THE IMPACT OF STRUCTURED HEALTHY LIFESTYLE PROGRAMS AMONG TYPE 2 DIABETIC PATIENTS IN PASIR PUTEH, KELANTAN: A CONTROLLED TRIAL.

by.
DR. SUHAIZA BT. SULAIMAN

DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTERS OF COMMUNITY MEDICINE (EPIDEMIOLOGY & BIOSTATISTICS)

UNIVERSITI SAINS MALAYSIA
NOVEMBER 2001

ACKNOWLEDGEMENT

It is with deep gratitude and appreciation that I acknowledge the assistance of everyone who has contributed to this study. Firstly, I would like to express my gratitude to Universiti Sains Malaysia for providing a grant for this research.

I wish to express my gratitude to Professor Dr. Rusli Nordin the Head of the Department of Community Medicine, School of Medical Sciences, Universiti Sains Malaysia and other lecturers for their advice and guidance.

Special thanks to Dr. Abdul Aziz Al-Safi bin Ismail, my supervisor for this dissertation. I am very grateful to him for going through the manuscript, making constructive remarks and valuable suggestions.

I also wish to thank the former Pasir Puteh Medical Officer of Health, Dr Naimah Jaafar and Dr. Abdul Haris Mohamed for their help and guidance during my posting and research in Pasir Puteh district.

Thanks also to Dr. Syed Hatim Noor and Dr. Aryub Mohd. Saddiq for their advice in statistical analysis.

My thanks are also extended to the staff of Selising Health Center and Gaal Health Center staff for their excellent cooperation and help during the study.

Last but not least, my deepest gratitude and thanks to my dear family, Dr.Mohd Ariff Mohd Noor, Marwan, Adli, Lutfil and Farhan. They have been tolerant with my work, thanks for your endless patience and love.

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ABBREVIATIONS

BMI	Body mass index
CAD	Coronary artery disease
CVD	Cardiovascular disease
CI	Confidence Interval
DCCT	Diabetes Control and Complication Trial
FFA	Free fatty acid
GLM	General Linear Models
GP	General Practitioner
HC	Health center
HDL	High density lipoprotein
HLA	Human leucocyte antigen
HRT	Hormonal replacement therapy
IDDM	Insulin dependent (Type 1) diabetes mellitus
IHD	Ischemic heart disease
LDL	Low density lipoprotein
MI	Myocardial infarction
MODY	Maturity Onset Diabetes of the Young
NIDDM	Non-insulin dependent (Type 2) diabetes mellitus
SD	Standard deviation
SPSS	Statistical Package for Social Science.
UKPDS	United Kingdom Prospective Diabetes Study
WHO	World Health Organization

ABSTRACT.

Diabetes is a public health problem as it causes considerable amount of disability, premature mortality as well as demand on health care facilities. Increased in disease prevalence and its complications were mainly related to unhealthy lifestyle. A non-randomised control trial was conducted with the aim of assessing the impact of structured healthy lifestyle programs amongst type 2 diabetic patients in Pasir Puteh, Kelantan. One hundred and forty type 2 diabetic patients from Selising Health Center (intervention group) and Gaal Health Center (control group) were selected for the study. The intervention group was given a structured health education programs on self-care, dietary advise and exercise. Data was collected using a questionnaire, anthropometric measurements and blood samples for random blood sugar (RBS) and HbA1c. Statistical Package for Social Sciences (SPSS) version 10.0 was used to analyze the data. The patients in both health centers had similar socio-demographic distribution (p value > 0.05). Most of them were Malays (99%), females (58.6 % intervention, 65.3 % control), married (74.3 % intervention, 86.7 % control), and non-smoker (66.7 % intervention, 72.9 % control). In the intervention group, their mean (SD) age and duration of diabetes was 55.4 (10.29) years and 5.6 (4.81) years respectively compared to the control group which was 54.2 (11.86) years and 5.4 (4.23) years respectively. The intervention packages effectively improved the knowledge and practice on healthy lifestyle among the patients as evidenced by improvement in HbA1c level ($p < 0.05$). Other variables (Body mass index (BMI), RBS and attitude) did not significantly improve ($p>0.05$). In conclusion, the structured healthy lifestyle programs which consisted of health education,

dietary advise and physical activity have effectively improved the knowledge, practice and HbA1c level of type 2 diabetes patients. The main challenge in management of these patients is however to sustain their healthy lifestyle.

