ABSTRACT
Diabetes mellitus has become a serious health concern whose prevalence has reached pandemic proportion. Studies have shown that exercise is the single most important factor for successful management among people with Type 1 and Type 2 diabetes. Exercise is seen as a possible yet underutilized tool in the management of diabetes (Paul and Heerden, 2004). The current study investigated exercise practices in the management of diabetes by adult diabetics at KNH in Nairobi, Kenya. It assessed the diabetic patients' physical activity (PA) level in terms of total MET-minutes/week and determined the relationship between the PA level and the diabetics' age, gender, type of diabetes, duration of the condition and knowledge on exercise. The subjects comprised 140 diabetic patients who had been diagnosed to have diabetes mellitus. The results indicated that a large percentage (46.1%) of diabetics are not exercising as required for the management of diabetes mellitus. It was also found that the extent of engagement in exercise/physical activity is highly associated with the diabetics' age, type of diabetes, duration of the condition and knowledge on exercise. This study recommends that the medical institution and exercise professionals strengthen the existing exercise therapy regime through in-depth patient and medical staff education on exercise. They should also design exercise prescription manuals to be used in this region and programs for each group of diabetics to ensure adherence to exercise protocols and procedure.

Key words: Exercise, physical activity (PA) level, management, diabetes mellitus.

INTRODUCTION
Diabetes mellitus is a condition where the pancreas ceases to produce enough insulin or when the cells stop responding to insulin produced such that glucose in the blood cannot be absorbed into the cells of the body (Edgren, 2004). It is a disease associated with problems of frequent and rapid swings of blood sugar levels between hyperglycaemia and hypoglycaemia but resulting primarily in hyperglycaemia (ACSM, 1995; Edgren, 2004). Although diabetes cannot be cured, it can be controlled and managed to normal limits successfully (Williams, 2004). This is based on patients' self management programs supported by education on diabetes, insulin, oral medication, diet and exercise therapies (Auxter, et. al., 2005; Sherrill, 1993). Insulin therapy aims at mimicking normal insulin release as much as possible to keep blood glucose from shooting too high after meals or too low between meals (Edgren, 2004). Diet therapy aims at controlling blood sugar levels, blood cholesterol and weight. Patients are taught on foods to avoid, those to take and self monitoring to detect foods with the greatest effects on the condition. Exercise therapy aims at managing blood sugar levels, increasing insulin sensitivity, weight control and increasing a sense of well being. Exercise, an important cornerstone of diabetes therapy, also has significant psychological and physiological benefits for people with diabetes (Allen, 2004).

Classification and Characteristics of Diabetes Mellitus
The three common types of diabetes mellitus are: Type 1, Type 2 and gestational diabetes. Type 1 diabetes also called Juvenile diabetes or Insulin Dependent Diabetes Mellitus (IDDM) develops when there is no insulin in the body because most or all pancreatic cells that produce insulin are destroyed (Williams and Pickup, 2004). The patients are often dependent on regular injections of insulin, usually given twice daily (ACSM, 1995). This type of diabetes occurs in younger persons under age of forty (40) (Williams, 2004).

Type 2 diabetes, is also called Non Insulin Dependent Diabetes Mellitus (NIDDM). It develops when the body still produces insulin but not enough or insulin resistance (when insulin produced even in plenty does not work properly) (Williams, 2004). Type 2 diabetes represents ninety percent of all diabetics (Steyn et al., 2004). It is highly linked to obesity (90% of patients are obese) particularly abdominal obesity (NASM, 2004) thus occurs mainly to overweight people and those who do not
exercise (Steyn et al., 2004). Its primary treatment includes diet and exercise to reduce the body weight and control glucose levels. Some may require oral hypoglycaemic agents or injectable insulin to stimulate the pancreas to produce additional insulin (Howley and Franks 1992; ACSM, 1995). The third type of diabetes called gestational diabetes develops in women during pregnancy but generally resolves after the baby is delivered (Steyn et al., 2004).

Exercise and Diabetes Mellitus

Exercise is an understudied component of the self-care regime for people with diabetes, and is often rated as one of the most difficult lifestyle changes to make (Allen, 2004). Intervention studies have shown that physical activity plays a major role in glucose tolerance and insulin sensitivity (Clark, 1997). A single bout of exercise can decrease blood glucose and increase insulin sensitivity. These effects can last for several hours following exercise and have beneficial effects in terms of metabolic control and regulation of glucose homeostasis (Allen, 2004).

