King, Aubert & Herman (1998) also reported a positive relationship between physical activity level and marriage. According to Center for Disease Control & Prevention (2001), changes in an individual's status from single to married did bring about a positive change in engaging oneself with regular physical activity.

In the present study, poor glycaemic control was associated with inactivity among the older age group. An earlier study also documented that moderate and vigorous physical activity provides good glycaemic control by reducing the value of HbA1c among diabetic patients (Bassuk & Manson, 2005). Another study on the elderly with type 2 diabetes also showed that regular physical activity and resistance exercise help in lowering the value of HbA1c (Castaneda *et al*., 2002). Physical activity helps in glycaemic control by improving insulin sensitivity thus improving glycaemic control (Asia-Pacific Type 2 Diabetes Policy Group, 2002).

The present study did not find any association between physical activity and anthropometry profiles as well as body fat percent ($p>0.05$). The study by Boule *et al.* (2001) showed that there was no association between physical activity and anthropometry profiles and body fat percent. Besides,a study by Mishra *et al*. (2006) also did not find any association between physical activity level and the risk of obesity in terms of body mass index. This might be due to obese individuals being motivated to increase their physical activity to reduce body weight (Mishra *et al*., 2006). In the present study, a sedentary lifestyle was associated with low physical activity level ($p<0.05$). Another study on adult Malaysian

diabetic patients also reported that 52.0% of the patients were not active in their non-leisure time (occupation and housework) (Tan & Magarey, 2008).

The present study found that lack of time and lack of energy were the common reported barriers to physical activity. An earlier study also cited lack of time (39.0%) as the most influencing factor for low physical activity level among type 2 diabetes mellitus patients (Abdel & Abdullah 2006). According to Handerson & Ainsworth (2000), women who were pre-occupied with their household chores or liked taking care of children or grandchildren found they had no time to do other activities such as exercise. Another study reported that health problems and lack of interest were also the main causes of physical inactivity (Brown *et al*. 1996). Other barriers to physical activity were lack of facilities, afraid of injury or health problems and laziness. An earlier study also reported other barriers to physical activity such as lack of facilities and co-existing comorbidities or health problems (Lawton *et al*., 2005).

Among patients who engaged in physical activity regularly, 57.0% reported that willingness to be healthy motivated them to exercise. Stead *et al.* (1997) also reported that willingness of the subjects to be healthy was a motivation for them to sustain an active lifestyle. Other reported motivations for patients to indulge in physical activity were doctor's advice or realisation of its importance, like to exercise and performing exercise as daily routine.

There are several limitations to this study. The first is the incomplete bio-chemical profile of the patients; all bio-chemical profiles whose date exceeded three months from the period of the present study were excluded. Therefore, only half of the patients had complete biochemical profile such as HbA1c value, 2 hours post-prandial and fasting blood sugar profile. Next, physical activity participation itself might be under or over-reported and may not reflect the true situation because most of the patients were unable to remember exactly the type and duration of the activity done.

CONCLUSION

This study found physical activity level and glycaemic control of subjects to be unsatisfactory. Low physical activity level was associated with poor glycaemic control in the older age group. Thus, there is a need to promote regular physical activity among DM patients in order to obtain optimal glycaemic control and prevent diabetic complications.

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