ABSTRAK.

Diabetes merupakan satu masalah kesihatan awam yang menyebabkan ketidakupayaan, kematian awal dan melibatkan kos perbelanjaan yang tinggi. Peningkatan prevalen penyakit ini dan komplikasinya berkait rapat dengan cara hidup yang tidak sihat. Satu kajian kawalan tidak rawak telah dilakukan dengan tujuan untuk mengkaji keberkesanan program cara hidup sihat yang tersusun di kalangan pesakit diabetes jenis 2 di Kelantan. Seratus empat puluh pesakit diabetes jenis 2 dari Klinik Kesihatan Selising dan Gaal telah dipilih. Kumpulan kajian telah diberikan pendidikan kesihatan mengenai penjagaan diabetes, pemakanan dan senaman. Data-data telah dikumpul dengan menggunakan borang soal-selidik, pengukuran antropometri dan pengambilan sampel darah untuk HbA1c dan paras glukos (RBS). Analisa data dilakukan dengan menggunakan program "Statictical Package for Social Science"(SPSS) versi 10.0. Pesakit dari kedua-dua klinik kesihatan mempunyai taburan sosio-demografi yang sama ($p>0.05$). Kebanyakan mereka adalah Melayu (99%), perempuan (58.6% kajian : 66.3% kawalan), berkahwin (74.3% kajian : 86.7% kawalan) dan tidak merokok (66.7% kajian : 72.9% kawalan). Bagi kumpulan kajian purata (SD) umur dan tempoh penyakit diabetes adalah 55.4 (10.20) dan 5.6 (4.81) tahun manakala bagi kunpulan kawalan adalah 54.5 (11.86) tahun dan 5.4 (4.23)tahun. Program intervensi telah memberi kesan yang efektif keatas pengetahuan dan amalan tentang cara hidup sihat dan paras HbA1c ($p<0.05$). Parameter lain seperti RBS, 'body mass index' (BMI) dan sikap tidak menunjukkan perubahan yang bermakna. Kesimpulan dari kajian ini menunjukkan bahawa program cara hidup sihat yang terdiri dari pendididkan kesihatan, nasihat pemakanan dan program aktiviti fizikal dapat

meningkatkan pengetahuan, amalan dan paras HbA1c pesakit diabetes jenis 2. Tetapi masalah yang lebih besar adalah untuk memastikan berapa lama mereka akan terus mengekalkan cara hidup sihat ini.

CHAPTER 1

INTRODUCTION

INTRODUCTION

1.1. Why Diabetes?

Diabetes mellitus is an emerging health problem worldwide. Its prevalence varies widely in different regions, but observation showed a significant increase in the prevalence of this chronic disease. In Malaysia, the prevalence in 1996 was about 8.3% (Ministry of Health Malaysia, 1997), an increase from 0.65% in 1960 and 2.1% in 1982 (Mustaffa, 1990). Similar trend was observed in developed countries such as the United States. The prevalence for the United States was about 0.4% in 1930, and this has increased to 2.4% in 1978 and 3.1% in 1994 (Satcher, 1999). Between 1980 and 1994, the number of persons diagnosed with diabetes in the United States increased by 2.2 million, an increase of 39% (Satcher, 1999). The increase in the prevalence was probably related to the increase in the proportion of the ageing group, lifestyle and dietary changes and improvement of diagnostic tests.

Diabetes is the seventh leading cause of death in the United States, and contributes to more than 193,000 deaths each year (Satcher, 1999). Currently an estimated 10.3 million people in United States are diagnosed with diabetes and another 5.4 million have undiagnosed diabetes (Satcher, 1999). They are at risk of developing serious complications which include:

Blindness – diabetes is the leading cause of new cases of blindness in adult 20-70 years old.

Renal Failure – diabetes is the leading cause of end stage renal disease.

Amputation – diabetes is the leading cause of lower extremities amputations not related to trauma.