First and fore most, exercise causes the body to depend on reduced levels of insulin due to its effects of increasing muscles sensitivity to available insulin causing blood glucose to be taken up faster than usual (Howley and Franks, 1992; Paul and Heerden, 2004). These mechanism results in exercise-induced lowering of blood glucose levels hence reduction of insulin dose in Type 1 diabetics (Paul and Heerden, 2004). Therefore patients can minimize the need and cost of insulin medication due to exercise (Howley and Franks, 1992).

Studies have shown that moderate-intensity exercise is best as it causes muscles to take up glucose at almost 20 times more than normal rates thus an effective way of lowering blood glucose levels. However intense exercise may have the opposite effect of raising blood glucose because the body recognizes exercise as a stress and releases stress hormones to promptly increase release of blood glucose (Haines, 2006). A recent meta-analysis also found that, on average, moderate-intensity physical activity can reduce HbA\(_1c\) by 0.6% among individuals with Type 2 diabetes. According to a United Kingdom Prospective Diabetes Study, this is a level sufficient to reduce the risk of microvascular complications by 22% (Karin et al., 2002).

In Type 1 diabetes, it is evident that the patients have an obvious abnormal glucose homeostasis and the impact of exercise on the metabolic state would be pronounced (Paul and Heerden, 2004). These patients are encouraged to control their blood sugar levels and when satisfactory glucose control is achieved, exercise will then result in lowering of pulmonary glucose level (Mngola, 2006). Therefore the main concern is to get the diabetic’s blood glucose “under control”. This means that prior to exercise, the diabetic injects proper amount of insulin, eats proper quantities of carbohydrates (to keep the levels close to normal values) and exercise as advised (Howley and Franks, 1992).

In Type 2 diabetes, exercise is the primary management of obesity which is usually an evident factor (90% of patients are obese) (Steyn et al., 2004). Obesity is highly associated with insulin resistance (Andreoli et al., 1997). Exercise helps in utilising the excess body fat, decreasing body weight and improving the body’s response to insulin. In addition, exercise reduces the risk of cardiovascular disease and co-morbidities such a hypertension and obesity in Type 2 diabetes (Paul and Heerden, 2004).

Exercise may also present several contraindications if not properly designed, prescribed and executed. However, the benefits outweigh the contraindications. Apart from the roles of exercise mentioned above, exercise also help lower blood pressure, improve blood circulation and protects against heart disease by lowering “bad” Low Density Lipoprotein (LDL) cholesterol and increasing “good” High Density Lipoprotein (HDL) cholesterol. With exercise there is increased energy levels, enhanced work capacity, improved muscle strength, increased bone density and strength. There is also reduced stress, relaxation and release of tension and anxiety thus improving the wellbeing of the diabetics (ADA, 2006; IDF and WDF, 2003; Haines, 2006).

Prevalence of Diabetes Mellitus

Prevalence of diabetes has reached pandemic proportion. International Diabetes Federation (IDF) states that about 200 million people worldwide are diabetic (Njenga, 2006). The World Health Organisation (WHO) has projected that diabetes prevalence will increase by 170% in developing countries by 2025 (WHO 1998). In Africa, the dramatic changes in lifestyle towards western lifestyles, brought about by industrialization and the resultant urbanization, have partly been blamed for the increase in diabetes cases. Increased sedentary lifestyles resulting in hypokinetic diseases is also evident thus predisposing many to Type 2 diabetes and co-morbidities such as cardiovascular disease and obesity (Paul and Heerden, 2004).

In Kenya, the Ministry of Health Division of Non Communicable Diseases (DNCD) estimates the prevalence of diabetes to be 6%, from an unpublished study of Non Communicable Diseases baseline risk factor survey conducted in 2005 in all provincial headquarters in the country (DNCD 2005). This translates to about 1.8 million Kenyans. The Diabetes Management and Information Centre (DMI) Kenya, also reports that most of the diabetics are from the urban areas where people tend to have poor eating habits and sedentary lifestyles. The prevalence is at 10.7% in urban areas compared to 2.7% in rural areas.

