I. INTRODUCTION:

Diabetes Mellitus is one of the most common metabolic disorders in the world. The majority of diabetes cases are type II, or non-insulin-dependant diabetes mellitus. The disorder was once believed to be a problem of affluent societies although recent data shows a dramatic increase in prevalence rates in the developing countries.

Diabetes is a chronic disorder with no known cures. Lifelong self care is required of the patient. The purpose of the treatment is to achieve and maintain blood sugar levels as close to normal as possible. This should permit the diabetic person to lead a life free of severe problems such as hypoglycemia (low blood sugar), hyperglycemia (high blood sugar), and ketosis, and in the long term, prevent vascular and neurological complications such as heart disease, kidney disorders, nerve damage, and blindness. A typical care regimen for a non-insulin-dependent diabetic patient includes dietary modification, exercise, blood glucose monitoring, and possibly medication.

While much progress has been achieved in devising effective treatment regimens, these efforts are rendered useless by patients' non-adherence to the regimens. This is a major problem in diabetes care. Lack of adherence with the various self-care procedures can result in serious health and socioeconomic consequences not only for the diabetic patient and his family, but also for the community at large. Research is needed to study patient self-care practices so that effective strategies can be designed towards their improvement.

Patient education has been recognised as an important part of chronic disease management,
particularly of diabetes mellitus. Although considered as an expensive option, evidence suggests that it may actually reduce long term costs in hospital admissions and curative care.

In order to be effective, disease education has to be relevant to the needs of the patient population and their social, cultural, and economic milieu. In developed countries, the health care facilities available to the patients and the characteristics of the patient population may differ radically from that in a developing country. Local based research may help determine diabetes education needs and lead to designing of relevant and effective diabetes education programs, which are virtually non-existent at present. Such programs need not be elaborate and expensive in order to be effective. Before any of the possible measures are initiated, the needs must be assessed.

The purpose of this study was to document self-care practices in a population of Pakistani diabetic patients. A cross-sectional study design was utilized to examine the self-care behaviors in a selected group of diabetic patients in the city of Lahore. An attempt was also made to identify determinants of the levels of self-care behaviors observed. Dietary intake data was obtained as part of the survey in order to assess deviations from the advised dietary prescription as well as to examine any dietary patterns in the population that may be contrary to currently accepted expert recommendations.
II. REVIEW OF LITERATURE

2.1 Diabetes Mellitus - An Introduction

Diabetes mellitus is a chronic disorder of carbohydrate metabolism, defined by the WHO Expert Committee on Diabetes mellitus (1980) as a "state of chronic hyperglycemia which may result from many environmental and genetic factors, often acting jointly". It is one of the oldest disorders known to mankind as physicians were familiar with it thousands of years ago in Egypt, Greece and India (Day, 1986).

Diabetes is also the most common of the serious metabolic disorders known to mankind and is widespread throughout the world. The exact prevalence is difficult to determine due to varying standards of diagnosis. The estimated rate for adults is 6% including both diagnosed and undiagnosed cases. The prevalence rises to 16% in people over 65 years of age (WHO Expert Committee on Diabetes mellitus [WHO], 1980). Experts claim that there are few populations in which the prevalence is less than 1% (Hamman, 1983). Although diabetes is considered as a 'disease of affluence', even the minimum estimates point towards the presence of 25-50 million diabetics in the developing world (King & Rewers for WHO, 1991).

Diabetes is a major community health problem and contributes directly or indirectly to mortality. In poor communities, where insulin therapy is difficult to provide, it may well be a fatal disease (WHO, 1980). It is also a contributing factor in a large number of hospital admissions. The high cost of diabetes to the individual and the society are summarised by WHO (1980) in Appendix A.
2.1.1 Complications of Diabetes

Diabetes is a lifelong disorder with no permanent cure available at present. There is an ever present risk of acute problems such as hypoglycemia and hyperglycemic coma as well as an increased risk of infection in hyperglycemic patients. Prevention of acute symptoms is accomplished relatively easily. However, the major problem of diabetes lies in its long term complications which often coincide with each other. The main diabetes specific complications are microangiopathy (impairment of blood vessels), retinopathy (deterioration of sight), nephropathy (kidney disorders), and neuropathy (nerve damage).

In addition, the incidence of atherosclerosis and coronary disease is higher in diabetics. Other complications increase the mortality risk. Available evidence suggests that poor diabetic control over the years is a major cause for the appearance of complications. However, measures to prevent these chronic complications have not proven to be effective (Zimmerman, 1990).

2.1.2 Classification

A heterogeneous disorder, diabetes may be present in varying degrees of severity ranging from asymptomatic to rapidly fatal. Several clinical classes have been identified. Mainly, the disease is classified into two types:

(i): IDDM, insulin-dependent diabetes mellitus, or juvenile onset diabetes. It can develop during the first forty years of life and is usually severe. As the name implies, insulin therapy is essential for control and long term survival.

(ii): NIDDM, non-insulin-dependent diabetes mellitus, or maturity onset diabetes. It occurs more
frequently in obese people in their middle or old age. This type is relatively milder and hyperglycemia is usually controllable by diet alone or with an oral hypoglycemic agent (Davidson, 1987).

It is believed that NIDDM and its associated mortality are more common in lower socioeconomic groups, whereas the risk of IDDM may be greater in higher socioeconomic groups (Hamman, 1983). In well-nourished populations, diabetes is more common in women than men (Ekoe, 1988).

2.1.3 Treatment

The treatment goal is to maintain the blood glucose levels within the normal ranges. The standard treatment approach includes the following:

1. Diet
2. Oral medication or insulin
3. Exercise
4. Self monitoring

Due to its chronic nature and the risk of acute and chronic complications, caring for a diabetic patient is a day to day task, hence making self-care important. The medical regimen is complex and requires substantial behavioral changes. Its several components which are rather cumbersome in themselves make it an inherently difficult regimen to follow. A fundamental knowledge of the disease is essential for health maintenance, as well as the acquisition of care and monitoring skills.

2.1.4 Special Considerations for NIDDM

In as much as NIDDM is a heterogeneous disorder, the treatment approach required is also
heterogeneous. As a large number of NIDDM patients are obese, weight reduction is an important component of a dietary regimen. Attention is to be given to the individuals with upper body fat localization because this form of obesity even when mild is linked with hyperglycaemia, exacerbated insulin resistance, greater abnormality of lipoprotein profile and increased cardiovascular risk (Hartz, Rupley & Rimm, 1984; Morris & Rimm, 1991). However, success with weight reduction programs is very poor and improvement in the area is one of the challenges of diabetes care. Very-low-calorie diets (VLCD) have been employed successfully for initial weight loss but most of it is quickly regained (Wing, 1992).

In addition to diet modification, exercise is also important, acting as an adjunct to low calorie diets for weight reduction. Moreover, glucose tolerance is reported to have improved after as little as one week of exercise in patients with mild NIDDM, as there is an increased uptake of glucose by muscles during activity even if insufficient insulin is available (Schneider & Ruderman, 1990). However, most of the benefits of exercise are short term, and are reported lost within three days, thus frequency and persistence are essential (Rogers et al, 1988). Once again, the challenge is to modify long standing behaviour patterns.
carbohydrates in diabetic diets. He prescribed unpalatable dietary regimens consisting of milk, lime water, blood puddings, suet, rancid meats, fats and small amounts of bread (Vinik & Wing, 1992). Later on in 1848, Bernard developed the hypothesis that glucose over-production by the liver was the cause of diabetes (Davidson & Freeman, 1986). The prominent French clinician, Bouchardat in 1870, followed in the footsteps of Rollo and advised a high-fat diet by substituting alcohols and fats for carbohydrates while objecting to the rancid nature of the Rollo diets. He urged "eating as little as possible", and was the forerunner in the use of fast days and exercise (Vinik & Wing, 1992).

Somewhat later Cantani limited daily food intake to about 500g of meat and fasting if glucosuria persisted. The treatment was continued for 3 months and extended upto 9 months if no response was observed. Patients were often placed in locked rooms to ascertain compliance (Davidson & Freeman, 1986). Meanwhile Von Noorden in 1902, noted that a high-carbohydrate regimen suppressed ketosis and prescribed a diet consisting predominantly of oatmeal. He announced it as a cure for diabetes (Nuttall, 1983).

Cantani's German follower Bernhard Naunyn hypothesized that 'glucose underutilization' caused diabetes. He noted that intermittent 24-hour fasts were beneficial in mild diabetics and that a high fat diet decreased glucosuria (Nuttall, 1983). Similarly Gulepa in 1910, reported the effectiveness of 3-5 day fast periods alternated with 7-10 day periods of severely restricted food intakes. These resulted in marked weight loss, emaciation and aglucosuria. Such philosophies were the basis of the 'Allen starvation treatment', developed by Fredrick Allen of the Rockefeller Institute around 1912. His low-calorie
regimens incorporating fasting days induced emaciation and weakness but in the pre-insulin era, allowed young patients to survive free of ketoacidosis for several years. Allen encouraged foods containing bulk but low in calories such as fluids, bran muffins and bran flakes (Vinik & Wing, 1992).

After the major breakthrough of the discovery of Insulin, investigators such as Geyelin of Columbia University presented data in 1923 substantiating that in the presence of insulin, high-carbohydrate diets were beneficial. Similar observations were made by Adlersberg and Porges in 1926, Sweeney in 1927, and further corroborated by Himsworth in 1935 at the University of London (Vinik & Wing, 1992).

2.2.2 Current Recommendations

Over the decades the idea of high-carbohydrate, high-fibre, low-fat diets has gained increasing support. By the early 1970's, the average carbohydrate prescription rose to about 40% of total energy intake. Prohibition of sucrose was the main message at the time. Between 1940 and 1970, the American Diabetes Association recommended carbohydrate restriction, a view reversed with the 1971 revisions. The position is reaffirmed with the 1979 and 1986 "Principles of Nutrition and Dietary recommendations for individuals with Diabetes mellitus". In essence, the revised recommendations restrict fat, limit protein intake to the RDI, and fill the void with carbohydrates (Vinik & Wing, 1992). However, the amount and type of carbohydrate allowed and the desirability of free diets verses a carbohydrate restricted, measured diet continues to be a controversy.
While the ideal diet for diabetic patients is yet to be determined, the current nutritional recommendations of the American Diabetes Association (1993) are summarised in the following table:

**Table 1**

**Nutritional Recommendations for people with Diabetes**

<table>
<thead>
<tr>
<th>Recommended Daily Intake</th>
<th>Cholesterol</th>
<th>Fibre$^c$</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>(To be tailored to individual needs)</em></td>
<td>(mg)</td>
<td>(g)</td>
</tr>
<tr>
<td>CHO Protein$^a$   Fat$^b$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(%$)$ g/Kg PUS S MUS</td>
<td>&lt;300S-30-(PUS+S)</td>
<td>&lt;300</td>
</tr>
</tbody>
</table>

a RDA for adults. Patients with incipient renal failure may require lower protein intakes
b If total fat is reduced, all components must be reduced proportionately.
c 25g/1000Kcal for people taking low calorie diets.

In addition, supplements for vitamins and minerals are required only if the diet is very restricted in calories or other special circumstances exist. Use of alternative sweeteners-nutritive (e.g. sorbitol, fructose) and non-nutritive (e.g. aspartame, saccharin) is accepted although not encouraged. Caution is to be applied regarding alcohol and salt usage (American Diabetes Association, 1993).

2.2.3 **Issues Concerning Diabetic Diets**

2.2.3.1 **Carbohydrate Content and Dietary Fibre**

Although high-carbohydrate (CHO) diets are the ones currently favoured by the leading professional authorities, there have been concerns about the
effects of such a diet on diabetics. Vinik and Wing (1992) summarise the major concerns as:

- High-CHO diets improve glucose tolerance in mild NIDDM (with normal fasting) but worsen it in severe NIDDM (raised fasting).

- High-CHO diets worsen postprandial glucose and triglyceride levels.

- High-CHO diets do not lower LDL cholesterol.

- Studies that show improvement in cholesterol and lipid levels have very high fibre.

- Only specific types of fibre (leguminous) attenuate CHO-induced hypertriglyceridemia.

- High-CHO diets may raise triglycerides (not necessarily transiently).

- High-CHO diets lower HDL in diabetic and non-diabetic individuals.

- High-CHO diets may increase insulin sensitivity or have no effects.

Despite these observations there is enough circumstantial and epidemiological evidence to continue the support of high CHO diets. However, the term carbohydrate is a generic one and the type of carbohydrate ingested is an important consideration. Dyslipidemic effects of high CHO are attenuated by a high soluble dietary fibre intake. A high fibre intake is also believed to improve hypertension, a condition frequently accompanying diabetes (Dodson & Pacy, 1984). Studies by Jenkins (1979) demonstrated that the addition of guar gum to a high CHO diet appears to reduce serum cholesterol and blunts the hypertriglyceridemic response induced by high-CHO, low-fat diet. The levels recommended for dietary
fibre intake to achieve any beneficial effects are as high as 37 to 44g, which may be difficult to achieve within a normal, palatable meal pattern (Karlstrom et al, 1984; Mann, 1984).

New sources of soluble fibre are being explored for improving the dietary intake. Viscous fibres such as psyllium husk and guar gum demonstrate reduction of serum cholesterol by 4-16% at doses of 6-36g/day (Reckless, 1984). Psyllium husk is a traditional remedy for constipation and other digestive disorders in Pakistan and is incorporated in daily diets. Guar, although a native plant in Pakistan, has received limited attention, possibly due to its poor palatability in native form. Guar bread prepared by replacing up to 15% of wheat flour with ground guar bean yields a product lower in energy density, and well accepted in palatability tests. Feeding trials report reduction of HbA1c as well as total cholesterol levels (Peterson, 1984).

Restriction of sucrose and other refined sugars has traditionally been a part of the diabetic prescription. Recently, studies have shown that the effect of sugar added to food may be no worse than cooked starch which rapidly hydrolyzes in the upper intestine (Lobbezoo & Brand-Miller, 1992). Previously it was assumed that complex carbohydrates have a low glycemic effect. Research indicates now that not only the food composition but also other factors may be responsible for differences in glycemic responses.

To measure this relative effect, Jenkins et al. (1981) introduced the glycemic index (GI). It is an in-vivo derived measure that identifies how the chemical composition of a given food will translate into blood glucose response in human subjects. GI has been measured for over 70 different foods. The nutrient composition of a food does not predict its
glycemic index as other factors such as cooking or processing methods, carbohydrate, fibre, fat and salt content affect the response (Brand & Collin, 1991). This accounts for some surprising results e.g. carrots have a higher glycemic response as compared to icecream.

GI values of foods can be used to estimate relative glycemic responses in mixed meals. Fat and protein influence the glycemic response when added to carbohydrate but the effect is similar over a range of foods (Wolever, 1989). A diet emphasizing low GI foods such as legumes, appears to contribute towards modest improvements in long term glycemic control in NIDDM patients (Brand et al, 1991).

A moderate amount of sugar added to low GI foods has been shown to improve palatability with no unfavourable effect on blood glucose (Vorster, Tonder, Kotze & Walker, 1987). Prudence is still advised with regard to added dietary sucrose as high levels are detrimental to blood glucose control (Coulston et al, 1985).

With the increasing interest in this area, GI of a number of ethnic foods has also been determined. Result of a GI trial of Pakistani staple foods favours the traditional belief that besan flour chapati is better for diabetics than wheat chapati (Rahman, 1992).

Inspite of their apparent usefulness, there are problems in using glycemic index values to advise dietary regimens as they go across the existing exchange lists. Also, the research in this area is still limited and further work is required before the available knowledge can be translated into practical dietary advice (American Diabetes Association, 1984).
2.2.3.2 Fat Content

While the initial concern in diabetic treatment was the maintenance of normal blood glucose levels, evidence of increased mortality among diabetics from cardiovascular problems has shifted the focus towards prevention of macrovascular disease and to deceleration of the progress of renal disease.