Cardiovascular disease – people with diabetes are 2 – 4 times more likely to develope heart disease or stroke than people without diabetes.

In Malaysia, the prevalence of chronic complications is high. The reported prevalence for common complications are retinopathy (53%), neuropathy (58%), amputations (2 %), legal blindness (1%), myocardial infarction (9%), stroke (6%) and renal failure (1%) (Mustaffa, 1998). However, all of these complications can be prevented or delayed.

A study done by the United Kingdom Prospective Diabetes Study (UKPDS) group had concluded that tight control of blood glucose and blood pressure will reduce the risk of developing macrovascular and microvascular complications (UKPDS, 1998). Another study done by the Diabetes Control and Complications Trial (DCCT) study group found that intensive therapy effectively delays the onset and slows down the progression of diabetic retinopathy, nephropathy and neuropathy in patients with type 1 diabetes (DCCT, 1993). Based on these data, it is important for diabetes to have a good quality of diabetic care.

1.2. The Quality of Diabetic Care

Preventive diabetic care is generally inadequate. The study by Peter et al. on the quality of diabetic care provided to patients in a large health maintenance organization in

deterioration in the quality of their life (The Diabetes Control and Complications Trial (DCCT) Research Group, 1996).

In Malaysia, an audit on diabetic care was done in a hospital to assess the effectiveness of diabetic management (Lim, 1990). Results revealed that the diabetic patients received less than adequate care. Only nine percent of the patients achieved good glycaemic control; 39% had hypertriglyceridaemia and 65% had undesirable weight gain while on treatment.

An audit on the adequacy of diabetic management in five Perak outpatient departments was done in April 1996 (Chan et al., 1997). Two hundred diabetic patients' records were analysed. All doctors and 100 patients answered the questionnaires on diabetes mellitus. Fifty five percent of doctors have adequate knowledge. Patient's knowledge varied among centers (13% - 80% adequacies). Overall control and monitoring were inadequate. Referrals for complications were delayed in two centers. Refresher course for doctors, patient's health education, protocols, screeners and physician visits are recommended.

As a conclusion, studies showed that diabetic care is still inadequate (Graffin, 1998, Lim, 1990 & Chan et al., 1997). This condition was reflected by high percentage of patients with poor glycaemic control and poor knowledge on diabetes mellitus. This will lead to an increase risk of the development of acute and chronic complications , creating an even greater future burden on the health care system and negative consequences for the patients.

The role of primary care doctors includes curative as well as preventive or promotive health care. Thus it includes caunselling of diabetic patients regarding the natural history of the disease. In order to give an effective advice and counseling it is necessary for a doctor to have deep understanding on the knowledge, attitude and practice of the patients.

1.3. Background of The Study Area.

Kelantan is situated on east coast of Peninsular Malaysia with Thailand (Pattani) on the Northeast, Perak on the West, Pahang on the South and Terengganu on the East (Figure 1.0.0). The estimated population for 1998 was 1,484,000 with the growth rates of 2.5% (Hassan, 1999). Majority of the population are Malays (94.1%), followed by Chinese (4.6%) and Indians (0.5%). Kelantan is a unique state with its own sociocultural background, type of dialect and special traditional environment, which are different from other states in Malaysia. It has 10 administrative districts consisting of Kota Bharu, Pasir Mas, Tumpat, Bachok, Pasir Puteh, Machang, Tanah Merah, Jeli, Kuala Krai and Gua Musang (Figure 1.0.0). In this study, Pasir Puteh district was selected. Pasir Puteh district is located on the Southeast of Kelantan, which is bordered by Kota Bharu district, Machang district, Bachok district and the Terengganu state. Pasir Puteh town is about 40 kilometres from Kota Bharu. The estimated population of Pasir Puteh in the year 2000 was 137,718 (Yearly Report Pasir Puteh Health Office 2000). Majority of the population work as farmers, fishermen and rubber tappers with a small percentage in the government service. The hospital services are provided by Hospital Tengku Anis with four Medical