Purpose of Study

Studies done elsewhere on exercise therapy report that most diabetic patients do not exercise adequately as
recommended while others report considerable amount of success in the use of exercise in managing diabetes (Kamiya, 1995; Paul and Heerden, 2004; Thomas et al., 2004; Karin et al., 2002). The purpose of this study was to investigate exercise practices in the management of diabetes by adult diabetics at KNH in Nairobi, Kenya. The main objectives of the study were to assess the diabetic patients' physical activity (PA) level in terms of total MET-minutes/week and to determine the relationship between the PA level and age, gender, type of diabetes, duration of the condition and knowledge on exercise. Findings of this study present vital information for the diabetes management regime and are useful to diabetes health care providers, educators, patients, policy makers and fitness instructors in enhancing the management regime, patients' education program and exercise practices among diabetics.

METHODS

Participants

The subjects comprised 140 diabetic patients attending the diabetes clinic at the Kenyatta National Hospital Medical Out-Patients Clinics. The subjects were randomly sampled based on voluntary availability. This was an efficient system to capture the variations and heterogeneity that exist in the target population with the quest to obtain a representative sample. The primary criterion for inclusion was that subjects had to be diagnosed to have diabetes mellitus and of 18 years and above. This study incorporated only diabetic outpatients of Type 1 diabetes, Type 2 diabetes or Impaired Glucose Tolerance (IGT). It is evident that most of those affected in Kenya are normally of ages 34 to 64 years. Just as in previous studies like that by Paul and Heerden (2004), children were excluded as they are not capable of providing reliable data especially where self reporting of exact daily occurrences need to be recorded. It was also observed that those under 18 years are mainly students who are in school where most of their activities are dictated and controlled thus difficult to assess their predisposition to using exercise as therapy. Those too weak to participate were also excluded. There was no restriction on gender, race or mobility status.

Instrument

Questionnaire was considered appropriate due to its ability to investigate an individual's perception/awareness, motivation and attitude. It was also found to be convenient due to the large sample size and short period of time patients had for the exercise considering the length of the questionnaire which had 44 questions. The study used a self-administered closed ended questionnaire which was divided into four sections. The first section comprised the demographic data of the patients. Second section consisted of the International Physical Activity Questionnaire (IPAQ) self administered – short version questionnaire adapted from IPAQ (2001). This section consisted of four item assessment: vigorous, moderate, walking and sitting physical activities. The assessment was done as instructed by the IPAQ protocol and analysis as per guidelines for data processing in total MET-minutes/week (IPAQ, 2005) as explained below. The third section comprised of questions for the diabetic patient’s evaluation on the exercise regime and predisposition to exercise. The questionnaire finally assessed the subjects' basic knowledge of diabetes and exercise. This was in statements in a 3-point likert scale of 3 responses: agree, disagree and not sure. The respondents were expected to answer to each variable according to their understanding and knowledge, which thereafter generated a total sum and a grade given to each respondent as either low, average or high/sufficient in knowledge.

The questionnaire was validated for content, adequacy, consistency and clarity by experts in the area of physical activity in the Department of Exercise, Recreation and Sports Science at Kenyatta University as well as the Kenyatta National Hospital Ethical and Research Committee (KNH-ERC). The adapted questionnaire was only in English and this was not seen as a flaw in the study since the comprehensibility of the questionnaire was pilot tested and improved before hand.

Procedure

The subjects were randomly sampled as they attended their annual check ups and quarterly treatment at the clinic as per their scheduled appointment, which made it highly unlikely to encounter a single patient more than once. The consent of the subjects was first sought and obtained before questionnaires were issued. Each patient required approximately 25 to 30 minutes to complete the questionnaire. Due to the nature and length of the clinic, only eight patients were contacted in a day (5.7% of the sample size) for a period of 5 weeks.

Assistance was given by the researchers particularly to those who could not complete the questionnaire on their own (about 25.9%) due to eye problems or inability to read due to illiteracy. For this group of patients the researchers assisted by asking the questions and filling the questionnaire with them. Another group of patients that were offered assistance by the researchers were the prisoners who could not write since they were handcuffed.

There was 100% response rate since all the 140 questionnaires issued were handed back. However one questionnaire was excluded from the data analysis after it was discovered that the respondent's answers were overly exaggerated according to IPAQ's data sorting regulations. Therefore overall useful data collected was 99.3% of the intended cases.