Diabetic populations in general present a dyslipidemic profile. Atherosclerosis accounts for 80% of all diabetic mortality, 75% of which is attributable to coronary atherosclerosis. Diabetes is also the most common cause of heart disease in young people. Approximately 77% of all hospitalizations for diabetes are due to coronary heart disease (CHD). Nearly half of all diabetics are dyslipidemic having higher plasma cholesterols than non-diabetics. Epidemiologically (in non-diabetics), high cholesterol levels are associated with high fat diets. Therefore, low-fat diets are recommended for diabetics also (Vinik & Wing, 1992).

However, a low-fat diet will inevitably be one high in CHO, which reportedly can lower high density lipoprotein (HDL) levels, theoretically raising CHD risks. Replacing saturated fats with polyunsaturated fat has been a recommendation due to its cholesterol lowering effect. Recently, concerns have been raised regarding its long term safety and possible carcinogenic effects (Grundy, 1991).

On the other hand, monounsaturated fats (MUF) have traditionally been a part of Mediterranean diets and are regarded as safe. They also demonstrate a lesser lowering of HDL in clinical studies. As questions about the suitability of high-CHO diet for patients with advanced NIDDM have been raised, replacement of some CHO with MUF is suggested provided that obesity is not a problem (Grundy, 1991). In diabetics, high
MUF diets show a similar or more favourable overall blood profile when compared to a high-CHO diet (Bonanome et al., 1991). One such diet tested by Garg, Grundy and Koffler (1992) demonstrated desirable effects on plasma lipids without any adverse effect apparent on glycemia. To improve serum cholesterol levels, a limitation of dietary cholesterol intake is also desirable.

Omega 3 fatty acids are polyunsaturated hydrocarbons believed to be the active component of fish oils. Their principal effects are the reduction of triglyceride and very low density lipoproteins (VLDL) levels in the blood, thereby lowering total low density lipoprotein (LDL) levels. Epidemiological evidence as well as clinical trials in non-diabetic populations show dramatic benefits in reducing heart disease risk factors (Sorisky & Robins, 1989). However, a number of clinical trials on NIDDM subjects have demonstrated a deterioration in glycemic control (Borkman et al., 1989). Therefore, caution is necessary in applying the results from non-diabetic populations to diabetics.

2.2.3.3 Protein Content

Renal impairment is one of the long term complications of diabetes and the recommendation for protein intake must take this into account. Research suggests that dietary protein restriction can slow the progression of chronic renal failure of diverse etiology. A dietary intake of 0.6g/Kg body weight has been demonstrated as useful in this respect (Vinik & Wing, 1992). However, very low protein diets are not suitable for diabetics because such a diet must be high in both CHO and fat content in order to maintain energy balance. Current recommendations suggest a level of 0.8g/Kg of body weight (American Diabetes Association, 1993).
In summary, as the diabetic diet has passed through the different stages of development, it has increasingly emerged as a diet pattern appropriate for the general healthy population, rather than a special 'sick diet'.

2.3 Compliance and Adherence with Therapeutic Regimens

With the advance in medical science, the predominant pattern of illness has shifted from acute to chronic illness requiring lifelong therapeutic management. This inevitably requires health behaviour and lifestyle adjustment on the part of the patients.

"Compliance" is the umbrella term used for all behaviours consistent with health care recommendations (Blevins & Lubkin, 1990). Haynes (1979) has defined compliance as "the extent to which a person's behaviour (in terms of taking medications, following diets or exercising lifestyle changes) coincides with the medical or health advice".

Concerns have been expressed regarding the use of the term compliance as it may imply that the patients are passive and must accept without question what their health professional compels them to do. Adherence is frequently used as a surrogate term, but is also deemed unsatisfactory by some due to limited meaning. Although used interchangeably in the literature, compliance and adherence have also been defined as having distinct meanings. Barofsky (1978) suggested three stages of patient response to health care advice: compliance, adherence and then the ideal state of therapeutic alliance. In this model compliance is linked to compulsion, adherence to conformity and self-care to the therapeutic alliance with the care provider. This describes the
progression of the patient to different levels of autonomy.

In the absence of a satisfactory substitute, 'compliance' and 'adherence' remain as the most frequently used terms in the literature inspite of the associated connotations and are used interchangeably.

Non-compliance with therapeutic regimens is a well-documented phenomenon for both chronic as well as acute illness. For diabetes, it is 'one of the biggest problems in treatment' (Lockwood, Frey, Gladish & Hiss, 1986). Since life preservation is considered to be a strong motivational force, non-compliance may be particularly difficult to understand and continues to baffle health workers. It is a complex behaviour. A given individual may comply well with certain elements of a regimen but not the others. In general, patients are more adherent to medications than to lifestyle changes (Lockwood et al, 1986).

For any disease non-compliance with medication regimens can be upto 50% or even more. Instructions concerning changes in habitual behaviour are even less likely to be followed (Sackett, 1976).

Compliance with diabetic regimens becomes even more unlikely than for other conditions as it involves several components. Moreover, it is a 'life sentence'. According to Cerkoney and Hart (1980), "a typical diabetic regimen is complex, of lifelong duration and requires behaviour changes".

2.3.1 Compliance with Dietary Advice

In studies of comparative compliance with different components of a diabetic regimen, it is seen that non-compliance rates are higher for dietary
changes. Cerkoney and Hart (1980) reported compliance levels of 81% for insulin administration, 77% for foot care, and 65% for diet. These are typical of the rates reported throughout the literature. Although estimates of adherence to dietary regimens vary between studies, ranging from 10% to 68%, it is concluded that most diabetic patients do not adhere to their prescribed diet (Wing, 1985).

Low compliance levels with dietary regimens become a serious concern especially for NIDDM patients as it often is their main control measure. In particular, this is accepted as the major cause for clinical difficulties in the long term management of overweight NIDDM patients with sub-optimal metabolic control (Campbell et al, 1990).

Despite its obvious importance, the problem of adherence has received relatively less serious attention than the physiological aspects of diabetes. However, during the last three decades, an increased interest in the behavioural, psychological and social issues concerning the disorder has occured. Skyler (1988) noted in an editorial of Diabetes Care:

"We must learn more about the human factors producing the motivation needed to adhere to complex and demanding medical regimens. This path of inquiry has taken a backseat to more glamorous and instantly glorifying forms of high-tech research. Behaviour research deserves a better billing".
2.4 Theories and Models to Explain Self-care Behaviors

More than 200 factors have been identified as associated with adherence behaviors (Haynes, 1976). However, there is little consensus on whether particular variables are predictive of adherence (McCaul, Glasgow & Schafer, 1987). Most of the variables are related to the patient, his illness, the regimen and the patient-provider relationship. Theories and models have been developed in order to present a unified conceptual explanation of adherence and other health related behaviours. Considerable overlapping of concepts occurs. Some of the important theoretical constructs are presented in the following section:

2.4.1 The Health Belief Model

Based on the value-expectancy theory of social psychology, the Health Belief Model (HBM) is the most widely applied model in diabetes care (Maiman & Becker, 1974). It extends the use of socio-psychological variables to the explanation of preventative health care. HBM hypothesises that health related behaviour mainly depends on two variables:

(1) the value placed by an individual on a given outcome, and

(2) the individual's perception of likelihood that a given action will achieve the outcome.

The main dimensions of HBM are:

Perceived susceptibility- This refers to a person's subjective perception of the risk of developing an illness or in the case of an established illness, an
estimate of resusceptibility and the belief in diagnosis. This perception differs between individuals.

**Perceived severity**- This concerns the subjective feelings of the degree of seriousness of an illness including the perception of both medical as well as social consequences of an illness.

**Perceived benefits**- Even if a person perceives himself as 'threatened' by an illness, the execution of health action is dependent upon the individual's perception of the action as efficacious.

**Perceived barriers**- The potential negative aspects of an action can impede its execution. For instance, the individual may perceive the action as expensive, dangerous, inconvenient, unpleasant or difficult to perform in other ways (Janz & Becker, 1984).

In addition, a stimulus or "cue" to start the decision making process is important. Moreover, at least a minimum level of motivation on the part of the individual is assumed.

In a review of studies conducted across different medical conditions, Janz and Becker (1984) found health behaviour to be most related to 'perceived barriers' followed by 'perceived severity'.

While generally considered as flexible and comprehensive (Jenny, 1983), the usefulness of HBM is questioned by Bloom and Hart (1983), who reported only one quarter of compliance as attributable to health beliefs. Kasl (1975) contends that the explanatory power of the model decreases when applied to curative rather than preventive health. Haynes (1976) states that compared to retrospective studies, weaker relationships are observed in prospective studies.
2.4.2 Social Learning Theory

The social learning theory (SLT) is closely linked to HBM. It emphasises learning based on culture and socialisation. Bandura postulated that individuals can learn new behaviors by observing others who serve as models and then imitating them (Houts & Warland, 1989). In addition to role models, symbolic representations such as pictures, can have the same effect. The term 'modelling' is used for the learning process.

An important point is the specificity of environmental and psychological influences on particular behaviors. This notion of specificity has been proven valid in studies of relative compliance with different aspects of a diabetic regimen. The level of compliance can be different for each aspect, thus rejecting the idea of a uniformly 'good' or 'poor' adherer (Schafer, Glasgow, McCaul & Dreher, 1983).

2.4.3 Locus of Control Theory

Like the SLT, Rotter's locus of control (LOC) theory focuses on the interplay between external and self-generated influences, and is one of the variables of SLT (Schlenk & Hart, 1984). It identifies individuals as having an internal or external locus of control.

An internally controlled individual is one who perceives that a reward follows from or is dependent upon his own actions, while the externally controlled individual considers that the reward or consequence is controlled by outside influences such as luck, chance or fate and may occur independent of one's actions.
Individuals with internal control are more likely to show health promoting behaviors as they feel responsible for what happens to them, but the externals feel that they have no control over it (Kist-Kline & Lipnickey, 1989). It has been suggested that matching individuals to programs relevant to their locus of control may have favourable results.

Schlenk & Hart (1984) have discussed studies on diabetic subjects which demonstrate a valid relationship between locus of control and adherence. However, Williams, Pickup and Keen (1988) remark that the relevance of LOC to diabetic adherence is obscure. They cite discrepancies in the literature and question the validity of LOC assessment. An internal locus is regarded as desirable, but Johnson (1984) points out that such patients can get frustrated and resentful if their efforts don't have the desirable effect. They also delay seeking medical advice, a risky behaviour in certain situations.

2.4.4 Relapse Prevention Model

The Relapse Prevention Model (RPM) of Marlatt and Gordon (1985) is described as a psychoeducational program that aims to equip an individual with behavioral self-management skills necessary to cope with problems in following a treatment (Rose-Colley, Eddy & Glover, 1989). Developed originally to understand relapse in substance addiction treatments, Kirkley and Fisher (1988) suggest that it is applicable to diabetic regimens too as non-adherence to dietary regimens may be best understood as intermittent lapses.

The model begins with the assumption that when an individual maintains a target behavior, a sense of control is enjoyed until a high risk situation occurs. If coping mechanisms are inadequate, a
relapse occurs, diminishing the sense of control (Rose-Colley et al, 1989). If the individual views the lapse as a 'time out', due to controllable factors, a return to control is likely. However, if it is attributed to uncontrollable, stable factors such as will power, then guilt and depression are likely to result. The undesirable behavior is also likely to continue.

RPM avoids blaming the individuals for any lapse. It attempts to identify factors that lead to the lapse such as covert antecedents, lifestyle imbalances and relapse setups. The overall goal is to develop self-control capacities and confidence (Simmons & Owen, 1992).

Another care model emphasising the right of patients to control their own health care behaviour is the 'patient empowerment model'. It too seeks to teach strategies to individuals to be able to overcome difficulties in taking care of themselves (Feste, 1992; Funnell et al, 1991).

2.5 Single Variables Associated with Care Behaviors

2.5.1 Personality and Diabetes

Patient adherence is obviously a complex problem and many explanations have been put forward to understand the phenomenon. A popular concept has been the association of a specific personality type with diabetes, and has been noted as early as 1679. Psychological factors have been regarded important in diabetes in three ways. Firstly as components of etiology; Secondly as determinants of fluctuation in control; and thirdly as a consequence of the disorder. Studies have been contradictory and
inconclusive in all of these areas (Dunn & Turtle, 1981).

While researchers have been trying to define, confirm or reject the presence of a diabetic personality, much on the pattern of an A-type or coronary-prone personality, the results seem to indicate that it is a myth and a misconception (Skyler, 1981).

A suggested alternative approach is to see the adherence behaviours as an expression of individual personalities in adjusting to the daily demands of a diabetic lifestyle. Improvement in metabolic control has been found associated with improvement in anxiety, depression, and quality of life; but not with a particular personality type (Mazze, Lucido & Shamoon, 1984; Ivanyi, Gyimesi, Hanyecz & Kallai-Szabo, 1988). Dunn and Turtle (1981) note that:

We need to know how different individuals react to the tyrannies of diabetes, explore the psychological demands of diabetes rather than its general psychological consequences and explore alternative models, for adequate adjustment and good diabetic control, which are adaptable to the personality of the individual.

2.5.2 Social Support

Social support by significant others or support networks has been recognized as an important determinant of patient adherence (Schlenk & Hart, 1984), and possibly has an indirect effect on metabolic control (Schafer, Glasgow, McCaul & Dreher, 1983). The support may be instrumental or emotional in nature, and performs emotional, cognitive and instrumental functions (Shillitoe, 1988, p. 179). Support networks can vary in size, density,
homogeneity, availability, and inter-member strength of ties (Hamburg, Lipsett, Inoff & Drash, 1980).

2.5.2.1 The Family

The family is the foremost of these support systems. It is important for several reasons. It is an ongoing source of support and reinforcement and also serves as a model for health behaviors. Moreover, the family provides a supervisory mechanism for reminding, assisting, encouraging, and reinforcing the patient with respect to following medical advice (Becker, 1979). According to Davis, Hess and Hiss (1988), patient reported social impact of diabetes is related to mortality. Glasgow and Toobert (1988) found that regimen component specific measures of family support were strong predictors of adherence. However, an individual's perception of support is just as important as its actual presence (Shillitoe, 1988, p. 180).

A large family size has been associated with poor metabolic control (Shillitoe, 1986, p. 170). This observation was also made by Kouris, Wahlqvist and Worsley (1988), who reported that patients living alone were more adherent to dietary recommendations. They explain this by suggesting that family support may cause dependency and lack of initiative thereby lowering adherence. Shillitoe (in Shillitoe, 1988, p. 170) made a similar observation offering an explanation that special needs of an individual are easier to accommodate in a small family than in a large one. In cultures where extended families are the norm and meals are prepared for the family at large, it would be difficult to modify the diet for any one individual.

It has been demonstrated that family involvement promotes regimen compliance and also apparently
improves long term dietary adherence (Wing, 1985). Inclusion of the spouse in the treatment program yielded better outcome results in three and six month follow ups. Brownell and Stunkard (in Wing, 1985) reported that when both spouses followed a weight loss program, losses were maintained better. Family members' help in the form of 'cuing' or reinforcement of proper eating behavior aids in achieving desirable results of a dietary regimen (Becker, 1979, p. 14). Shenkel, Rogers, Perfetto and Levin (1985), found in a psychological study that the behavioral intention of adherence was more strongly predicted by how important following the regimen was to a "significant other" in a patient's life than were the patients own beliefs.

While some researchers question the value of spouse support in the long term (Wing, Epstein & Marcus, 1990), the patient's perspective may be different. Anderson and Kornblum (in Anderson, 1990) report that every diabetic adult in their study stated that support and cooperation of their family were essential in their disease management.