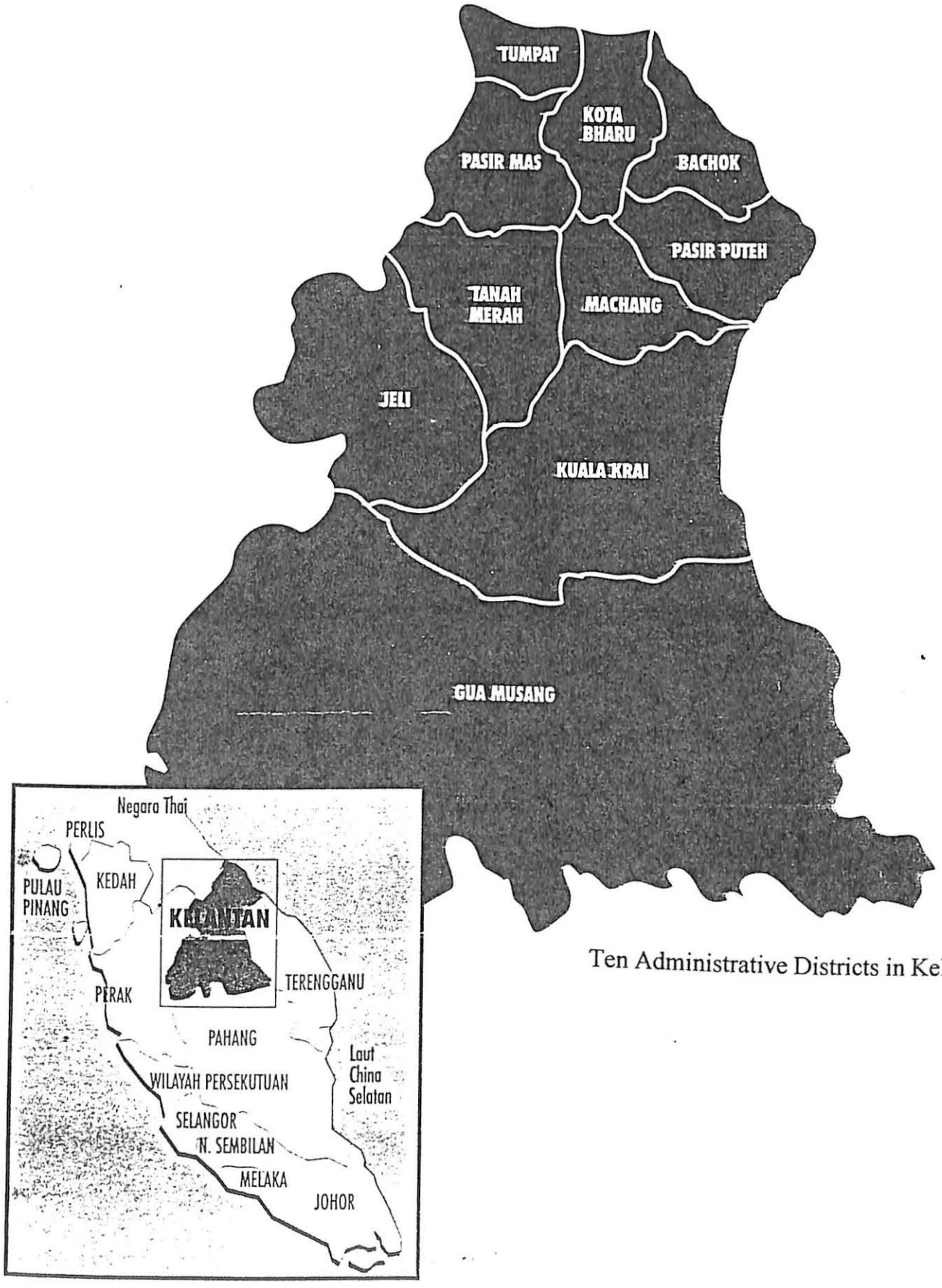
Officers. It is located in the town of Pasir Puteh. There are 10 General Practioners with 8 of them in the town, one each in Cherang Ruku and Selising. The government primary health cares are delivered through five Health Center (HC) that are located in Selising, Gaal, Cherang Ruku, Jeram and Pasir Puteh town. Two of the Health Centers, that is Selising HC and Gaal HC were randomly selected for the study.