Physical Activity Data Processing Procedure

The physical activity (PA) levels were assessed according to the physical activities the patients engaged in. The short-version of IPAQ is designed to contain four main
questions. Each of the questions represents a group of physical activities within a level of intensity of similar METs (metabolic equivalents). There is a question on vigorous intensity PA (activities of greater than 6 METs), moderate intensity PA (activities of 3 to 6 METs), walking activities and sitting activities. In the analysis, IPAQ gives a protocol to be followed in rating an individual’s response. In this protocol only the vigorous, moderate and walking activities responses are involved. The purpose of collecting information on sitting activities, which are regarded sedentary/no activity, is to monitor the total number of hours of activity per day not to exceed 16 hours (the total working duration in a day) of the possible 24 hours.

Table: IPAQ Analysis Procedure for PA in Met-minutes/week

<table>
<thead>
<tr>
<th>Walking Met-minutes/week</th>
<th>3.3 × walking minutes × walking days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moderate Met-minutes/week</td>
<td>4.0 × moderate intensity activities minutes × moderate days</td>
</tr>
<tr>
<td>Vigorous Met-minutes/week</td>
<td>8.0 × vigorous intensity activities minutes × vigorous intensity days</td>
</tr>
<tr>
<td>Total PA Met-minutes/week</td>
<td>Sum of walking + moderate + vigorous Met-minutes/week scores</td>
</tr>
</tbody>
</table>

The table above shows the computation process. The values of total time in a day were multiplied by number of days per week and by the category’s Met value.

IPAQ analysis protocol gives three levels of physical activities namely low (have less than recommended levels of activity), moderate (have sufficient levels to enable attainment of health-related effects) and high (have highly sufficient levels which should also be monitored as could contraindicate). The sorting procedure is by total number of days per week and total Met-minutes/week. Those with less than total of 3 days of PA per week are classified as low level. Those with less than a total of 600 Met-minutes/week are also classified as low. Those with a total of between 600 Met-minutes/week to 1500 Met-minutes/week in 5 or more days are classified as moderate (those with similar Met-minutes/week but have less than 5 days are excluded and classified as low). Those with 7 or more days of at least 3000 total Met-minutes/week or above 1500 total Met-minutes/week with at least 3 days of vigorous intensity activity are classified to be of high level of PA.

Data Analysis

Data collected was coded and entered for analysis using the Statistical Package for Social Sciences (SPSS) version 12. The data was cleaned and sorted to identify any entry that did not meet the analysis protocol requirements. Chi-square (X²) was used to analyse the relationship between the independent variables (age, gender, Type of diabetes, duration of diabetes and knowledge level) and the dependent variable, PA level. The level of significance was set at p .05. Tests were also done to determine the power of this sample size as a representative of the population. The G Power 3.0.3 power analysis protocol was used with Post hoc engaging a large effect size of 0.40 because the subjects were of a special group who are likely to cluster in different aspects. It was established that the lowest power possible of this study was at 96.5% and highest power at 99.6% confidence levels.

RESULTS

Demographic information:

The final sample comprised 139 persons with diabetes. The males were 68 (48.9%) and females 71 (51.1%) where the number of females slightly exceeded that of males. The mean age of the respondents was 49.61 years with ages ranging from 18 to 75 years. The results indicated that the dominant age groups of the respondents were those between 41-50yrs who were 41 (29.5%) and 51-60yrs who were 39 (28.1%). Just as it is stated in studies and literature on the types of diabetes, it was evident that most of diabetics are of Type 2 diabetes. The results presented 96 (69.1%) respondents of Type 2 diabetes and 42 (30.2%) of Type 1 diabetes and only one (1) with pre-diabetes IGT (Impaired Glucose Tolerance). The duration of time from when the diabetics were first diagnosed with diabetes was assessed. Majority (47, 33.8%) of the respondents had had diabetes for a period between one to five (1-5) years.

The Exercise Regime

The study sought to explore the existing exercise regime in order to understand its efficiency and effectiveness. Four questions facilitated collection of this information.