2.5.2.2 The Health Care Provider

The significance of the doctor-patient relationship has been noted as early as Hippocrates, who noted its potential capacity in facilitating care (Meichenbaum, 1987, p. 71). All treatment recommendations are affected by the quality of relationship between the health care provider and the patient.

Meichenbaum (1987) has identified two kinds of variables that are at work, namely the relationship variables and the organisational-structural variables.
The **relationship variables** include provider's personal characteristics such as approachability, friendliness, compassion, concern, and the amount of supervision offered (Coleman, 1985; Meichenbaum, 1987, p. 71) most of which are regarded as obviously important by Stunkard (1980). Personal characteristics of the physician are also noted as instrumental in dietary adherence (Maclean, 1991). From the patient's perspective important considerations are the perception of being respected, understanding of the regimen, meeting of expectations, and feeling of trust. Amir, Rabin and Galatzer (1990) note that provider criticism is a very important area of concern in diabetes care, and the way it is received by the patient may well determine coping behaviors. Sharing of the responsibility for care decisions as opposed to the patient being a passive receiver of orders is also deemed desirable for improving adherence. Becker (1979) considers the patient-provider contract as an important tool in this regard.

The **organisational-structural variables** refer to the administrative structure and working procedures of the health care facility including referral process, appointment scheduling, waiting times, and other procedures. While each of these elements affects patient adherence, the one factor that is identified by researchers as being the most important is continuity of care from the same physician (Amir et al, 1990; Meichenbaum, 1987, p. 65; Stunkard, 1980; Tattersall & Gale, 1990). The importance of patient's seeing the same health provider at every visit is strongly emphasised, even though in some cases it would be necessary to alter administrative procedures to make it possible.
2.5.3 Diabetes Education and Knowledge

In the face of the problems of diabetes management, 'patient education' has been the theme of the care professionals. For some medical conditions it is not vital that the patient understands the disease as long as medical instructions are followed. However, diabetes can pose problems in daily life such as hypoglycaemic episodes which require critical decisions. These decisions can not be made without an understanding of the disorder.

Patient education is defined as "a planned learning experience using a combination of methods such as teaching, counseling, and behaviour modification techniques which influence patients' knowledge and health behaviour" (Delphi Group on patient education in Dunn, 1990). In order to reap the maximum benefits from the technical advances in diabetes management, the patients must first receive the message.

2.5.3.1 Knowledge of Patients:

The amount of knowledge required for a diabetic person is formidable. Not surprisingly, studies have reported serious deficiencies in knowledge as well as practical skills, even with different assessment methods used on different groups of patients. Several explanations have been offered. There is a general agreement among researchers (Collier and Etzwiler, 1971; Dyer, 1982; Schatz 1988) that a well-informed patient is more likely one who:

(a) has learned about diabetes from a variety of sources,

(b) is a young adult at time of diagnosis, and
(c) is well educated.

On the basis of the assumption that younger patients are better learners, Karlander, Alinder and Hellstrom (1980) made a point that type II diabetic patients were less knowledgeable about diet than type I patients. A community study in the U.K. found that diabetes knowledge was generally low in the community, being higher in educated Europeans as compared to people from the Indian sub-continent (Simmons, Meadows & Williams, 1991).

Such educational deficits have been held responsible for 27% of diabetic hospital admissions in an American study (Geller and Butler, 1981). Moffit, Fowler and Eather (1979) reported reductions in hospital admissions after the introduction of an education program. Disbrow (1989) has reported similar reductions and the resulting savings to various American hospitals in detail. In some cases the benefits were so striking that insurance companies agreed to cover the service. The main reasons for educating a diabetic person as given by Krall (1985, p. 466) are;

- To improve the quantity as well as quality of life by helping the patient manage diabetes so as to have fewer complications and sick days.

- To function and cope with the problems of day to day living.

- To decrease the cost of diabetes care to self, family, community, and the health system.

2.5.3.2 Knowledge of professionals:

In order to reach the patient effectively, the teachers must be educated first..... Krall (1985) proposed the teaching as a pyramid, where each
level is in contact with the next, as shown in Figure 1:

![Diagram]

**Figure 1**

Theoretical ideal teaching scheme for diabetic patients. From Krall (1985)

Unfortunately, deficiencies in the knowledge of care-providers have been reported in the literature. The deficient areas range from basic knowledge and expertise (Hessett, Moran & Boulton, 1989), glucose testing skills (Hilton, 1987), to drug interactions and diet therapy. The last two are reported by Martin, Higginbotham and De Luise (1980) as the commonest areas of ignorance.

In a study of Pakistani physicians, general nutrition knowledge was found to be poor (National Institute of Health [NIH], 1988a). In another study in Karachi, Ahmad (1989) reported that erroneous beliefs about diabetic diets were held by the majority of physicians approached.

Beyond the knowledge deficit is another concern expressed by Czyzyk (1982), who notes that physicians are not always the best teachers. Maguire, Fairbairn and Fletcher (1986) describe newly qualified doctors as being 'extremely incompetent' at giving patients information or advice.
Jaffery (1985) maintains that in developing countries, diabetes education is lacking at all levels from the patient, his family, and the community at large, to health providers and resource allocators.

2.5.3.3 Knowledge and Diabetes Control:

The underlying assumptions for patient education are that educational programs are effective means of imparting knowledge, and that improved knowledge would translate into better compliance with treatment advice and, subsequently, to improved metabolic control. The actual equation, however, does not turn out to be so simple.

While research supports that amount of knowledge may positively affect compliance (Schatz, 1988; Campbell et al., 1990), a positive relationship between knowledge and control has not been demonstrated consistently. Most of the recent studies show that diabetes knowledge did not predict glycemic control (Dunn, Beeney, Hoskins & Turtle, 1990; Campbell et al., 1990; Rettig et al., 1986). In isolation from other aspects of management, this is an important limitation of diabetes education (Dunn, 1988).

Nevertheless, this does not mean that patient education is a useless pursuit. While knowledge itself does not guarantee change, without it there is no basis for a change. It is only the first step. The second step is attitudinal change, as without motivation the knowledge will not be put to use. The ultimate desired result is an appropriate change in behaviour leading to improved control and quality of life (Krall, 1985).

There is also no evidence of a direct relationship between health professionals' knowledge and their
patients' glycemic control, although their beliefs and attitudes to care have been shown to predict the patients' control (Weinberger, Cohen & Mazucca, 1984). These authors conclude that what doctors believe about care is more important than what they know about it.

2.5.3.4 What to Teach and How to Teach:

The American Diabetes Association (1991) has set down patient education standards to be observed. Krall (1985, p.47) has listed the order in which the different aspects of the disease should be taught to a newly diagnosed patient, beginning with the minimum basic survival information. Information overload must be avoided and no more than seven concepts should be addressed in a 15-minute period (Achterberg, 1987). However, the minimum information necessary and sufficient to maintain control has not been clearly defined in the literature.

Education programs may be set in out-patient or in-patient facilities and individual or group counseling may be utilized. The group approach is cost and time effective, and favours learners (Dunn, 1986; Shillitoe, 1986, p. 72).

Surwit, Scovenn and Feinglos (1982) have identified eight behavioral strategies from the literature which have been successfully employed in increasing patient adherence.

1. **Specific assignments** that define tasks very clearly.

2. **Skill** training to develop relevant new behaviors.

3. **Cueing** specific behaviors, such as reminders for clinic visits.
4. **Tailoring** the regimen according to particular needs and lifestyle of a patient.

5. **Contracting** between patient and provider for the agreed behavior change.

6. **Shaping** the behavior pattern for the treatment gradually.

7. **Self-monitoring** treatment related behaviors.

8. **Reinforcement** of new desired behaviors by appreciation.

### 2.5.3.5 The Low Literacy Level Patient

Literature on diabetes education since 1985 has covered creative programs aimed at the poorly educated and the illiterate patient, an area largely ignored in the past (Dunn, 1988). Adult literacy rate is generally low in developing countries, being as low as 27% in Pakistan (Appendix B). Any educational efforts for patients, therefore, would need to be bold and imaginative in order to make an impact. Bollag (1983) has pointed out differences in communication with an illiterate person. He points out that:

- The illiterate lives in a here-and-now world. His thinking is concrete and his thoughts near to the object. Accordingly, nutritional advice must be simple, clear and realistic. Food demonstrations must be done with familiar foods and utensils.

- Experience is important for perception. People living in environments exposing them to different stimuli have different perceptions of reality and different abilities to recognise reality in pictures. It is important to realise that 'pictorial literacy' or ability to read pictures is developed
proportionately to the amount of pictorial stimulation exposure of an individual in his environment. The illiterate perceive pictures more as concrete objects rather than abstractions.

As traditional diabetes education programs are generally expensive, ingenuity becomes even more important for developing countries where funds are limited. Flexible formats have been reported as successful in patients with low literacy (Dunn, 1988). Krall (1985) cites imaginative approaches used in some developing countries, such as 3-minute films for teaching in Cuba that are followed by nurses and dietitians answering questions. In Egypt, food models are used for dietary guidance, while in Dominican Republic, nurse educators teach small groups of patients without much visual aid materials. In Bogota, Columbia, volunteers teach patients and also look after particular city areas and encourage affluent persons to 'adopt' a type I diabetic patient i.e. provide lifesaving insulin for him.

While Bloomgarden et al.(1987) report the failure of a knowledge based program to promote improved metabolic control, Dunn and Turtle (1988) believe that behavior change in the low literacy patient is possible by interventions whose aim is direct behavioral change.

Education of a diabetic person regarding his disease is a necessity as his very survival depends on it. However 'education' does not necessarily mean the same thing to everyone and one system may not be applicable everywhere. Diabetes education programs should be tailored to the needs of the particular patient population.
2.6 Methodological issues in compliance research

While every area of research has its share of problems, compliance research may have more than most. The first and foremost problem is that of definition. The particular behavior involved needs to be identified, whether it is the reluctance to initiate treatment or failure to follow recommendations afterwards.

Beyond the definition remains the complex problem of measurement. Any definition of compliance requires that behaviors be judged against a known standard. This standard may not be known or may never have been given by the health care provider (e.g. prescription for exercise). It would not be possible conceptually to measure adherence if half of the construct is unavailable or missing (Rios, 1991).

Diabetes regimen adherence is unique in that it does not consist of a single behavior such as pill taking, rather it is multi-behavioral in nature. Studies have demonstrated that levels of adherence are often unrelated across different aspects of the regimen (Glasgow, McCaul & Schafer, 1987; Cerkoney & Hart, 1986). Thus, it becomes inappropriate to label patients simply as compliant and non-compliant with the associated implication that compliance or the lack of it, is a character trait, when it has been observed that it is a changeable phenomenon (Yue et al, 1984).

Johnson (1992), has identified five approaches of measuring adherence, namely health status indicators, health provider ratings, behavioral observations, permanent products and patient self reports.
Health status indicators such as glycosylated haemoglobin and body weight have been used as a measure of compliance. However, the relationship may not be a direct one (Glasgow et al, 1987). Adherence is only one of the factors affecting a patient's metabolic status. Many other factors function together towards this end result. For instance, patients vary in the way they respond to diets and metabolise drugs. If the prescribed treatment is ineffective, even perfectly adherent behavior will not make it effective. Health status indicators are very useful in identification of a problem. Additional methods need to be employed to determine the source of the problem (Johnson, 1992).

Provider ratings of patient adherence are suspect due to possible bias arising from knowledge of the patient's metabolic status. Moreover, patients may be labelled as adherent or otherwise without taking into account differences for various regimen components (Orme & Binik, 1989). Physicians tend to overestimate compliance, at times upto 50% (Roth & Caron, 1978), and also their own ability to detect it (Blackwell, 1992). Accuracy in the estimate has not been shown to improve with the degree of experience, confidence in judgement or increased contact with the patient (Mushlin & Appel, 1977; Roth & Caron, 1978).

Direct behavioral observation has proved to be a useful method for detecting particular self care behaviors such as deficits in care skills like insulin injection or blood glucose testing. The method requires observations made by someone other than the patient, which can include clinic staff, family, friends or regimen partners. The technique has been used successfully at home (Epstein et al, 1981) and group situations such as special training camps (Wildman & Erickson, 1977). To ensure the validity of data, the observer must be given clear
instructions on what behavior to observe and then trained as to how to do it. The method is often laborious and time consuming. Measurement reactivity is also a concern. Behavior tends to change when the patient is aware of being observed (Wildman & Erickson, 1977).

**Counting permanent products** as in pill counts, weighing bottles of insulin or counting glucose test strips is an interesting strategy. However, it is of limited usefulness in that many diabetes related behaviors are not linked with a permanent product. Also, if the patient is aware of the measurement, they may manipulate the product.

**Patient self reports** concerning regimen adherence are mostly obtained through interviews, or with a daily record. Validity of the data is dependent upon skill and sensitivity of the interviewer, the patient's memory and self assessment ability as well as a willingness to report the behavior. What patients report though, may not be an accurate documentation of the actual behavior as they tend to over report good compliance (Roth & Caron, 1978) and under report poor compliance (Haynes et al, 1976). However, patient reports of non-compliance appear to be more valid than reports of compliance (Diehl, Bauer & Sugarek, 1987). Gross deviations from the regimen are reported more accurately than minor ones. It may indicate that patients who report poor performance could likely be believed and that they are probably quite deviant from their prescription. Johnson (1992) notes that quality adherence data is obtainable when patient self reports are sought about specific behaviors. Data quality is better if these reports are over a specific period of time as demonstrated by Glasgow, McCaul and Schafer (1987). Multiple interviews are recommended, preferably in the presence of a significant other. The self report
method is advantageous in that detailed information can be obtained readily and inexpensively and little demand is placed on the patient other than the time needed to conduct the interview.

As all available strategies to measure adherence have shortcomings as well as advantages, a combination of methods may be applied to yield a more accurate data set. The problem of quantitatively expressing the adherence levels from the information is also an issue to consider. It can generally be done in three ways. First is a quantitative assessment of the degree to which a regimen was followed, expressed as a percentage or ratio. The second is defining the patient or the behavior in terms of compliance as good, fair, poor or other categories. The third approach is to establish an index or global adherence scores with multiple behaviors as components of the index (Glasgow, Wilson & McCaul, 1985).

According to Glasgow et al. (1985) the first approach is difficult to take if the advice given is of a general nature (e.g. "get some exercise" or "reduce your bread consumption"). Another problem is quantifying the adherence of patients exceeding the advice. Would they be considered more compliant or non-compliant? Researchers maintain that deviations in either direction are potentially harmful as in the case of tablets or exercise (Christensen, Terry, Wyatt, Pichert & Lorenz, 1983). With quantitative assessment, it is also difficult to compare different aspects within a regimen (e.g. Would performing 3 of 4 glucose tests be equivalent to taking 75% of the insulin injections?). It also becomes very difficult to compare adherence quotients across patients if their regimen prescription have been radically different (e.g. Is a person conducting 2 of 4 prescribed urine tests less compliant than one who
conducts 2 of 3 assigned tests?)(Glasgow et al., 1985).

Category definition of patients as fair, poor or good compliers runs the risk of being subjective as well as judgemental. To allow for comparisons across studies, an objective criterion of definition needs to be established. Another issue to consider is that of inadvertent non-compliance, which is not the result of a patient's wilful disregard of provider instructions but is due to the failure to understand or recall them (Johnson, 1992).

The use of a global compliance score is also not free of problems as its reliability has not been thoroughly examined. It is also insensitive to the complexity of diabetes regimen behaviors.

Despite all the inherent problems, compliance research is an important if intriguing area of study. Glasgow et al. (1985) propose that the terms compliance and adherence be reserved for cases when the patient behavior can actually be compared with a documented objective prescription. The use of a term such as "levels of diabetes self-care behaviors" is recommended. It is further suggested that these behaviors be measured even when no clear provider prescription is available. Such measures, though not the same as adherence, are useful to study as diabetes care behaviors can have an effect on diabetes control independent of the actual prescription.