Diabetes is one of the most prevalent chronic diseases in Kelantan. At the primary care level (Health Center), diabetic patients are seen by Medical Assistant and occasionally referred to the Medical Officers when they have problems. Previously the records are kept in a simple outpatient cards. There were various degrees of completeness and quality of recording, since there was no standard format of documentation. Now, a new format of recording diabetic patients' data was introduced by the Ministry of Health Malaysia. However screening of complications was rarely done unless patients complain about it. The monitoring of diabetes is based on random blood sugar (RBS) because the HbA1c test is only available at Hospital Kota Bharu (HKB). The entire specimen for HbA1c collected in this district has to be sent to HKB and the results are ready after two weeks. There is no dietician posted at the district level. Dietary advice is given informally by the Medical Officers and Medical Assistants.

This study is focused mainly on the impact of healthy lifestyle on the level of glycaemic control, knowledge, attitudes and practice among diabetic patients at primary care level. It is also an attempted to provide a structured education program for them during intervention. The assessment of HbA1c level, BMI, RBS and score of knowledge,

attitude and practice were carried out before and after the intervention program in order to assess the effectiveness of the program.

Figure 1.0.0 Map of Peninsular Malaysia and Kelantan.



Ten Administrative Districts in Kelantan

CHAPTER 2

LITERATURE REVIEW

LITERATURE REVIEW.

2.1. Introduction.

Diabetes mellitus is characterized by hyperglycaemia and disturbances of carbohydrate, fat and protein metabolism that are associated with absolute or relative deficiencies in insulin action and/or insulin secretion (World Health Organization (WHO), 1985). The characteristic symptoms are thirst, polyuria, pruritus, blurring of vission and weight loss (Garber, 1994). In its most severe forms, ketoacidosis or a non-ketotic hyperosmolar state may develop and lead to stupor, coma and, in absence of effective treatment, death may occur. Often the symptoms are not severe, or may be absent, and consequently hyperglycaemia of sufficient degree to cause pathological and functional changes may be present for a long time before the diagnosis is made. The long term effects of diabetes mellitus include progressive development of specific complications of retinopathy with potential blindness (Klein et al., 1996), nephropathy that may lead to renal failure (The Diabetes Control and Complications Trial Research Group 1993) and/or neuropathy with risk of foot ulcer, amputation (Adler et al., 1999) and features of autonomic dysfunction, including sexual dysfunction (Fedele et al., 2000). People with diabetes are at increased risk of cardiovascular, peripheral vascular, and cerebrovascular disease (Savage, 1996).

Several pathogenetic processes are involved in the development of diabetes (Tuomilehto et al., 1987). These include processes which destroy the beta cells of the pancreas with consequent insulin deficiency and others that result in the resistance to insulin action. The

abnormalities of carbohydrate, fat and protein metabolism are due to deficient action of insulin on target tissues resulting from insensitivity or lack of insulin.

2.2. Classification of Diabetes Mellitus.

The first accepted classification of diabetes mellitus was published by WHO expert committee in 1980, and in modified form in 1985 (Alberti et al., 1998). The 1980 Expert Committee on Diabetes Mellitus had classified diabetes mellitus into four major types; insulin dependent diabetes mellitus (IDDM), non-insulin dependent diabetes mellitus (NIDDM), gestational diabetes and diabetes secondary to other conditions. In 1985 WHO Study Group Report on Diabetes Mellitus, a new class of malnutrition related diabetes mellitus (MRDM) was introduced (WHO,1985). This classification of diabetes mellitus (Table 2.1) is widely accepted and is used internationally as it was based on clinical description (Alberti et al., 1998). It represented a compromise between clinical and aetiological classification and allowed classification of individual subjects and patients in a clinically useful manner even when the specific cause or aetiology was unknown (WHO, 1994).

Table 2.1.Classification of diabetes mellitus and allied categories of glucose intolerance.