Table: Diabetic Patients Report on the Exercise Regime

<table>
<thead>
<tr>
<th>Inquiry:</th>
<th>YES No</th>
<th>%</th>
<th>NO No</th>
<th>%</th>
<th>TOTAL No</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Have consulted the doctor/nurse and were advised to exercise</td>
<td>92</td>
<td>66.2</td>
<td>47</td>
<td>33.8</td>
<td>139</td>
</tr>
<tr>
<td>2</td>
<td>Comply with the exercise therapy as advised by the doctor/nurse</td>
<td>57</td>
<td>41.0</td>
<td>82</td>
<td>59.0</td>
<td>139</td>
</tr>
<tr>
<td>3</td>
<td>Find information given by the doctor/nurse on exercise enough</td>
<td>64</td>
<td>46.0</td>
<td>75</td>
<td>54.0</td>
<td>139</td>
</tr>
<tr>
<td>4</td>
<td>Feel they should be given more information on exercise</td>
<td>121</td>
<td>87.1</td>
<td>18</td>
<td>12.9</td>
<td>139</td>
</tr>
</tbody>
</table>

The table above shows responses concerning the current exercise regime as practiced in prescription, adherence and education. It is evident that out of the many who attend clinic, some patients do not attend counseling/
education forums offered and have not consulted with the diabetes personnel on exercise. However, 92 (66.2%) reported to have consulted the doctors and nurses and have received advice on exercise. Only 57 (41.0%) respondents reported to have complied with the exercise therapy as advised by the doctor/nurse. In terms of sufficiency of the information given by the doctor/nurse 64 (46.0%) felt that it was enough while the rest (54%) felt it was not sufficient. In conclusion 121 (87.1%) of the respondents felt they should be given more information (in depth) on exercise.

**Diabetics’ Physical Activity Level**

The IPAQ data processing and analysis procedure for grouping individuals in three activity levels according to their total MET-mins/week and total number of days in activity was used. The respondents were then classified accordingly as either low (have less than recommended levels of activity), moderate (have sufficient levels to enable attainment of health-related effects) or high (have very high levels which should be monitored as could contraindicate).

<table>
<thead>
<tr>
<th>Level</th>
<th>Frequency</th>
<th>Percentage (%)</th>
<th>Mean of total MET-mins/week</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>64</td>
<td>46.1</td>
<td>443.84</td>
</tr>
<tr>
<td>Moderate</td>
<td>69</td>
<td>49.6</td>
<td>1181.51</td>
</tr>
<tr>
<td>High</td>
<td>6</td>
<td>4.3</td>
<td>5306.83</td>
</tr>
<tr>
<td>Total</td>
<td>139</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

The results in the table above represent the categorization of the diabetics according to the physical activity levels of low, moderate or high and the mean total MET-minutes/week. The result shows that there was an almost even percentage of those within low level and those of moderate level physical activity. Majority (69, 49.6%) of the respondents with a mean of 1181.51 MET-minutes/week were classified to be within moderate physical activity level. This was followed by 64 (46.1%) in low level physical activity with a mean of 443.84 MET-minutes/week. Only 6 (4.3%) were classified to be within the high activity level with a mean of 5306.83 MET-minutes/week. A summary of the distribution of diabetics’ physical activity levels is shown in chart 1 below.

**Figure 4: Age distribution and representation across the three PA levels groups.**

**Gender and Physical Activity Level**

The figure 5 below shows the distribution of gender of the respondents across the three PA level groups. Most of the males were of low PA level while most of the females were of moderate activity levels. However, majority (83.3%) of those in high activity levels were males.

**Figure 5: Gender distribution of the respondents across the three PA level groups**

**Knowledge on Exercise and Physical Activity Level**

The figure 6 below shows the distribution of the respondents’ knowledge levels across the three PA level groups.
Figure 6: Respondents' knowledge levels across the three PA levels groups

Most of those with low level of knowledge were of low PA level while majority (57.8%) of those with average knowledge were of moderate activity levels. Respondents with sufficient knowledge featured prominently in both low and moderate activity levels which show that those with high knowledge levels do not necessarily put it in practice.

Type of Diabetes and Physical Activity Level

Figure 7 below shows the distribution of the types of diabetes across the three PA levels.

Type 1 diabetics were almost equally represented in both low and moderate PA levels. The same is observed with Type 2 diabetics but a little more of them fall in the moderate level. However majority (66.6%) of the high performers were of Type 2 diabetics. These diabetics, who are more often obese (Andreoli et al., 1997; Levene, 2003; Steyn et al., 2004), are put on an exercise regime hence their high representation among the active.