Reviewers suggest that future adherence research may investigate in detail within-subject changes in self-care behaviors over time. Such analytical strategies using longitudinal study designs may prove enlightening in detecting associations between health status and behavior (Glasgow et al, 1985; Johnson, 1992).
2.7 Dietary Data Collection

Methods

Diet is an important component of any diabetic regimen. Christensen et al. (1983) identify three general considerations for description of dietary adherence of diabetics. The first is the assessment of actual consumption; the second, its comparison to an advised plan; and the third is the communication of this comparative assessment meaningfully. The first step, that of measuring the dietary intake, is regarded as the most difficult.

Dietary intake of individuals may be determined by record or recall of all food consumed over a given period of time.

2.7.1 Records of Food Intake:

Dietary records or food diaries are detailed descriptions of types and amounts of foods consumed, meal by meal, over a prescribed period, usually 7-10 days (Witschi, 1990). Several methods are used.

2.7.1.1 Weighed Records

In this approach, records are kept of all food and drink consumed over a given period of time. Recording is done at the time of consumption.

2.7.1.1a Precise weighing- The ingredients used in preparation, cooked amounts and served amounts are weighed. The amount of food eaten is obtained by subtracting plate waste from table weights.

2.7.1.1b Weighed inventory- This is similar to precise weighing except that
inedible wastes are not weighed. Food is weighed immediately before consumption. Weighed plate waste is later subtracted.

2.7.1.1.c Duplicate portions- An exact duplicate of the consumed meal is taken and weighed. Nutrient content can be determined by chemical analysis of aliquots (Margetts, 1982).

Weighed food records provide the most accurate food consumption data. However, it is an expensive and time consuming method and requires extreme co-operation of the subject. Co-operation rates range from 35-75% (Marr, 1971) and can be expected for only a limited time. The method may effect the kind and amount of food that the subject eats (Malhalko, Johnson, Gallagher & Milne 1985), so that actual intake may be accurately reflected but not the usual intake. For the same reason, the method may be unsuitable for patient adherence studies.

2.7.1.2 Records in Household measures

In this method, food quantities are expressed in terms of household volumetric measures such as cups or teaspoons. These are later converted to weights for analysis.

2.7.1.3 Menu Records

A description of consumed food is made without any quantitation.

A loss of precision occurs with recording in household measures and with no measures and representation of the usual intake increases. The more accuracy that a survey demands, the more
demanding it is on the subject, and the lower is the cooperation rate. As non-compliers to a study protocol may be different from the rest of the population, therefore a low dropout rate is desirable (Witschi, 1990).

2.7.2 Past Intakes Recalled

Recalls elicit past intakes as remembered at an interview or on a self-completed questionnaire. The period of time for which the recall is made varies from 24 hours to 2-3 months in a diet history.

2.7.2.1 Food Frequency Questionnaires

These collect information on the frequency of consumption of a number of specified food items over a specified period, with a set number of time choices such as once a week, twice a week. The method is better suited to qualitative rather than quantitative assessment. Sometimes attempts are made to quantify the information by enquiring about portion sizes as well. At best, the information is of a semi-quantitative nature. Food frequency is an inexpensive and standardised method for collecting information on specific foods, does not require highly trained personnel and is suitable for large population samples.

2.7.2.2 Diet History

A diet history is a multicomponent approach. It involves a detailed investigation to determine an individual's usual intake. The method requires an hour or more of careful questioning by a skilled nutrition professional.
2.7.2.3 The 24-hour recall

It is the most widely used assessment method (Witschi, 1990) and involves the quantitative reconstruction of the food consumed over the last 24 hours or the previous day. Aids such as photographs or food models may be used to minimise quantification errors. Moore and coworkers (in Witschi, 1990) found that estimates of food intake were more accurate when food models were used. Guthrie (1984) noted that without measuring aids, the ability of young adults to describe predetermined quantities of food was poor.

The accuracy or reliability of the 24-hour recall is not as high as the weighing methods. However, the value of 24-hour recall in assessing the average intake of groups is well established when large patient samples (>50) are used (Block, 1982). For patient adherence studies, there are the advantages of simplicity and clinical efficiency, particularly among populations with limited literacy.

Johnson, Silverstein, Rosenbloom, Carter and Cunningham (1986) have successfully used an adaptation of the 24-hour recall interview as a general adherence measure. The method is also non-reactive i.e. it does not alter the observed behaviour as a result of observation. Stunkard and Waxman (1981) suggest that self reported data may be more accurate than previously thought. However, a trend towards underestimation of large amounts of food and overestimation of small amounts was also noted.

The main limitation of the method is that dietary intake from day to day is highly variable. Certain days may be more representative of the usual intake than others, but it is difficult or impossible to identify a 'representative' day. The inter and intra-individual variation has been observed even in the
developing countries belying the assumption of minimum day to day variability because of a limited number of food items (Galal, 1989). Within person variation is effected by the consistency of the pattern of food selection and variability of nutrients in the consumed foods.

Total energy intake is usually the least variable, while nutrients tend to have a higher variance. A bias in the estimated intake results in a biased population mean intake but that does not influence the relative distribution of intakes around that mean (Beaton, 1989). Anderson (1988) advises cautious interpretation in case of data based on a single day's measurement.

It has been emphasized repeatedly in the literature that there is no 'ideal' or 'best' method (Medlin & Skinner 1988), but there are preferred methods for defined purposes (Beaton, 1989). The task is to match method or combination of methods to purpose. The choice would also be influenced by time available, money, sample size and available trained personnel.

2.7.3 Sources of Error in Dietary Data

The respondents are a major source of error in dietary intake evaluation. Provision of reliable data depends upon their willingness, motivation, awareness of food intake and memory. Hackett, Appleton, Rugg-Gunn and Eastoe (1985) found that survey fatigue, learning effect and knowledge of the study purpose influenced reports. The use of household measures to determine food quantities in interviews which are later converted to weights results in loss of precision (Marr, 1971). Casual estimates produce the largest error in portion size estimation.

Memory is an important factor in the ability to recall a diet. Socially accepted foods may be
remembered better, while meals perceived as poor may be relegated to the sub-conscious. It is suggested that obese subjects tend to under report food intake (Witschi, 1990). Memory of intake on a previous day is more accurate than for a longer period (Commonwealth Department of Health, 1983).

On the side of the researchers, standardized procedures for probing and coding must be followed during the interview, to avoid errors (Frank, Hollatz, Weber & Berenson, 1984). Results can differ depending on whether the probing was detailed or vague, and whether more than one interviewer were employed.

Behavioural factors are also important. Mannerisms, gestures and even non-verbal body language may suggest "appropriate" response to the subject. Reporting may be influenced by the interviewer's reactions or opinions to the subject's responses. A feeling of rapport and a non-judgemental attitude towards the respondent are essential (Witschi, 1990).

After the information has been collected from the respondents, systematic errors may be introduced by incorrect coding of foods or mis-identification of foods by the coders.

Nutrient database errors are the next consideration as they cannot provide an exact measure of an individual's intake. Nutrient data are derived from food samples of varying origins and so would have limited accuracy when applied to particular cases (Jacobs, Elmer, Gorden, Hall & Moss, 1985).

The basic error in nutrient determination can arise from inadequate sampling of foods for analysis. There are variations in varieties of foods owing to maturity levels, agricultural practices, cultivars, post harvest physiology and seasonal differences. The
nutrient assays may not be accurate or maybe missing for many nutrients. Accuracy is reduced in case of prepared foods as errors can arise from differences in cooking methods and recipes. Furthermore, there is a failure to consider interaction of nutrients and their bioavailability.

Evaluation of diets particularly for micronutrients is subject to error even when food tables appropriate to the geographical region are used. The error would be even greater if the nutrient analyses are based on foreign tables (Bagu & Rutishauser, 1984).

2.8 Glycosylated Haemoglobin as a Measure of Glycemic Control

Through the 1980's, glycosylated haemoglobin (HbA1c) has been hailed as the greatest single technical advance in diabetes care since the invention of NPH insulin (Home, 1990). The test makes it possible to estimate the mean blood glucose levels over the preceding two months by one single measurement.

The test is based on the principle that glucose in blood combines with haemoglobin continuously and nearly irreversibly during the lifespan of red blood cells. Exposure to high concentrations of glucose over extended periods would result in further non-enzymatic glycosylation or "browning" of blood proteins. This is proportional to both the levels of glucose and the lifespan of the protein in circulation (Chisholm & Lazarus, 1991). The HbA1c has been accepted as a measurement which reflects the mean daily blood glucose concentration and the degree of carbohydrate imbalance over that period of time.

Therefore, the test is particularly useful as an indicator of long term blood glucose control in
Diabetes mellitus, and thus of treatment efficacy. It has also been used as an indirect indicator of patient compliance. No dietary preparation or fasting is necessary, which is an advantage over blood glucose tests as they show the level at a particular time on a particular day, and may not be representative of the general pattern. Even mean laboratory measured self collected home blood glucose profiles between days show a 30% coefficient of variation (Home, 1990).

The test is an adequate measure of mean blood glucose but does not account for day to day variations in blood glucose. It is also an expensive testing procedure in either human or material resources or both, depending on the degree of automation of the testing procedure used. The HbA1c test is now part of standard diabetic care in the hospitals of many developed countries, and is recommended at least semi-annually for all patients (American Diabetes Association, 1989).

Results of HbA1c tests across different studies may not be directly comparable due to interlaboratory variation and different assay methods used. Interlaboratory standardization and suitable uniform standards as well as quality control samples are lacking at present, so caution is required in comparing results from different laboratories (Chisholm & Lazarus, 1991).
2.9 Diabetes in Developing Countries:

Diabetes mellitus, particularly type II has been considered a disease resulting from an affluent lifestyle. For this reason diabetes and other non-communicable diseases like cancer and cardiovascular disease were thought to be a problem of the developed societies. However, recent data point towards an increase in these diseases in the developing world. King and Rewers for WHO (1991) note that an epidemic of diabetes seems to be occurring in adult people throughout the world, possibly as a result of lifestyle and socioeconomic change. Prevalence is noted all over the world ranging from rare in rural Melanesians of Papua New Guinea to 50% in Pima Indians of U.S. An important observation is that the populations exceeding the 10% mark are only those from migrant and disadvantaged communities in the industrialised nations, and from developing countries. On the basis of the available data, diabetes in adults should now be considered a Third world problem. Serantes (1985) estimated that the number of diabetics in the developing countries would increase to 65 million by the mid-nineties. The problem is therefore of a gigantic magnitude.

Diabetes is a costly disease both for the individual and society. Most of the established diabetes care strategies may be useful only in a portion of the developed world. Basic principles of education may be an exception (Krall, 1985). Bollag (1983), noted some differences between Western countries and the developing world with respect to diabetes mellitus, as given in the following table:
Table 2

**Important points of differences between Western countries and the developing world with respect to diabetes mellitus**

<table>
<thead>
<tr>
<th>Countries</th>
<th>Western</th>
<th>Developing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diagnosis</td>
<td>early detection to prevent complications</td>
<td>warranted only if treatment can be provided</td>
</tr>
<tr>
<td>Prevalence and distribution</td>
<td>1-2% of population have diabetes. 75% of these have non-insulin-dependent diabetes</td>
<td>data are scanty. Changing frequency in various developing countries. J- and Z-type diabetes.</td>
</tr>
<tr>
<td>Monitoring</td>
<td>attempts to control metabolic derangements</td>
<td>at best: control of symptoms</td>
</tr>
<tr>
<td>Management</td>
<td>complex including insulin</td>
<td>prevent obesity; do not change healthy food habits</td>
</tr>
<tr>
<td>Community surveys</td>
<td>for high risk groups, including the obese and adult with a strong family history</td>
<td>to gain further epidemiological data on prevalence, incidence and traditional management</td>
</tr>
<tr>
<td>Prognosis</td>
<td>late vascular complications</td>
<td>death of insulin-dependent diabetes in hyperglycaemic ketoacidosis</td>
</tr>
</tbody>
</table>

From Bollag (1983)

With the many health problems faced by the developing countries, diabetes mellitus holds a relatively low priority. However an increasing magnitude of the problem has led WHO to prepare guidelines for the development of national programs
for diabetes in order to assist member states (King & Rewers for WHO, 1991). Given the changeability of environmental and behavioural factors, risk factor identification is also recommended as a priority (King & Rewers for WHO, 1991).

2.9.1 Diabetes in Pakistan

Little information is available regarding the actual countrywide prevalence of diabetes in Pakistan. Data from smaller scaled studies indicate a prevalence rate comparable to many developed countries. Saleem, Bano, Iqbal and Rehan (1990), in a survey of Lahore region found an overall prevalence of 3.96%. The urban prevalence at 4.75% was significantly higher than the rural 3.17%. Earlier studies reported prevalence in higher income groups at 4.9% as compared to 2.7% in lower income groups (Gupta et al, 1971). Cleave, Campbell and Painter (1969) observed diabetes to be less common in Pakistanis as compared to Indians, possibly due to consumption of wheat as the main cereal. A low rate of 1.5% was reported by West and Kalbfleisch (in Trowell, 1975). These studies indicate that prevalence rates have either been underestimated in the past or are actually rising. According to the Diabetic Association of Pakistan (1992), a 'high prevalence' exists, the rate has risen from the past, and it is likely to become a major health problem in the very near future.

A high prevalence rate has also been noted in Pakistani and other South Asian immigrant populations in the U.K. (Simmons, Williams & Powell, 1992) leading the authors to suggest that a genetic predisposition may be at work.

Available data also point to a female preponderance, a characteristic noted usually in well
nourished populations (Ekoe, 1988). In a hospital study of 1000 patients, Haider and Obaidullah (1981) found the proportion of female diabetics to be 63.8%. Saleem et al. (1990) also report significantly higher prevalence rates in females, for both rural and urban areas. Similar trends are noted in South Indian diabetics, the findings being attributed to higher obesity rates (Ramachandran, Jali, Mohan, Snehathatha & Viswanathan, 1988).

Type II diabetes appears to be more common (94.8%) in Pakistan (Haider & Obaidullah, 1981). The same group has also studied diabetic complications. Hypertension was present in 26.4% of the diabetic population (Haider, Obaidullah & Maqbool, 1980), while coronary heart disease was evident in 9% (Haider, Obaidullah, Ud din, Zubair & Saleem, 1978). Impaired renal function has been noted in both diabetic males and females (Ahmad & Ahmad, 1991). Kirmani, Ahmad, Rawala and Sabiha (1975) observed that cataracts occurred earlier in Pakistan than in Europe, the change being early in diabetics also.

2.9.2 Health Care in Pakistan

According to Banerji (1989), "the health care services of a community can be considered a cultural response of that community to its health problems which are mediated by a complex interaction of biological, environmental, cultural, social and economic factors". Like most underdeveloped countries, Pakistan is rural based in terms of population (Appendix B). In these cultural conditions, western medicine is a relatively recent and alien element. Western medicine was introduced in the Indo-Pak sub-continent by the British in the later half of the eighteenth century.
At the time of independence in 1947, the services were available to only a select segment of the native population in India and Pakistan, mostly urban (Sharma & Chaturvedi, 1978). The health services in Pakistan still have a very strong urban bias, e.g. 81.9% of the hospital beds are in urban areas while only about 30% of the population live in these areas (Zaidi, 1985). While the health care system structure is well defined (Appendix B), scarcity of resources and trained manpower has hindered effective health care provision (Khan, Islam & Bryant, 1989). According to Zaidi (1985), it may not be so much a case of 'scarce' resources as of their misallocation. So for the affluent, specialist medical services are readily available; but for the poor, particularly the urban poor, health care is unsatisfactory (Mull, 1987; Zaidi, 1985).