A. Clinical classes
   Diabetes mellitus
      Insulin - dependent diabetes mellitus
      Non - insulin - dependent diabetes mellitus
         (a). Non - obese
         (b). Obese
      Malnutrition - related diabetes mellitus
      Other types of diabetes associated with certain conditions and syndromes : (1) pancreatic disease; (2) disease of hormonal etiology; (3) drug-induced or chemical - induced conditions; (4) abnormalities of insulin or its receptors; (5) certain genetic syndromes; (6) miscellaneous.
   Impaired glucose tolerance
      (a) Non-obese
      (b) Obese
      (c) Associated with certain conditions and syndromes
   Gestational diabetes mellitus

B. Statistical risk classes (subjects with normal glucose tolerance but substantially increased risk of developing diabetes)
   Previously abnormality of glucose tolerance
   Potentially abnormality of glucose tolerance

Source : WHO Technical Report Series 844.

The classification of the three major clinical forms, insulin dependent diabetes mellitus (IDDM), non-insulin dependent diabetes mellitus (NIDDM), and malnutrition related diabetes mellitus (MRDM), is based on fundamental differences in aetiology, natural history and clinical picture and on the vital clinical and therapeutic distinction on whether or not the person requires insulin to prevent death (Garber, 1994). The metabolic and clinical characteristics of the two major types of diabetes mellitus are summarized in Table 2.2.

Other specific types of diabetes mellitus are less common, but are those in which the underlying defect or disease process can be identified in a relatively specific manner (Alberti et al., 1998).

2.3. Diagnosis.

The clinical diagnosis of diabetes is clear when there are clinical symptoms and an unequivocal elevated blood glucose. Patients with symptoms and random plasma glucose of 11.1 mmol/l or above or fasting blood glucose of 7.8 mmol/l or above are diabetics as defined by WHO (WHO, 1985). Similarly it is easy to identify patients who are clearly not diabetic by finding arandom plasma glucose below 5.5 mmol/l. The problem frequently arises in the community when a patient is found to have glucose level between the two extreme values and does not complain of any usual signs and symptoms of diabetes. For this group of patients, the glucose tolerance test should be performed (Ministry of Health Malaysia, 1996). This test remains the definitive standard for diagnosing diabetes. The diagnostic criteria is shown in Table 2.3.

Table 2.3. Diagnostic values for the oral glucose tolerance test (OGTT) – WHO criteria.

	Glucose concentration, mmol/l			
	WHOLE BLOOD		PLASMA	
	Venous	Capillary	Venous	Capillary
Diabetes mellitus • Fasting • 2 hours after glucose load	 ≥ 6.7 ≥ 10.0	 ≥ 6.7 ≥ 11.1	 ≥ 7.8 ≥ 11.1	 ≥ 7.8 ≥ 12.2
Impaired Glucose Tolerance • Fasting • 2 hours after glucose load	 < 6.7 6.7 - 10.0	 < 6.7 7.8 - 11.1	 < 7.8 7.8 - 11.1	 < 7.8 8.9 - 12.2

Source: WHO Technical Report Series 844. 1994.

2.4. Management of Diabetes Mellitus.

Once diabetes is diagnosed, it is important that prompt and effective treatment is made available to the patient. There are four major components in the management of diabetes mellitus; diet, exercise, medication and education (Mustaffa, 1990). In addition, monitoring of diabetic control and management of complications should also be considered. For the effective management, it requires the involvement of patients and medical staff. The physician should act as a counselor or an advisor who can best outline treatment modalities or options and counsel patients regarding therapeutic modalities (Garber, 1994). It is essential that patients actively participate in these therapeutic decisions, particularly because successful implementation of such decision is frequently determined by the patients' sense of responsibility for treatment (Davidson, 1991).

2.4.1. Dietary Management.

The first and essential treatment for all patients with diabetes mellitus is diet management. Diet therapy is aimed at achieving four major goals (Garber, 1994):

i. Maintenance or achievement of ideal body weight.

ii. Distribution of caloric intake into many small loads taken through the widest possible interval during the day.

iii. Avoidance of rapidly absorbed carbohydrate loads.

iv. Maintenance of proper, long-term nutritional balance.

The British Diabetic Association Nutritional Subcommittee suggested that the Nutritional recommendation for people with diabetes should consist of carbohydrate between 50 - 55%, total fat between 30 - 35% and protein between 10 - 15% of total energy intake (British Diabetic Association report, 1992).

Thus the diet should certainly contribute to minimize fluctuations in blood glucose concentration, and to reduce blood glucose concentration towards normal as chronic hyperglycaemia is now established as an antecedent to microvascular complication (Klein, 1996).