Duration of Having Diabetes and Physical Activity Level

Figure 8 below shows the distribution of the duration of diabetes across the PA levels.

The above distribution show that most (55.3%) of those with a period between 1 to 5 years were of moderate activity level while most (72.7%) of those with more than 20 years of diabetes had low activity level. Duration periods of less than 1 year, 1 to 5 years and 6 to 10 years were equally represented in the high level category. The results show that most (50%) diabetics are low in activity level after diagnosis. Then the activity level is seen to increase in many diabetics with 1 to 10 years of diabetes. However, the trend goes down with less diabetics being active with time.

Table: Test of relationship between independent variables and the PA Levels

The testing of the hypotheses drew findings that the patients' age, type of diabetes, duration of diabetes and knowledge on exercise had significant relationship on the patients' PA levels while gender had no significant relationship on the PA levels.
DISCUSSIONS

Guidelines state that exercise be prescribed, just like medication, according to measures such as type of exercise, duration, frequency, intensity, and should balance with diet and medication taken for safety and usefulness (Levene, 2003; Sherrill, 1993; Howley and Franks, 1992). Although diabetics are put on an exercise therapy for management of diabetes, clinical procedure indicates that exercise intensity cannot be uniformly recommended because all patients have unique problems and variations in severity of the disease (Peterson, 1982; Howley and Franks, 1992). Therefore doctors prescribing exercise therapy should consider the basics of exercise physiology and training principles. It is also noteworthy that an exercise program depends on the baseline fitness level of the patient, and the goals of the program set together with the patient. Generally, one should adapt to these types of exercise according to one’s general physical condition, preferences, and lifestyle (IDF and WDF, 2003). Again, this is consistent with the view that any exercise intervention should consider the socio-cultural contexts of the individuals in order to enhance adherence and reduce risks (Martinus et al., 2006).

Findings on PA levels shows that an average percentage (49.6%) of diabetics seems to achieve moderate PA levels that according to ADA (2006); Haines (2006); IDF and WDF (2003) and IPAQ (2001) is required for there to be any health-related benefit. A large percentage 46.1% is operating on lower level, that is less than recommended levels that cannot achieve health-related benefits. Similar observations reporting extensive low PA levels by diabetics have been recorded by Kamiya et al., (1995) in Japan, Thomas et al., (2004) in Scotland, Karin et al., (2002) and Katrina et al., (2006) in USA. For instance the study by Karin et al., (2002) reported almost one third of the sample having no regular physical activity, and another 38% as having an insufficient amount of physical activity. Although according to our assessment many diabetics portray sufficient levels of physical activity this may not be sustainable at all times. This is because the assessed activities are assumed to be habitual which may not be consistent over time. For instance, fluctuation in activity is possible with different seasons of the year like it is with farmers, changes in occupational activities as with students and informal business or state of diabetes control. Diabetics could also get sickly and assume extensive rest breaking the activity pattern. Therefore the assessment gives a general aspect of usual practice that is not necessarily habitual.

From the findings on age in relation to the PA level, it can be seen that most of the younger diabetics were of moderate and high activity levels. It is also clear that from age 51 onwards, the age increase was accompanied with increased numbers of patients in the low activity level compared to the other levels. Therefore, with more of the oldest aged patients in the low activity level, it is evident that age is associated with physical activity levels (as an influencing factor affecting activity with advancement of age causing less activity). However, this increase in inactivity with age could also be due to encroachment of other complications of diabetes which are evident in old age (IDF and WDF, 2003). This also supports findings on duration of diabetes where most (72.7%) of those with more than 20 years of diabetes were of less than recommended (low) activity levels thus advancement in duration (which goes with increase in age) affects activity. Similar findings have been observed in studies done elsewhere demonstrating that inactivity is more commonly seen in older patients. For instance, in a study by Karin et al., (2002), individuals over age 65 years were found to be more likely to report non-engagement in physical activity. Thomas et al., (2004) also reported that those who were active were more likely to be younger.

Findings on gender in relation to the PA level means that although there seemed a difference in the distribution of the males and females across the three activity levels, where males dominated the low activity level and females dominated the moderate level, the amount of association was not significant. This finding implies that both genders had similar tendencies in the participation in physical activity and any differences observed were not out of the societal gender roles and responsibilities but out of chance. Similar findings have been observed in studies done elsewhere. Thomas et al., (2004) observed that there were no differences between males and females in activity. Morrato et al., (2007) also reported that sex, a traditional predictor of activity, was not evident among respondents with diabetes.