As the urban based curative care model has had constant political patronage, the already stagnant indigenous systems of medicine have declined further and become dominated by incompetent practitioners, sometimes even quacks and imposters. As the scientific basis of these systems deteriorates, the resulting vacuum is filled by a variety of superstitious practices (Banerji, 1989). Thus for the majority of the population, the western health care system is elusive while the traditional or folk medicine is ineffective. To shift this pattern, there has recently been an interest towards primary health care and community programs. The Agha Khan University and Agha Khan Health services have taken active initiatives in this direction (Smego & Barrett, 1990).

2.9.3 Diabetes Care in Pakistan

The first specialist diabetes outpatient clinic in Pakistan was established in 1962 at Ganga Ram
Hospital, the teaching hospital for Fatima Jinnah Medical College, Lahore. It was subsequently taken over by the Pakistan Medical Research Council (PMRC). Care procedures were standardised in 1971. The clinic has served as a research base as well as a care facility (Haider, 1982). Most major hospitals in the country now have diabetic clinics providing ambulatory care. Patient education programs as they exist in the developed countries are unknown at both public and expensive private health care facilities. The services of dietitians are rare or not at all available (Jaffery, 1985).

In 1966, the Diabetic association of Pakistan (DAP) was formed in Karachi with an outpatient clinic and laboratory (Naim 1988, in Ahmad, 1989). Another association bearing the same name started in Lahore in 1968. Besides conducting specialist diabetic clinics, the organisations have made an effort towards diabetes care by holding annual training courses for physicians. DAP Karachi also publishes a monthly newsletter "Diabetes Digest", and in 1986 established a branch of the association in Peshawar. As a part of its annual training program for physicians in 1992, DAP Lahore arranged an open seminar for the public in order to increase public awareness and to make 'diabetes public' (Diabetic Association of Pakistan, 1992).

At present, the activities of the different diabetes related organisations are limited and lack coordination. However, they are supported by dedicated physicians and may provide a platform for future activities in the area of diabetes care.

As 82% of mortality in Pakistan is attributable to treatable causes like parasitic and infectious diseases (Zaidi, 1985), diabetes care, being a problem of relatively lesser importance, must be a
part of the existing health care system. The additional burden on the resources should be minimum. In the, beginning only simple and cheap methods should be employed. Keeping this in view, the Diabetic Association of Pakistan, Lahore (1992) has recommended the use of Benedict's test in place of more expensive urine testing strips, beef insulin instead of human insulin and the prescription of cheaper brands of hypoglycaemic drugs.

In the long run, health education is probably the most important means of influencing the health and disease pattern (Bollag, 1983). With respect to diabetes, health education means dietary and self-care advice, both on individual and community level.

2.10 Diet Patterns in Pakistan

2.10.1 General Patterns

Pakistan inherits its food patterns from the rich food cultural heritage of the Indo-Pak sub-continent. As a separate nation, Pakistan has been on the world map for only forty-six years, but the foodways of the region have developed over the centuries. They are further modified by a strong Islamic tradition in the country. The main Islamic dietary guidelines are prohibition of pork and alcohol consumption, and slaughtering of animals for meat in a prescribed manner.

Wheat is the main staple cereal of the country, mostly consumed as flat unleavened bread 'chapatis'. Less commonly, other varieties including the western type of leavened loaf breads are consumed. Other cereals as rice and maize are also consumed. Mutton, beef and chicken are popular meats. Consumption of
fish and seafood is low (National Institute of Health [NIH], 1988b, p. 56).

The cereals form the basic and the major part of a meal. They are accompanied by either meat, vegetables, pulses or legumes or combinations, mostly cooked as spicy curries. In general, a curry cooked with large amounts of fat is preferred. However, this trend is declining in higher socioeconomic groups (NIH, 1988b, p. 127). Hydrogenated vegetable fat (banaspati ghee) is the widely used cooking medium while a variety of liquid vegetable oils are also becoming more accepted. The use of clarified butter fat (desi ghee)-the traditional cooking fat- has declined due to high cost, but it still holds a high status in rural areas.

Regional variations in meal patterns occur, but the major differences are between rural and urban areas. Consumption of meat as well as commercial food products is lower in rural areas. Consumption of eggs, fruit and leafy vegetables is low in all areas. The quality of wheat flour also differs between rural and urban areas. The commercially milled flour available in urban areas is often refined while whole grain flour is the norm for rural areas. Bran is sifted off and discarded when making breads.

In a traditional society like Pakistan, food also plays an important cultural role. The symbolic properties of food are no less important than their nutritional qualities. Food is used as an expression of Islamic values such as piety, charity, hospitality, and honour (Murphy, 1986). An offer of food or drink declined by a guest runs a risk of seriously offending the host.

Inspired by the traditional humoral medicine systems still practised in the country such as Greek or "Unani" medicine, the notion of foods having 'hot'
and 'cold' properties, and being 'light' or 'heavy' to digest also exists.

2.10.2 Ramadan Fasting with Reference to Diabetes

Fasting during the holy month of Ramadan is one of the pillars of Islam. During the fast which lasts from dawn to sunset, the individual abstains from all food, drink and oral medicines. The fast may be as long as 16 hours depending on the time of the year. As Islamic calendar is lunar, the time of observance of Ramadan varies each year. Although certain categories of people are exempt from fasting including travellers, pregnant, menstruating or breastfeeding women, young children, and seriously ill people, most Muslims still choose to fast including those with a chronic disease like diabetes.

Food patterns in Ramadan are characterised by ritualistic importance given to meal preparation at sunset and dawn. There is a tendency towards gorging during the period when eating is allowed. High fat foods such as fried breads and refined carbohydrates in the form of drinks and fruit are commonly consumed in large quantities.

Very little literature is available regarding Ramadan fasting for diabetic patients. Sulimani, Famuyiwa and Laajam (1988) in their review cautiously maintain that it is not contra-indicated for most diabetic patients, but infact may help an overweight NIDDM patient lose weight. However, there is a high risk of hypoglycemia as well as hyperglycemia. They regard fasting as safe for patients on diet alone,
and with dosage adjustments for those on tablet treatment.

Moderate activity must be maintained along with adherence to the prescribed diet plan that is evenly spaced over the non-fasting period as three meals. Overeating and over exertion are to be avoided. Fasting is not advisable for patients with unstable glycemic control and those with serious complications (Sulimani et al., 1988).
III. MATERIALS AND METHODS:

3.1 The Study Population

The population studied consisted of two hundred non-insulin-dependent diabetic patients, diagnosed at least one year prior to the study, and defined as non-insulin-dependent by their clinic or health care provider. Patients hospitalized at the time of the study for a diabetes related emergency or another condition were excluded, as were those who were in emotional distress. The majority of the subjects (n=180) were selected from the outdoor patients' or diabetic clinics of three health care facilities in Metropolitan Lahore, Pakistan.

3.2 Procedure

Patients were interviewed after they had seen their physician, who suggested that they see the researcher. Random selection of patients from available clinical records was impractical as formal detailed appointments are rarely made and the exact time and date that a patient would visit the clinic could not be determined. Moreover, many patients may not be registered although they occasionally use the clinic services.

The respondents were informed that the researcher was interested in their medical situation, that time constraints existed and that they may choose not to respond to any question that they consider inappropriate. The interview was undertaken after obtaining the consent. An effort was made to listen carefully to what the respondents said both verbally and non-verbally without introducing preconceived ideas. If contradictory responses to questions were noticed, they were clarified by asking
further questions. Most of the questions asked were open ended although expected responses were given on the questionnaire sheet in order to expedite the recording of responses by the researcher. The subjects remained anonymous unless they requested the results of the blood tests.

On the average, three patients were interviewed for each working day. The entire session with each patient took 20-30 minutes. Equal numbers were taken from each clinic (n=60). A brief introduction of the three locations follows:

3.2.1 Mayo Hospital, Lahore

It is a major teaching hospital and the busiest health facility of the city of Lahore, servicing not only the heavily populated inner city area but also referrals from other local hospitals and rural health centres. The Hospital is attached to King Edward Medical College, one of the prime medical education institutions of Pakistan.

The diabetic outpatient clinic at the Mayo Hospital is operated under the supervision of the Diabetic Association of Pakistan, which was established in 1968 as one of the first organisations of its kind in the country. The clinic services from forty to eighty patients every day.

3.2.2 Sir Ganga Ram Hospital, Lahore

It is also one of the major public hospitals situated in the main city area and serves as a teaching hospital for Fatima Jinnah Medical College for Women. The diabetic clinic of Ganga Ram, established in 1962, was one of the first specialist clinics in the country. It is currently operated under the supervision of the Pakistan Medical Research Council (PMRC), providing ambulatory care to
patients as well as serving as a research base. Patient attendance is twenty to forty per day.

3.2.3 MCL Filter and Diagnostic Clinic, Santt Nagar, Lahore

This clinic services the locality of Santt Nagar in the city providing general medical services, and is not a specialist diabetic clinic. It is one of the five clinics established on an experimental basis by the Metropolitan Corporation of Lahore and is conducted on the basis of community participation. The cost of medicines, provided free to the patients, is met by a guaranteed voluntary contribution from available sources from within the community. These may include individuals, organisations or commercial sponsorships. The operating costs of the clinic including personnel, building and equipment are provided by the council.

The concept is believed to have proven extremely successful in improving health care and patient satisfaction as well as relieving the load of major city hospitals by providing initial diagnosis and routine outpatient services to the local community.

3.2.4 Non-Clinic Sample

In addition, a portion of the sample (n=20) was obtained by the snowball sampling method (Chadwick, Bahr & Albrecht, 1984). This was considered necessary due to the nature of the study. A study sample based entirely on patients visiting clinics is likely to introduce bias as the subjects would all be 'compliant' in at least one element of their regimen.

References were sought from physicians and patients. After obtaining consent through the referring source, the subjects were interviewed at their homes or another location convenient to them.
3.3 Methods of Assessment

3.3.1 Questionnaire

The main survey tool was a questionnaire administered in an interview format in Urdu or Punjabi. It was pretested on ten patients from Ganga Ram Hospital and necessary changes in format were made. The questionnaire covered the following areas:

a. **Demographic data**: Age, sex, marital status, education, income range, family size, occupation and activity.

b. **Disease status**: Duration, current treatment, complications or other medical conditions present as indicated by medical records or health care provider.

c. **Regimen definition**: The different diabetes related care activities, the levels that were advised, and the dietary modification that was advised to the patient.

d. **Self-care levels**: The level of the care activities currently being performed by the patient.

e. **Psychological correlates**: Perception of severity of disease and susceptibility to illness, perceived benefits and barriers to compliance.

f. **Environmental factors**: Family support, satisfaction with health care.

g. **Basic diabetes knowledge**: An 11 item test covering basic diabetes and diet knowledge. The instrument is limited in that it is non-standardized. Available validated knowledge scales were not used due to their length (Hess & Davis, 1983) or their reference to specific terms, commercial products and exchange lists (Dunn et al, 1984).
h. **Food intake data:** Dietary intake was elicited by using the 24-hour recall method. Respondents were asked to recall actual food, beverage and other consumption during the previous twenty four hour period. The food recall was done at the beginning of the interview and solicited in a non-judgemental manner. Standard techniques employed in this process included the use of standard weight food models and household measures to estimate portion sizes (Appendix C). Nasco™ Life/form replicas (Nasco) were used for this purpose. To estimate chapati sizes, cut-outs made from light, medium and heavy cardboard in different diameter sizes were utilized.

Extensive probing was done to determine the specific nature of the food eaten and the exact method of preparation e.g. the kind of flour used in chapati making, whether sugar was added to beverages and the kind of fat used in cooking.

### 3.3.2 Blood Samples

Glycemic status was measured using a glycosylated hemoglobin (HbA1c) test. Blood samples were taken from ninety-two of the subjects for the test. This number was originally intended to be one hundred. However, due to loss of equipment during transit, it was possible to obtain ninety-two samples only. Of these, two samples did not yield reliable results due to the presence of interfering haemoglobin fractions. These results were not used leaving the total number of available results at ninety.

Capillary blood samples were obtained using finger pricks. Sterile, disposable lancets were used with the 'Autolet' device. Fingertip of the subject was lightly rubbed to encourage blood flow and a prick was made on one side. A quantity of 5 ul of blood was
collected in capillary tubes which, in turn were placed in the specimen collection vials, sealed and labelled. Bio-Rad Diamat™ HbA1c test sample preparation kit was used. Specimens prepared using this method are reported to be stable for two weeks at room temperature or four weeks at 2-8°C.

The prepared blood samples were shipped to Australia in two batches. They were analysed by the Endocrinology Laboratory at Royal Prince Alfred Hospital, Camperdown. Analyses were performed on Bio-Rad MDMS High Pressure Liquid Chromatography (HPLC) system.

3.3.3 Anthropometric measurements

The subjects were weighed on the spring scales available in the clinics. Measurement was made to the nearest 0.1 of a kilogram. The accuracy of the scales was ascertained as frequently as possible. Heights were measured using the wall charts in the clinics. Non-clinic visiting subjects were weighed and measured using similar equipment.

3.3.3.1 Body Mass Index

Body mass index (BMI) was calculated using the formula:

\[
\text{BMI} = \frac{\text{Weight of the subject in Kilograms}}{(\text{Height of subject in metres})^2}
\]

Classification was made on the basis of National Heart Foundation recommended criteria (Health and Welfare Canada, 1988).
Table 3

Classification used for the Body Mass Index

<table>
<thead>
<tr>
<th>Class</th>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underweight</td>
<td>&lt;19</td>
<td>&lt;18</td>
</tr>
<tr>
<td>Acceptable weight</td>
<td>20-25</td>
<td>19-24</td>
</tr>
<tr>
<td>Overweight</td>
<td>26-30</td>
<td>25-30</td>
</tr>
<tr>
<td>Obese</td>
<td>&gt;31</td>
<td>&gt;31</td>
</tr>
</tbody>
</table>

3.4 Analysis of Data

3.4.1 Dietary Data

The nutrient content of the diets was analysed using the computer software program 'SODA' or System Online Dietary Analysis version 4.1 (Computer Models, 1990). The program utilizes data from British and Australian nutrient databases which may not be suitable for analysis of Pakistani foods. Therefore, based on the food items recalled in the survey a database was built on 'Ownfoods' program in SODA. Nutrient values were taken from the Food Composition Table for Pakistan (Government of Pakistan, 1985), Food Composition Tables for the Near East (FAO, 1982), and McCance and Widdowson's Composition of Foods (Tan, Wenlock & Buss, 1985), in this order of preference. The values for wheat and rice based items (e.g. chapatis, breads, rice dishes) were calculated from the latter, in order to obtain more accurate dietary fibre estimates. It was further necessary to compile a set of food tables for those composite dishes that are not listed in the above mentioned food tables. These values were calculated from recipes.
The daily intakes were coded before entering in the program. Whenever possible, recipes were reduced to their ingredients for coding rather than using the composite dish, e.g. when exact amounts of ingredients used to make up a dish were known.

The surveys were analysed for total energy, macronutrient, and fibre content and compared with recommended intakes. The desirable intake for energy was calculated by the SODA program using the Schofield equation (Schofield, 1985) utilizing height, weight, age, sex, and activity level (Appendix F). The desirable intakes for fat, protein, carbohydrate and fibre were based on recommended intakes given by the American Diabetes Association (1993).

Qualitative assessment of the surveys included consumption of foods from different food groups. It was also assessed whether meals were missed or any food items restricted by the individual's health care provider were consumed. A deviation was assumed only if the patient had reported that particular item restricted by their health care provider.

3.4.2 Statistical Modelling

Logistic Regression on BMDP program (Engelman, 1985) was used in order to examine the relationship between the self-care components (the dependent variables) and various predictor variables (the independent variables). If there were small number of cases in categories of a predictor variable, they were categorised into dichotomous form for logistic regression analysis. The frequencies of blood and urine testing and clinic visiting were transformed as the number of times each activity was reported performed over a six month period. This period was based on the minimum levels reported in the survey.
The population was split at the median into two groups. The median for all three care activities was a frequency of once a month. Therefore, the categories of the variables used in the analysis would be (a) Patients undertaking the care activity once a month or less often, and (b) Patients undertaking the care activity twice a month or more often.