Many diabetic patients consider diet to be the most traumatic aspect of their treatment (House, 1986). Compliance with diabetic diet has been notoriously poor, as the short term penalties for non-compliance are not always apparent and the reward for keeping to a diet

is a negative one (absence of complication) (Nutrition Subcommittee of the British Diabetic Association's Professional Advisor Committee, 1992).

Several studies have shown the importance of dietary control in managing type 2 diabetes (UKPDS, 2000 ; Wolever et al., 1992 ; Fontveille, 1992 ; Frost, 1993 ; Brand, 1991). Initial therapy in patients with newly diagnosed type 2 diabetes substantially reduced plasma triglyceride, marginally improved total cholesterol and subfraction, and resulted in a potentially less atherogenic profile, although this did not eliminate the excess cardiovascular risk in patients with type 2 diabetes (UKPDS, 2000). To calculate the caloric prescription required for a patient with diabetes, the patient's present body weight and an estimation of his or her customary degree of physical activity is required (Mustaffa, 1990).

2.4.2. Exercise

Regular exercise is now recognized to have several real and potential benefits that apply to both diabetic and non-diabetic individuals. In both type 1 and type 2 diabetes mellitus, exercise will increase insulin sensitivity, lower blood glucose and have positive psychological effect (Russel et al., 1999). In addition to that, it also improves several of the recognized risk factors for cardiovascular diseases; both of the low and very-low-density lipoprotein concentration in serum decrease with physical training, whereas high-density lipoprotein increases (Horton, 1988). Psychological benefits of exercise such as increase of sense of well-being, improve self-esteem, and an enhanced quality of life,

may also be important for those with type 1 or type 2 diabetes (Horton, 1988). The aims of regular exercise are (Ministry of Health Malaysia, 1996):

i. To assist in blood glucose and lipid control.

ii. To reduce and maintain satisfactory body weight.

iii. To improve cardiovascular tolerance.

Several studies had strengthened the importance of long-term exercise programs for the treatment and prevention of this disease and its complications (American Diabetic Association, 1996, Roger et al., 1988 & Stratton et al., 1987)). In order to be effective, exercise should be carried out 3 to 4 times a week for 30 minutes (Ministry of Health Malaysia, 1996) per time.

2.4.2.1. Potential Benefits of Exercise

i. Prevention of Cardiovascular Disease.

In patients with type 2 diabetes, the insulin resistance syndrome continues to gain support as an important risk factor for premature coronary disease, particularly with concomitant hypertension, hyperinsulinaemia, central obesity, and the overlap of metabolic abnormalities of hypertriglyceridemia, low HDL, altered LDL and elevated FFA (American Diabetes Association, 1999). Regular physical activity changes these

lipid fractions in a favourable direction, decreases the blood pressure and increases the insulin sensitivity (Russel et at., 1999, Horton, 1988).

ii. Weight Loss

Data has been accumulated suggesting that exercise may enhance weight loss and in particular weight maintenance when used along with appropriate calorie-controlled meal plan (American Diabetic Association. 1997). The increased energy expenditure during exercise will produce a greater degree of negative energy balance and may improve weight reduction (Horton, 1988). A decrease in adiposity is frequently associated with improvements in insulin resistance, glycaemic control, and risk factors for coronary heart disease in patients with type 2 diabetes.(Schneider et al., 1990).

iii. Improvement in Glucose Utilization.

Several long-term studies have demonstrated a consistent beneficial effect of regular exercise training on carbohydrate metabolism and insulin sensitivity (American Diabetic Association, 1997). Exercise helps patients use their endogenous insulin more effectively (Russell. 1999). An improvement in glucose tolerance tests has been shown in the type 2 diabetes with as little as 1 week aerobic training (Roger et al., 1988).

iv. Enhance Socialization.

Exercise and organized sport allows diabetic patients to participate in social activities, and this active participation will promote socialization, peer acceptance and personal esteems (Russell, 1999). Exercise training and increase cardiorespiratory fitness are

associated with decreased anxiety, improved mood and self-esteem, increased sense of well being and enhanced quality of life. (Schneider et al., 1990).