Inadequacy in patients’ knowledge on exercise could also deter exercise practices resulting to limited exposure and wrongful approach to physical activity (Shillitoe, 1988). On findings on relationship between subjects’ knowledge on diabetes and exercise and PA level, it is evident that knowledge level is significantly associated with activity level where there was a significant association of high knowledge with better performance. The knowledge on exercise procedures and importance to diabetics was sufficient; however comparing overall knowledge and performance there is a gap between the sufficient knowledge and the evidently low practice level. A similar outcome was reported by Sivagnanam et al., (2002) in India where high knowledge on diabetes and exercise was observed. However, the satisfactory knowledge scores found were posed amidst a large knowledge-action gap which may have been due to certain deeply entrenched false beliefs and poor exercise practices. Even with the recorded 91.3% of diabetics having good knowledge on exercise for diabetics, it is discouraging that many diabetics still do not know the kinds of exercises they can do. The knowledge given in education programs could be mainly on benefits of exercise and how to monitor ones self before during and after exercise but not giving a variety of such
kinds of exercises, dosage and/or demonstration of the same. Diabetics end up not exercising yet they know the importance simply because they are not confident enough with information given amidst fear of the unknown. There is need to address the fears, complications and problems arising from exercise that discourage patients from this important treatment module.

Results on relationship between type of diabetes and PA level indicated that Type 2 diabetics are most active. This may be supported by the fact that in the representations of both types of diabetes, the Type 2 diabetics dominate as majority (90%) of all diabetics (IDF and WDF, 2003; ADA, 2006; Levene, 2003; Steyn et al., 2004). Therefore as a result of the large population size of the Type 2 diabetics and the fact that most are put on an exercise therapy due to accompanied obesity, Type 2 diabetics appear to be more active than Type 1 diabetics.

On the findings on duration of having diabetes, many diabetics are low in activity level after diagnosis. Then the activity level is seen to increase in many diabetics with 1 to 10 years of diabetes perhaps due to more exposure on management and treatment especially for Type 2 cases who have to cut down on their body weight. However, the trend goes down with less diabetics being active with time maybe due to presence of other complications of diabetes which appear with advancement of the disease (IDF and WDF, 2003). Advancement in age could also be an influencing factor as it is evident that most (72.7%) of those with more than 20 years of diabetes (who are mostly elderly) have less than recommended levels (low) of activity.

**CONCLUSIONS**

The percentage of patients with diabetes who participate in significant physical activity is not satisfactory as physical activity is almost a mandatory form of management of diabetes. According to set standards (ADA, 2006; Haines, 2006; IDF & WDF, 2003 and IPAQ, 2001) this is required for there to be health-related benefit. A large percentage of diabetics are operating on low activity level which is less than recommended levels of PA that do not achieve any health-related benefits from exercise/physical activity done for management of diabetes. Reasons for inactivity could be exercise constraints such as perceived barriers to exercise, fears, misconceptions and complications arising from exercise. Studies have also reported that the main reasons for non-compliance to exercise regime are patients’ attitudes, social/cultural and environmental factors (Sallis et al., 1989; Levene, 2003).

Many diabetics would like to exercise more, which is advisable, given the actual high rates of low level of activity but are hindered by factors which can be addressed and eliminated. Diabetics should be able to exercise according to their capabilities, physical limitations and personal interests and increase in compliance to exercise/physical activity therapy can be achieved by a variety of means, including public health programs, support groups and community-based interventions.

**RECOMMENDATIONS**

This study recommends that the medical institutions and exercise science professionals in Kenya should:

1) Strengthen the existing exercise therapy regime through in-depth patient and medical staff education on exercise.

2) Incorporate individualized patient exercise supervision, regulation of diabetics daily PA as well as offer encouragement through support groups and seminars.

3) Design exercise prescription manuals to be used in this region and programs for each group of diabetics to ensure adherence to exercise protocols and procedure.

4) Include a variety of exercises in diabetes education materials and ways which diabetics can incorporate exercise in the daily activity.

5) Sensitize the fitness industry on how to safely and effectively handle diabetes cases in their exercise and fitness programs through in-depth instructors and staff education on exercise and diabetes.

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