Fasting, exercise, and dietary deviations were entered as dichotomous (yes, no) variables. Only those patients who were advised to perform the respective self-care activity by their health care provider were included in the analysis.

**Dependent Variables:**

Dependent variables used in the analyses were:

a. frequency of blood glucose testing

b. frequency of urine testing

c. frequency of clinic visits

d. fasting during the month of Ramadan

e. doing exercise during the previous week

f. dietary deviation from advice in the 24-hour recall

**Independent Variables entered into each model:**

**Demographic variables:** Age, sex, duration of diabetes, socioeconomic status, marital status, family size, level of general education, sickness of another family member

**Physiological variables:** Body mass index, presence of complications or other medical conditions, number of diabetic emergencies in the previous 12 months

**Health care variables:** Availability of same doctor every visit, provider criticism, satisfaction with
time, satisfaction with treatment, Source of diabetes information, family help

**Health beliefs:** Perceived risk of complications, Perceived severity, perceived benefits of control, self image of compliance

**Knowledge:** Number of correct answers on the 11 item diabetes knowledge test

**Variables entered in addition to above:**

For dependent variable f: Format of advice, Change in advice, time spent on first consultation, satisfaction with diet knowledge, Perceived difficulty in following advice

HbA1c levels and Knowledge scores were modelled on BMDP stepwise regression, using continuous dependent variables of age, disease duration, knowledge score, BMI, number of diabetic emergencies in previous year, and family size.

### 3.4.3 Univariate Analyses

Univariate analyses were done on BMDP program to examine the inter-relationship between selected predictor variables. Chi-square test was used with Yates correction for cross tabulations with one degree of freedom. The significant inter-relationships are reported in the Results and Discussion.
IV: RESULTS AND DISCUSSION

4.1 Subjects

Of the 200 individuals interviewed, the majority were female. Table 4 summarises the demographic characteristics of the sample including age, disease duration, family size, gender, education level, and occupation. Family size refers to the number of people living together in a household for whom the meals are prepared together, and includes extended families whose members eat at the same table.

It can not be determined whether the female preponderance in the sample is representative of the Pakistani diabetic population or is a reflection of the hospital visiting diabetic patients, as comprehensive descriptive data regarding both is not available. However, hospital based studies (Haider & Obaidullah, 1981) report similar gender proportions in the sample. Smaller scaled community studies (Saleem, Bano, Iqbal & Rehan, 1990) suggest that prevalence of diabetes is higher in females.
### Table 4

**Demographic characteristics of the diabetic patients sample (N=200)**

<table>
<thead>
<tr>
<th></th>
<th>Mean or %age</th>
<th>SD</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age</strong></td>
<td>49.9</td>
<td>9.6</td>
<td>30-76</td>
</tr>
<tr>
<td><strong>Diagnosed duration</strong></td>
<td>6.3</td>
<td>5.2</td>
<td>1-25</td>
</tr>
<tr>
<td><strong>Family size</strong></td>
<td>7.0</td>
<td>3.3</td>
<td>1-20</td>
</tr>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>24.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>75.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Education</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Illiterate</td>
<td>35.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ability to read Urdu</td>
<td>16.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary</td>
<td>12.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Secondary &amp; intermediate</td>
<td>24.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Higher degree</td>
<td>11.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Marital Status</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married</td>
<td>82.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Never married</td>
<td>1.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Divorced or widowed</td>
<td>17.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Socioeconomic bracket</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low and low-lower</td>
<td>57.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lower middle</td>
<td>24.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Middle</td>
<td>11.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Upper middle and upper</td>
<td>8.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Occupation</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Homemaker</td>
<td>0.0</td>
<td>83.4</td>
<td>63.0</td>
</tr>
<tr>
<td>Employed, light work</td>
<td>48.9</td>
<td>6.6</td>
<td>17.0</td>
</tr>
<tr>
<td>Hard labour or field work</td>
<td>20.4</td>
<td>5.9</td>
<td>9.5</td>
</tr>
<tr>
<td>Retired</td>
<td>30.6</td>
<td>3.9</td>
<td>10.5</td>
</tr>
</tbody>
</table>

#### 4.2 Body Mass Index

Figure 2 shows the distribution of the sample according to the body mass index (BMI) which ranged from 14.41 to 41.62 (Mean=26.25, SD=4.71). A considerable proportion of patients (57.5%) fall into the overweight and obese range. One hospital based study in Lahore (Haider, 1982, p. 5) reported that 50% of the 1000 patients studied were overweight defined as >110% of the standard weight.
Figure 2: Body Mass Index of the sample of diabetic patients

Each column represents a range e.g. 14 represents 14-14.9.
Figure 3 presents the comparative distribution of various weight ranges by sex. The proportion of females in the overweight and obese range is significantly higher than males (p<0.002), while the proportion of males is higher in the underweight range.

### 4.3 Glycosylated Haemoglobin (HbA1c)

Glycosylated Haemoglobin in the tested subjects (n=90) ranged from 4.90 to 14.1 (Mean=8.75, SD=1.83). Figure 4 shows the frequency distribution according to HbA1c levels. Only 5 subjects are within the normal control range as defined by the testing laboratory (3.5-5.5), while 21 show extremely high levels (>10).

The HbA1c results are not intended as a direct measure of adherence as other variables also affect it. Rather it is used to indicate the diabetes control of patients.

In a multiple regression model HbA1c was predicted by disease duration. Increased duration was associated with higher HbA1c levels. No relationship was found with age, BMI, number of diabetes related emergencies during the previous year, diabetes knowledge, and family size. It is reported in the literature (Schafer, Glasgow, McCaul & Dreher, 1983) that diabetic control is not directly linked to psychosocial factors, the link being theoretically through their effect on adherence which in turn is just one of the factors that effect it. Shillitoe (1988, p. 52) points out that due to the interpersonal variations on measures such as HbA1c, large sample sizes and multiple readings are required to establish relationships with the treatment variables.
Figure 3: Weight Ranges of Diabetic Patients according to Body Mass Index

- **Males**
  - Underweight: 16.3%
  - Acceptable weight: 46.9%
  - Overweight: 2.7%
  - Obese: 4.1%

- **Females**
  - Underweight: 19.2%
  - Acceptable weight: 33.8%
  - Overweight: 5.5%
  - Obese: 2%

- **Combined**
  - Underweight: 37%
  - Acceptable weight: 42%
  - Overweight: 15.5%
  - Obese: 4.2%
Figure 4: Distribution of sample according to glycosylated haemoglobin status (n = 90)
4.4 Emergency Hospitalization:

Subjects were asked if they had been hospitalized in the previous twelve months due to a diabetes related emergency such as a hypoglycemic or hyperglycemic episode. Forty people (20%) said yes. Of these 28 had been hospitalized once, six were hospitalized twice and another six were hospitalized three times.

4.5 Complications and Other Medical Problems:

An attempt was made to determine the presence of diabetic complications and other related medical problems in the sample. This information was obtained from medical records where available, and in case of their non-availability, from the respective health care provider. Under-reporting is possible as considerable time may have lapsed since the last detailed examination depending on how frequently the patient visited the clinic and the clinic procedures. On the other hand some of the minor problems may have been cleared at the time of the interview.

Due to time constraints it was not possible to arrange a thorough checkup along with the interview. The information therefore, may be regarded as a general indication. Table 5 shows the medical problems suffered by the patients other than diabetes and includes minor as well as major ones. The rate for hypertension in this sample (31.5%) is close to 26.4% reported by Haider (1982, p. 7).
Table 5

Complications and other medical conditions in the diabetic patients

<table>
<thead>
<tr>
<th>Frequency reported</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>At least one detected condition</td>
<td>74.5</td>
</tr>
<tr>
<td>Two or more</td>
<td>29.0</td>
</tr>
</tbody>
</table>

Frequently suffered conditions:

- Eye problems: 39
- Hypertension: 31.5
- Heart disease: 16
- Kidney disorders: 14
- Foot problems: 13
- Neuropathy: 11
- Skin infection: 7
- Lung infection: 4.5
- Others: 2.5

Note: As some patients had multiple problems therefore total number of responses exceeds n.

4.6 Diabetes Knowledge:

The number of correct responses to the 11 item knowledge test ranged from 0 (n=2) to 10 (n=1), the mean score being 4 (SD=1.88). The item responded correctly most often was regarding heart disease as a complication of diabetes (63% answered correctly), while the least number of correct responses were received for the question regarding dietary fibre (6.5% gave the correct response). Table 6 shows the knowledge test items and the responses received.
| Table 6 |

**Subjects' Responses to Diabetes Knowledge Test Items**

<table>
<thead>
<tr>
<th></th>
<th>Responses %</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>True</td>
</tr>
<tr>
<td>It is better for diabetics to have very low blood sugar (F).</td>
<td>27.5</td>
</tr>
<tr>
<td>Being overweight has no effect on people with diabetes (F).</td>
<td>14</td>
</tr>
<tr>
<td>Heart disease is one of the possible complications of uncontrolled diabetes (T).</td>
<td>63</td>
</tr>
<tr>
<td>Some people have sugar in their urine only, and some have it in the blood too (F).</td>
<td>46.5</td>
</tr>
<tr>
<td>A person can feel it without testing if their blood sugar has gone up (F).</td>
<td>68.5</td>
</tr>
<tr>
<td>Diabetics need to take special care of their:</td>
<td></td>
</tr>
<tr>
<td>Hands</td>
<td>5</td>
</tr>
<tr>
<td>Face</td>
<td>5.5</td>
</tr>
<tr>
<td>Feet</td>
<td>49.5</td>
</tr>
<tr>
<td>Don't know</td>
<td>40</td>
</tr>
<tr>
<td>The desirable range for fasting blood glucose is:</td>
<td></td>
</tr>
<tr>
<td>60 - 80 mg/100ml</td>
<td>7</td>
</tr>
<tr>
<td>80 - 115 mg/100ml</td>
<td>18.5</td>
</tr>
<tr>
<td>120 - 200 mg/100ml</td>
<td>25</td>
</tr>
<tr>
<td>Don't know</td>
<td>49.5</td>
</tr>
<tr>
<td>Insulin is:</td>
<td></td>
</tr>
<tr>
<td>A kind of drug</td>
<td>6.5</td>
</tr>
<tr>
<td>A hormone found in the body</td>
<td>10.5</td>
</tr>
<tr>
<td>Some kind of injection</td>
<td>50.5</td>
</tr>
<tr>
<td>Don't know</td>
<td>32.5</td>
</tr>
<tr>
<td>Diabetics can take which of the following kinds of foods freely?</td>
<td></td>
</tr>
<tr>
<td>Lettuce, cabbage, cucumber</td>
<td>36</td>
</tr>
<tr>
<td>Meats</td>
<td>39</td>
</tr>
<tr>
<td>Fresh fruit</td>
<td>3</td>
</tr>
<tr>
<td>Don't know</td>
<td>14.5</td>
</tr>
<tr>
<td>All</td>
<td>2</td>
</tr>
<tr>
<td>None</td>
<td>5.5</td>
</tr>
<tr>
<td>A person on a diabetic diet should eat:</td>
<td></td>
</tr>
<tr>
<td>Only when very hungry</td>
<td>33.5</td>
</tr>
<tr>
<td>At regular intervals</td>
<td>58.5</td>
</tr>
<tr>
<td>Whenever it is convenient</td>
<td>6.5</td>
</tr>
<tr>
<td>Don't know</td>
<td>1.5</td>
</tr>
<tr>
<td>What are fibre rich foods?</td>
<td></td>
</tr>
<tr>
<td>Vegetable and plant foods</td>
<td>6.5</td>
</tr>
<tr>
<td>Meats</td>
<td>4.5</td>
</tr>
<tr>
<td>Don't know</td>
<td>86</td>
</tr>
<tr>
<td>'Baadi' foods</td>
<td>3</td>
</tr>
</tbody>
</table>
Patients were asked about their major source of diabetes knowledge. Doctors and clinic staff were reported by nearly half of the sample as their major source. Figure 5 presents the patients' responses.

Figure 5

*Patients' Main Source of Diabetes Related Knowledge*

The low levels of knowledge are further demonstrated by the benefits of blood glucose control expressed by the sample. Very few people gave responses that indicate a good understanding of the disease. The categories that the responses fell under are given in Table 7.
Table 7

Benefits of diabetic control perceived by the respondents

<table>
<thead>
<tr>
<th>Type of benefit</th>
<th>Frequency %</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>1.5</td>
</tr>
<tr>
<td>Vague</td>
<td>59.5</td>
</tr>
<tr>
<td>'feel good'</td>
<td></td>
</tr>
<tr>
<td>'can work better'</td>
<td></td>
</tr>
<tr>
<td>Symptomatic</td>
<td>19.0</td>
</tr>
<tr>
<td>'don't feel thirsty'</td>
<td></td>
</tr>
<tr>
<td>'urinate less often'</td>
<td></td>
</tr>
<tr>
<td>False</td>
<td>3.0</td>
</tr>
<tr>
<td>'can eat sweets freely'</td>
<td></td>
</tr>
<tr>
<td>Clear understanding</td>
<td>7.0</td>
</tr>
<tr>
<td>Not sure</td>
<td>10.0</td>
</tr>
</tbody>
</table>

In multiple regression analysis, higher knowledge scores were predicted by longer disease duration, higher socioeconomic level and being male. The relationship of gender may be a function of higher general education levels in males as compared to females. As an independent variable, knowledge scores were not linked to any care variables.
Table 8

**Multiple Regression Models predicting Knowledge and HbA1c Levels**

<table>
<thead>
<tr>
<th>DEPENDENT VARIABLE</th>
<th>Multiple R</th>
<th>Multiple R²</th>
<th>(df)</th>
<th>F ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge Scores:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Socioeconomic level</td>
<td>0.2262</td>
<td>0.0512</td>
<td>1</td>
<td>10.68</td>
</tr>
<tr>
<td>Sex</td>
<td>0.2707</td>
<td>0.0733</td>
<td>2</td>
<td>7.79</td>
</tr>
<tr>
<td>Disease duration</td>
<td>0.3030</td>
<td>0.0918</td>
<td>3</td>
<td>6.61</td>
</tr>
<tr>
<td>HbA1c Levels:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disease duration</td>
<td>0.3364</td>
<td>0.1131</td>
<td>1</td>
<td>11.23</td>
</tr>
</tbody>
</table>

### 4.7 Self-care Behaviors

Patients reported various diabetes care activities advised to them by their care providers. A number of respondents reported an advised behavior, but they did not recall being advised a specific level of that behavior. Table 9 presents the proportion of the sample who reported that they were expressly advised to engage in a diabetes related care activity, and the percentage of those who were advised to engage in the activity to a specific level.
Table 9

Care Activities Advised to the Diabetic Patients by their Health Care Providers

<table>
<thead>
<tr>
<th>Activity</th>
<th>% of subjects advised</th>
<th>% given specific details&lt;sup&gt;a&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urine testing</td>
<td>56.5</td>
<td>79.6</td>
</tr>
<tr>
<td>Blood testing</td>
<td>93.0</td>
<td>86.5</td>
</tr>
<tr>
<td>Visiting clinic</td>
<td>82.0</td>
<td>71.9</td>
</tr>
<tr>
<td>Exercise</td>
<td>67.5</td>
<td>17.7</td>
</tr>
<tr>
<td>Weight reduction</td>
<td>45.5</td>
<td>3.2</td>
</tr>
<tr>
<td>Ramadan fasting Permitted</td>
<td>20.5</td>
<td>32.2</td>
</tr>
</tbody>
</table>

<sup>a</sup> Refers to how frequently blood and urine tests and clinic visits are to be undertaken; the kind and amount of exercise; and goal weight. The percentage is of the subjects advised the respective activity.