2.4.2.2. Risk of Exercise

The potential complications of exercise need to be considered in all patients with type 2 diabetes (Table 2.4). The risk of these complications can be minimized if patients are screened before embarking on an exercise program, the exercise is appropriately prescribed, and the patient is carefully monitored (American Diabetic Association 1997).

Table 2.4: Potential adverse effects of exercise in Type 2 diabetes mellitus.

Cardiovascular.
Cardiac dysfunction and arrythmias
Excessive increment in blood pressure
Postexercise orthostatic hypotension.
Microvascular.
Retinal haemorrhages
Increased proteinuria
Acceleration of microvascular lesions.
Metabolic.
Worsening hyperglycaemia and ketosis
Hypoglycaemia
Musculoskeletal and traumatic.
Foot ulces
Orthopedic injury related to neuropathy
Accelerated degenerative joint disease.
Eye injury and retinal haemorrhage.

Source: Schneider et al., 1990.

2.4.2.3. Special Precautions

Many type 2 diabetes patients must take special precautions when they begin to exercise regularly (Schneider et al., 1990). The precautions include:

i. Proper footwear and other protective equipment.

ii. Exercise in extreme heat or cold should be avoided.

iii. Feet should be inspected daily and after exercise.

iv. Exercise during poor metabolic control should be avoided.

v. Hydration should be maintained, especially during and after prolonged exercise in a warm environment.

vi. If the patient is taking insulin, blood glucose should be self-monitored before, during and after exercise.

2.4.2.4. Compliance.

Several maneuvers can improve compliance with an exercise program (Schneider et al., 1990), such as:

i. The exercise should be enjoyable, i.e. patients should choose activities that they like.

ii. The patients should exercise at a convenient time and location; regular exercise performed at a site near the individual's home or workplace has a greater chance of being continued.

iii. The patient's behaviour should be reinforced by his or her family and involved medical personnel. Participation in exercise groups may be useful.

iv. Quatitative indices of progress to provide feedback should be utilized eg. measurement of heart rate during submaximal exercise and measurements of body composition.

v. Unrealistically high performance goal should not be set.

Although the general exercise recommendations can be helpful, physicians may have to aid patients in modifying diet and insulin regimen because the recommendations require tailoring to meet individuals needs (Colberg, 2000).

2.4.3. Pharmacotherapy

2.4.3.1. Oral Hypoglacaemic Agents.

Oral hypoglycaemic agents (OHA) should only be used after adequate trial of therapy with prudent diet and exercise. Duration of trial therapy with diet and exercise alone to control diabetes is usually three months but it is variable and depends on patients' compliance and response to therapy (Ministry of health Malaysia, 1996). OHA that are used in type 2 diabetes currently belong to 4 different types.

2.4.3.1.1. Sulphonylureas Group.

Sulphonylurea drugs lower blood glucose by stimulating pancreatic insulin release, increasing insulin sensitivity at the tissue and by reducing hepatic glucose production (Jeffcoate, 1993; Beigelman, 1986; Ministry of Health Malaysia, 1996). Second generation are preffered over the first generation as they restore first phase insulin secretion postprandially and reduce basal insulin and therefore less hypoglycaemia and weight gain (Beigelman, 1986). Currently available sulphonylurea are listed in Table 2.5.

Table 2.5: Currently available Sulphonylureas and the respective recommended dosage.

Drug	Minimun dosage	Maximun dosage	Duration
Tolbutamide	500 mg TDS	1 gm TDS	short
Chlorpropamide	125 mg OM	500 mg OM	very long
Glibenclamide	2.5 mg OM	10 mg BD	medium
Gliclazide	40 mg OM	160 mg BD	short
Glipizide	2.5 mg OM	10 mg BD	short

Source: Ministry of Health Malaysia, 1996

2.4.3.1.2. Biguanides.

Biguanides do not stimulate insulin secretion, and probably lowers blood glucose by increasing hepatic glucose output (Jeffcoate, 1993). Metformin may be considered in the management of obese patient who remains symptomatic or hyperglycaemia despite dieting (Ireland et al., 1980). There is theoretical risk of metformin precipitating lactic