Table 10 shows the frequency of clinic visits, blood and urine testing reportedly advised to the patients.

Table 10

Frequency of care activities advised

<table>
<thead>
<tr>
<th></th>
<th>Everyday</th>
<th>Once a week</th>
<th>Twice a month</th>
<th>Once a month</th>
<th>Once in two months</th>
<th>Not specified</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urine test (n=113)</td>
<td>17 (15)</td>
<td>11 (9.7)</td>
<td>31 (27.4)</td>
<td>29 (2.5)</td>
<td>2 (1.7)</td>
<td>23 (20.3)</td>
</tr>
<tr>
<td>Blood test (n=186)</td>
<td>0 (0)</td>
<td>10 (5.4)</td>
<td>53 (28.5)</td>
<td>95 (51)</td>
<td>3 (1.6)</td>
<td>25 (13.4)</td>
</tr>
<tr>
<td>Clinic visit (n=164)</td>
<td>0 (0)</td>
<td>2 (1.2)</td>
<td>44 (26.8)</td>
<td>68 (41.5)</td>
<td>4 (2.4)</td>
<td>46 (28)</td>
</tr>
</tbody>
</table>

Note. Figures in parentheses represent percentages.
Considerable variation is evident in the levels of each advised self-care activity across the patient population. Furthermore, in each of these groups, various levels of engagement in the respective activity were reported, where subjects performed the activity either as advised, to a lower or higher level than advised, or not at all. These levels are reported in later paragraphs of this section. Due to this variation, meaningful statistical analysis would be difficult owing to the small number of subjects in each category. Moreover, the prescription definition is subject to patient definition, modification, and recall error.

In the absence of a standardised, objectively documented prescription, it is difficult to define patients as adherent or non-adherent. Moreover, adherence is changeable and not a static personality trait, which can be measured more satisfactorily in a longitudinal study. In such a situation, Glasgow, Wilson and McCaul (1985) propose the measurement of levels of patient self-care behaviors independent of the prescription. These levels nonetheless effect diabetic control. This approach is relevant as subjects reported care behavior levels both lower and higher than those prescribed. In addition, a considerable number were not advised a particular level.

Therefore, in order to identify the predictors of self-care levels, these reported levels were entered as separate dependent variables in logistic regression analyses as detailed in the Methods section. It was necessary to use individual variables rather than a global score as it is frequently reported in the literature that adherence levels are different across various aspects of a diabetic regimen (Glasgow, McCaul & Schafer, 1987; Cerkoney & Hart, 1986). Only patients who reported that they
were advised to perform the respective care activity were included in the analysis. Inclusion of patients who were not advised the care behavior would introduce a non-random measurement error into the models (Irvine, 1989).

Table 11 presents a summary of significant factors which predict the various care behaviors. A causal relationship between the independent and the predictor variables cannot be made but an association (or lack of it) may be concluded. The significant predictor variables appearing in the models are discussed later in this thesis.
Table 11
Logistic Regression Models Predicting Self-Care Levels

<table>
<thead>
<tr>
<th>DEPENDENT VARIABLE</th>
<th>COEFFICIENT</th>
<th>COEFF/S.E.</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urine Test Frequency:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frequency advised:</td>
<td>2.4156</td>
<td>1.825</td>
<td>0.000</td>
</tr>
<tr>
<td>test every day</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Satisfaction with treatment</td>
<td>-0.6322</td>
<td>-2.084</td>
<td>0.016</td>
</tr>
<tr>
<td>Presence of one complication</td>
<td>0.9427</td>
<td>2.484</td>
<td>0.028</td>
</tr>
<tr>
<td>Presence of multiple complications</td>
<td>-0.5834</td>
<td>-1.470</td>
<td>0.028</td>
</tr>
<tr>
<td>Blood Test Frequency:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frequency Advised:</td>
<td>5.0496</td>
<td>3.351</td>
<td>0.000</td>
</tr>
<tr>
<td>Test once a week</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Information source:</td>
<td>0.9433</td>
<td>3.319</td>
<td>0.034</td>
</tr>
<tr>
<td>Mass media</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Socioeconomic status</td>
<td>0.4757</td>
<td>2.479</td>
<td>0.027</td>
</tr>
<tr>
<td>Body Mass Index</td>
<td>-0.9162</td>
<td>-1.900</td>
<td>0.072</td>
</tr>
<tr>
<td>Clinic Visit Frequency:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frequency Advised:</td>
<td>2.6277</td>
<td>5.735</td>
<td>0.001</td>
</tr>
<tr>
<td>Visit twice a month</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frequency Advised:</td>
<td>-2.1577</td>
<td>-6.717</td>
<td>0.001</td>
</tr>
<tr>
<td>Visit bi-monthly</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exercise</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perceived severity:</td>
<td>-0.70695</td>
<td>-2.285</td>
<td>0.014</td>
</tr>
<tr>
<td>very severe</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perceived severity:</td>
<td>1.0829</td>
<td>3.089</td>
<td>0.014</td>
</tr>
<tr>
<td>moderately severe</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Socioeconomic level</td>
<td>-0.62730</td>
<td>-3.108</td>
<td>0.006</td>
</tr>
<tr>
<td>Education</td>
<td>-1.1900</td>
<td>-2.077</td>
<td>0.028</td>
</tr>
<tr>
<td>Fasting</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. of emergencies</td>
<td>-7.2180</td>
<td>-2.674</td>
<td>0.034</td>
</tr>
<tr>
<td>Diet Deviation:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BMI</td>
<td>0.76219</td>
<td>2.232</td>
<td>0.053</td>
</tr>
<tr>
<td>Satisfaction with treatment</td>
<td>-0.41342</td>
<td>-2.468</td>
<td>0.026</td>
</tr>
<tr>
<td>Self image: compliant</td>
<td>-0.53556</td>
<td>-1.867</td>
<td>0.018</td>
</tr>
<tr>
<td>Socioeconomic level</td>
<td>0.20047</td>
<td>1.675</td>
<td>0.094</td>
</tr>
</tbody>
</table>
4.7.1 Medication

Majority of the patients surveyed were on medication. Figure 6 classifies the sample according to the type of treatment.

Figure 6

**Distribution of Sample According to Treatment**

Of the people prescribed tablets, 80% reported taking them exactly as advised, 11.3% took less than advised, and 8.7% took higher doses.

The reason for over and under dosage voluntarily offered by the subjects (as it was not elicited) was the same, i.e. that they had adjusted the dose because they did not feel well on the prescribed dose.

On the whole, 53.2% of all tablet treated patients reported never missing their medication, while 26.8% admitted to at least an occasional lapse. The reasons offered for the lapses are given in Table 12.
Table 12

Reasons Offered by Tablet Treated Patients for Not Taking Their Medication as Prescribed

<table>
<thead>
<tr>
<th>Reason</th>
<th>Number of Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-adjust dose if feel unwell</td>
<td>24</td>
</tr>
<tr>
<td>Stop taking when feel well</td>
<td>24</td>
</tr>
<tr>
<td>Forget to take</td>
<td>21</td>
</tr>
<tr>
<td>Miss if not available free of charge</td>
<td>8</td>
</tr>
<tr>
<td>Take more when not following diet</td>
<td>6</td>
</tr>
<tr>
<td>Miss if away from home</td>
<td>2</td>
</tr>
<tr>
<td>Miss if emotionally upset</td>
<td>2</td>
</tr>
</tbody>
</table>

Number of tablets taken was not entered as a dependent variable in logistic regression analysis, as the number of tablets to be taken varies with each patient according to their condition. Therefore taking more tablets can not be considered as a better care behavior, in fact it can be just as harmful, or more, as taking none.

Univariate analysis by Chi-square suggests that the number of tablets advised is related to medication taking behavior. Patients prescribed 2 to 5 tablets per day reported taking them as prescribed, while those who reported taking less than prescribed were those who were advised either more than 5 or less than 1 tablet per day (p<0.00).

Comparatively speaking, medication taking was the behavior reportedly most often followed according to advice. Similar results have been reported in the literature (Irvine, 1989). It is also noted that
tablet treated patients are less adherent to their regimens in general as compared to insulin-dependent patients. It is understandable as it is easier to take tablets than to make lifestyle changes. Tablet treated individuals may feel that any discrepancy in other areas of their regimen may be covered by taking their medication faithfully.

4.7.2 Glucose testing

The patients reported that they were advised to monitor glucose by either blood tests (n=186), urine tests (n=113), or both (n=109). In the case of patients advised to do both, the frequency advised was not necessarily the same.

It is important to note that the blood tests are most likely to be performed at the clinic or another health facility, although it could not be ascertained in the survey. Eight subjects volunteered the information that they owned glucometers. The extent to which these were being utilised is not known. Urine tests are more likely to be performed at home. However, at the PMRC clinic they are routinely carried out along with the blood tests.

Of the 186 subjects advised blood testing, 93 (50%) reportedly performed it as often as advised, 38 (20.4%) did more often, 52 (27.9%) less often, while 3 (1.6%) did not do it at all. For urine testing, the proportion is 30 (26.5%), 29 (25.6%), 35 (30.9%), and 19 (16.8%) respectively. In the proceeding sections, glucose testing refers to both urine and blood tests.

In the logistic regression analysis, urine testing frequency was positively predicted by presence of one complication and negatively by satisfaction with the treatment. The blood testing frequency was negatively predicted by body mass index, and positively by mass media as the information source and socioeconomic
status. Advised frequency was a positive predictor in both cases.

4.7.3 Clinic visiting

Of the 118 patients advised to visit the clinic at specified intervals, 79 (66.9%) reported visiting as or more than advised, 32 (27.1%) visited less often than advised, while 17 (14.5%) came to the clinic only in case of a health problem. In those who were not given a specific interval (n=46), 11 reported regular visits.

In the logistic regression, clinic visit frequency was predicted by the frequency advised. Frequent clinic visits could be for the purpose of obtaining medication supply which is provided free of charge to eligible patients. This factor was not taken into account in this study.

4.7.4 Exercise

A considerable number of patients (n=135) said that they were advised to exercise, but of these only 19.2% recalled being advised to engage in a specific level of exercise. Walking was the most frequently advised exercise (n=96), jogging being the only other kind (n=1). The rest of the patients were given general advice to exercise (n=38).

Of those advised to exercise, eighty-four subjects (62.2%) reported engaging in some conscious exercise over the preceding week. Walking was the most common activity (n=77), although nearly half of the people saying that they exercised, engaged in very light activity such as ten minutes of slow walking every day.

In the logistic regression model, exercise was predicted by three factors. This model suggests that
people who belong to a higher socioeconomic and education level are less likely to exercise, while those who considered their diabetes as moderately severe are more likely to engage in exercise. Perception of severity was measured on a three point scale. Although it is recognized that a 4 or 5 point scale is a better choice to avoid a 'central tendency error' (Meadows & Wise, 1988), pretest of questionnaires revealed the difficulty of verbally expressing such a scale, particularly to low literacy level subjects.

4.7.5 Fasting in Ramadan

Fasting during the holy month of Ramadan requiring abstinence from all food and drink for as long as 16 hours a day, has potential risks for a diabetic patient (Sulimani, Pamuyiwa & Laajam, 1988). As Ramadan fasting is an option based on one's religious belief, it is not a matter of concern if a patient who has the approval of his doctor to fast chooses against it. However, it poses a medical risk for those who attempt to fast despite their doctor's proscription.

A number of patients reported fasting during the preceding Ramadan. Table 13 shows the distribution according to the approval of health care provider. Statistical analysis was limited to patients who were recommended not to fast. As for patients who had not consulted their doctor regarding this matter, it is not clear whether it was due to their unawareness of the potential effect of fasting on diabetes or an intentional decision. For instance, one patient remarked that she did not visit the clinic during Ramadan as she may be advised to give up fasting, which she was not prepared to do. Either way, it points towards an important information gap, as a large proportion of this group attempted fasting.
Taking the population as a whole, chi-square test shows that women attempted fasting more as compared to men (p<0.004).

**Table 13**

**Reported Fasting in Ramadan According to the Doctor's Advice**

<table>
<thead>
<tr>
<th>Doctor's Advice</th>
<th>Fasting Done</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Approved</td>
<td>32</td>
</tr>
<tr>
<td>Not approved</td>
<td>13</td>
</tr>
<tr>
<td>Not consulted</td>
<td>84</td>
</tr>
</tbody>
</table>

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>129</td>
</tr>
<tr>
<td></td>
<td></td>
<td>71</td>
</tr>
<tr>
<td></td>
<td></td>
<td>200</td>
</tr>
</tbody>
</table>

In the logistic regression analysis, fasting was not predicted significantly by any factor other than the number of diabetic emergencies, possibly due to small number of cases. The number of diabetic emergencies was negatively related to fasting, which suggests that a person would be less likely to attempt fasting if they have been in poor health. It was not possible to identify any other predictive factors which contribute to patients' disregard of the medical advice regarding fasting. Religious belief may be assumed as the obvious factor but it was not the purpose of this study to measure it.

**4.7.6 Diet adherence:**

Nearly all subjects reported dietary modification advice of some kind as given to them, the minimum being restriction of sweets (n=6). Figure 7 presents the format in which the patients said that they were given their dietary advice. Exchange lists were not reported as a method of instruction. The printed diet
Figure 7: Format of Dietary Advice Given to the Patients
guides are produced by the pharmaceutical companies such as Hoechst and provide general guidelines, or a 'Traffic Light' guide to foods. Printed diet charts as offered by some clinics consist of a sample menu plan for a day. In the absence of the above mentioned resource materials, a health care provider may write instructions for the patients. Figure 8 shows the persons who advised the care regimen to the patients.

![Pie Chart]

Figure 8

**Persons who Advised the Care Regimen to Patients**

Considerable variation exists between the dietary instructions given to patients. Most of the advice as recalled by the patients, however, seems to be concerned with exclusion or inclusion of specific foods in the diet. Table 14 lists the dietary advice as recalled by the patients.
Table 14

Reported dietary advice given to the diabetic patients by their health care providers

<table>
<thead>
<tr>
<th>Frequency reported</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avoid sugar</td>
</tr>
<tr>
<td>Avoid starchy foods</td>
</tr>
<tr>
<td>Limit food intake</td>
</tr>
</tbody>
</table>

**Fruits:**
- Avoid very sweet fruits: 27
- May eat particular fruits only: 22
  - Apples: 18
  - Loquat: 6
  - Guava: 6
  - Jaman (Roseapple): 4
  - Peach: 3
- Eat no more than one fruit serving in a day: 15
- Avoid all fruits: 9
- Avoid eating banana: 7

**Rice:**
- Avoid rice: 102
- Eat rice as boiled only: 9
- Eat rice with meat only: 2

**Bread:**
- Eat less bread and chapati: 78
- Eat besan flour chapati: 9
- Eat whole grain chapati: 1

**Meat:**
- Eat more meat and eggs: 26

**Vegetables:**
- Avoid potatoes: 102
- Avoid vegetables that grow underground: 59
- Eat fresh vegetables: 8

**Other:**
- Avoid "Baadi" foods: 51
- Reduce fat intake: 15

*aFigures in parentheses are percentages of total population. bSee appendix H*

Of the 117 who were advised to limit food intake, eighty were given some guidelines. Seventy-eight were told to reduce their bread and chapati intake, 22 of these were suggested the exact amount to be eaten each day. Using cereal intake advice for energy
restriction is based on the concept that the staple cereal forms the major part of the meal, other items being accompaniments. For instance, curries are eaten soaked by bread or rice but seldom on their own. Therefore, a reduction in bread or rice intake would proportionately reduce the amount of accompanying foods at the meal.

Several methods have been used to assess the adherence to a diet prescription. One approach is to compare the total energy and macro-nutrient composition of the diet to the recommended. Where exchange lists have been used for instruction, the intake is compared to the devised plan and number of deviations from the former is noted (Christensen, Terry, Wyatt, Pichert & Lorenz, 1983). Horwath and Worsley (1991) have scored diets on features such as adding sugar to beverages and frequency of consumption of particular foods. In the present study, as a homogenous standard diet prescription was not available, diet recalls are evaluated on whether they contained any foods that were reported as restricted by the care provider. Therefore a limitation exists in that two similar recalls may be evaluated differently depending on the dietary prescription reported by the respective patient.

The logistic regression models suggest that a higher BMI and socioeconomic level predict dietary deviation, while self image of compliance and satisfaction appear to be negatively related to it.
4.8 Dietary Data

Twenty-four hour recalls were obtained for all subjects. The analysis was limited to macro nutrients and fibre. Descriptive statistics for the analysis are given in Table 15:

Table 15

<table>
<thead>
<tr>
<th>Simplified Descriptive Statistics for Nutrient Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mean</strong></td>
</tr>
<tr>
<td>Energy (MJ)</td>
</tr>
<tr>
<td>CHO (g)</td>
</tr>
<tr>
<td>(% of energy)</td>
</tr>
<tr>
<td>Fat (g)</td>
</tr>
<tr>
<td>(% of energy)</td>
</tr>
<tr>
<td>Protein (g)</td>
</tr>
<tr>
<td>(% of energy)</td>
</tr>
<tr>
<td>Fibre (g)</td>
</tr>
</tbody>
</table>

Figure 9 represents the proportion of macronutrients as they contribute to the total mean energy intake. The mean energy intake of nutrients is at 6 295 KJ which is considerably lower than the national average of 9 134 KJ (NIH, 1988b). Figure 10 presents the distribution of energy intake and distribution according to the percentage of the calculated requirement of individuals. The majority of the sample had an intake lower than 80% of the requirement, while 14% had an intake in excess of their requirement.
Figure 9: MEAN ENERGY DISTRIBUTION BY SOURCE

- Protein: 16%
- Carbohydrate: 44%
- Fat: 40%

TOTAL kJ = 6 295
Figure 10

Energy Intake Distribution

Each column represents a range e.g. 4 is 4-6 MJ

MJ consumed on the reported day

Energy Distribution by % of Requirement

% of Energy Requirement Consumed
These results are not as one would expect considering the overweight and obesity noted in the sample. The energy intake did not correlate with BMI (-0.6). In the subgroup of the population with an excess energy intake (n=28) just 15 were overweight. The intake of 56.7% of the overweight and obese population was below the mean intake of 6 295 KJ.

Several explanations may be possible for this observation. Data based on self-reported intakes indicates that overweight people do not necessarily eat more than normal-weight people and often eat less (Braitman, Adlin & Stanton, 1985). A lower metabolic rate in obese persons and the 'thrifty gene concept' have been offered as explanations. However other reports suggest that obese individuals are likely to under report intakes (Zegman, 1984; Prentice et al, 1986; Schoeller, 1990), although all reports do not support these findings (Blake, Guthrie, Smiciklas-Wright, 1989).

While utmost effort was made to obtain as much detail regarding the consumed foods as possible, and serving sizes were estimated with the help of visual aids, errors in description and recall are possible. Cooking fat quantities quoted show large variation, and it is possible that different amounts are used for cooking similar items. In this event, the results for fat and total energy content of the diet may well be altered. This problem was also noted in the latest national nutrition survey of Pakistan (NIH, 1988b). The most accurate way to determine the composition of a diet is to weigh duplicate portions of the intake and analyse them.

The 24-h recall has the limitation that it may not be representative of the usual intake pattern, although it is reported that total energy intake is the least variable (Beaton, 1989). Alternately it may
be assumed that the overweight persons are lowering their intake in order to lose weight. A definite statement as to which of the previously mentioned explanations is valid would be possible only if an objective measure of true dietary intake was available.

While the 24-hour recall has its limitations as mentioned in the literature review, it was appropriate for this study. While dietary records kept for 3 to 7 days can provide a better picture of intake, in a study of adherence they may not be the best choice due to a "Hawthorne effect", i.e. people changing their behavior as a result of being observed. As anticipated, a major proportion of the sample had limited or no literacy skills which would make record keeping impossible or at best produce measurement errors. Cooperation rates are also low for dietary records and the responding population may be biased from the adherence point of view.

4.8.1 Protein

Protein and fat intakes are also summarized in Table 15. Taking the current recommendation of 0.8 g/kg body weight (American Diabetes Association, 1993) as a guide, 65% of the population had an intake within this range while the rest had a higher consumption. The distribution is presented in figure 11.
Figure 11: PROTEIN DISTRIBUTION

### Protein Distribution

<table>
<thead>
<tr>
<th>Protein g</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>3</td>
</tr>
<tr>
<td>20</td>
<td>8.5</td>
</tr>
<tr>
<td>30</td>
<td>14.5</td>
</tr>
<tr>
<td>40</td>
<td>19.5</td>
</tr>
<tr>
<td>50</td>
<td>15.5</td>
</tr>
<tr>
<td>60</td>
<td>17</td>
</tr>
<tr>
<td>70</td>
<td>9</td>
</tr>
<tr>
<td>80</td>
<td>3</td>
</tr>
<tr>
<td>90</td>
<td>4.5</td>
</tr>
<tr>
<td>100</td>
<td>1</td>
</tr>
<tr>
<td>110</td>
<td>3</td>
</tr>
<tr>
<td>&gt;120</td>
<td>1.5</td>
</tr>
</tbody>
</table>
4.8.2 Fat

For diabetic patients it is recommended that fat should make a contribution of 30% to the total energy intake (American Diabetes Association, 1993). Figure 12 shows the distribution of the sample according to the percentage of energy contributed by fat. Seventy percent of the population had a consumption above the recommended level, while 30.5% of the population were meeting more than half of their energy needs from fat.

It was not possible to analyze the proportion of saturated to unsaturated fat in the intake as data are not available for all Pakistani foods. However, subjects were asked what kind and quantity of cooking fat was used in their homes. The cooking fats reportedly consumed by the sample are given in Table 16. It would appear that the majority are consuming saturated fats as a cooking medium.

Table 16

Reported Cooking Fats

<table>
<thead>
<tr>
<th>Type of Fat</th>
<th>Frequency of consumption %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrogenated vegetable Oil (ghee)</td>
<td>64.5</td>
</tr>
<tr>
<td>Vegetable Oil</td>
<td>31.5</td>
</tr>
<tr>
<td>Clarified butter (Desi ghee)</td>
<td>8.5</td>
</tr>
<tr>
<td>Animal fat</td>
<td>0.5</td>
</tr>
</tbody>
</table>

*Note.* Some respondents reported using a combination
Figure 12: Percent Energy from Fat Distribution
The total quantity consumed in a household divided by the number of family members gives a rough estimate of the quantity of added fat consumed by each person. Although it is only an estimate and does not account for such factors as unequal distribution, discarded cooking fat, or eating out, it does give some indication of the quantities used in cooking. Mean per person estimated intake ranges from 9.5 to 110 g per day (Mean=41, S.D.=20.1). The national nutrition survey figures for Lahore (NIH, 1988b) estimated added fat intake at 28 g per day.

Data for Lahore show that added fats contribute 15% of the total energy intake (NIH, 1988b). The percentage could not be determined for this population as the quantity of fat used in calculating the composite foods has not been reported in the Food Composition Table for Pakistan and is reported for selected items only in the FAO tables. If the national survey data is taken as a guide, it means that half of the recommended fat allowance of 30% is likely to be from added fats. As this type of fat may be reduced without reducing the quantity of foods that it is added to, there may be a scope for bringing the fat content of the diet to the desirable proportion of 30% of energy intake as opposed to 40% observed at present. Education regarding food preparation methods would be required.

4.8.3 Carbohydrate and Fibre

Nearly half of the sample had carbohydrate supplying 40% of the total energy intake or more, as given in Figure 13. However, other data suggest that the form of carbohydrate consumed and fibre content may not be satisfactory.

There are differing opinions on the fibre content of the diet. An intake of 40 g of fibre or 25 g/1000
Figure 13: Percent Energy from Carbohydrate Distribution

Each bar represents a 5% group e.g. 0 is 0-5%
Kcal is recommended on diabetic diets and a maximum level of 50 g is not considered unreasonable (American Diabetes Association, 1993). This amount is higher than the levels of 30 g recommended for the general population, although some authors feel that a level higher than 25 g is difficult to achieve unless eating patterns are drastically changed (Tattersall & Gale, 1990, p. 52). The dietary fibre component is considered essential for the efficacy of currently promoted high carbohydrate diets (Riccardi et al, 1984). At least 15 g of soluble fibre daily in the average NIDDM patient is likely to produce 10% improvement in fasting plasma glucose, glycosylated hemoglobin, and in serum total- and LDL- cholesterol concentrations (British Diabetic Association, 1992). The blood lipid lowering effect is attributed to the soluble fibre and similar leguminous fibre. Another advantage is promotion of satiety and weight loss.

Data for dietary fibre are still under review and changes are expected as analytical procedures are improved and interpretations redefined. The food table for Pakistan, and FAO tables give crude fibre values which under estimate the actual level of dietary fibre. The values reported in McCance and Widdowson's tables are for dietary fibre. These dietary fibre values are calculated from the Southgate method, which can overestimate total dietary fibre in high starch foods (Cashel & Lewis, 1990). The values for cereals (breads, rice) were calculated from these tables, so it is likely that the error of under-estimation would be reduced. Cereals accounted for 74.3% of the total carbohydrate intake in this population (Median=75.6, S.D.=12.9). However, if the intake of pulses and legumes is high it could alter the results considerably.

Given the error of under-estimation, the population still shows an intake level below the recommended 40g
per day, and much lower than the levels of 100-170g that have been reported for developing countries (Bingham et al, 1979). Figure 14 shows the fibre distribution in the sample. Even taking the lowest figure of 15 g, 97% of the population falls under it. An urban food intake pattern even in a developing country may be different from a rural one which is high in vegetables and whole grain cereals and low in animal foods. This difference also exists in Pakistan (NIH, 1988b, p. 81).

Figure 15 presents the subjects' consumption from various categories of food on the recalled day. Quantities are not noted here. A comparison with national data for adult males is given (NIH, 1988b, p. 55). Although a direct comparison is not the purpose, as the two populations are likely to be different in demographic characteristics, the consumption trends of both appear quite similar for several food categories. Only 6.5% of the diabetic sample had consumed leafy vegetables and 49% had consumed any vegetables (excluding tubers and root vegetables) on the reported day. Approximately 57.5% of the subjects had consumed legumes or pulses on the recalled day.

National figures for per capita availability of food items shows that while availability of cereals, meat, milk, sugar and oils has increased since the first available data in 1950, the availability of pulses has reduced by 60% (Khan, 1991). The production has also declined. However, their contribution to the energy intake has increased from 6% to 8% during the period 1977-87 (Khan, 1991). On the other hand, the availability of oils has increased nearly five fold since 1950 and contributes 13% of total energy compared to 9% in 1977.
Figure 14: Fibre Distribution
Figure 15: Consumption From Food Categories Compared to Adult Pakistani Males

- Rice: 30.5% (National Sample), 74% (Diabetic Sample)
- Sugar: 24.5% (National Sample), 69% (Diabetic Sample)
- Tea: 43% (National Sample), 64% (Diabetic Sample)
- Milk: 5% (National Sample), 31% (Diabetic Sample)
- Fruits: 29% (National Sample), 18.5% (Diabetic Sample)
- Leafy vegetables: 5% (National Sample), 6.5% (Diabetic Sample)
- Vegetables: 45% (National Sample), 49% (Diabetic Sample)
- Pulses & legumes: 33% (National Sample), 57.5% (Diabetic Sample)
- Eggs: 9% (National Sample), 15% (Diabetic Sample)
- Fish: 3% (National Sample), 0% (Diabetic Sample)
- Meat: 35% (National Sample), 60% (Diabetic Sample)
- Cereal: 99% (National Sample), 100% (Diabetic Sample)

% of people consuming foods on the reported day

Legend:
- National Sample
- Diabetic Sample
As the general pattern of the population appears to be towards a high carbohydrate diet with the major portion of the carbohydrate coming from wheat and rice, then a low fibre intake indicates that these are being consumed in a refined form that is low in fibre. The availability of wholegrain wheat flour is often problematic in urban areas due to a lack of regulation, so that a flour sold as wholegrain may be of a much lower extraction rate. Moreover, a degree of refinement is generally preferred for better quality of chapatis, so most of the bran is sifted off before preparation. Rice is consumed in its polished form in both rural and urban areas. The commercial breads popularly used for breakfast are almost exclusively white; brown or wholemeal bread are only available at speciality shops. An increase of fibre intake in the existing diet pattern would require that the cereals are consumed in an unrefined form. As it requires changing tastes and preferences, much educational effort would be required.

The fibre in wheat is mainly insoluble fibre. To encourage an increased uptake of soluble fibres, an increased intake of pulses, legumes and leafy vegetables is also required in this population. Legumes have also been shown to have a low glycemic index (Akhtar, Asim & Wolever, 1987).

Other available sources also need to be explored. Guar, although a native plant in Pakistan, has received limited attention, possibly due to its poor palatability in native form. Ground guar bean has been successfully incorporated in breadmaking, resulting in a product with lower energy density and acceptable palatability. Feeding trials show reduction in HbA1c levels as well as total cholesterol (Peterson, 1984).
4.9 Food Beliefs

Subjects were asked whether they believed any specific food(s) to be particularly beneficial for diabetics. The majority responded in the affirmative. Table 17 shows the responses in the order of frequency.

Table 17

Foods Believed to be Beneficial for Diabetics by the Respondents (n=191)

<table>
<thead>
<tr>
<th>Foods</th>
<th>Number of responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Besan flour chapatis and Pakoray*</td>
<td>177</td>
</tr>
<tr>
<td>Karela (Bittergourd)</td>
<td>81</td>
</tr>
<tr>
<td>Grams</td>
<td>69</td>
</tr>
<tr>
<td>Jaman (Roseapple)</td>
<td>49</td>
</tr>
<tr>
<td>Bitter herbs</td>
<td>22</td>
</tr>
<tr>
<td>Cucumber</td>
<td>17</td>
</tr>
<tr>
<td>Whole grain flour</td>
<td>17</td>
</tr>
<tr>
<td>Meats</td>
<td>14</td>
</tr>
<tr>
<td>Peaches</td>
<td>11</td>
</tr>
<tr>
<td>Spinach</td>
<td>10</td>
</tr>
<tr>
<td>Vegetables growing above the ground</td>
<td>10</td>
</tr>
<tr>
<td>Pumpkin</td>
<td>9</td>
</tr>
<tr>
<td>Falsa berry</td>
<td>9</td>
</tr>
<tr>
<td>Apple</td>
<td>8</td>
</tr>
<tr>
<td>Loquat</td>
<td>7</td>
</tr>
<tr>
<td>Lentils</td>
<td>6</td>
</tr>
<tr>
<td>Round gourd</td>
<td>5</td>
</tr>
<tr>
<td>Almonds</td>
<td>5</td>
</tr>
<tr>
<td>Okra</td>
<td>3</td>
</tr>
<tr>
<td>Cottage cheese</td>
<td>1</td>
</tr>
<tr>
<td>Pancreas</td>
<td>1</td>
</tr>
<tr>
<td>Lassi*</td>
<td>1</td>
</tr>
</tbody>
</table>

Note. As multiple responses were also given, the total number of responses exceeds n. *See appendix H

While some of these food beliefs are traditional wisdom and others idiosyncratic, the two most frequently reported ones in the table have been
scientifically examined. A glycemic index trial of besan flour chapati indicates that it can produce a lower glycemic response than wheat chapati (Rahman, 1992). Chickpea supplementation over twenty weeks reportedly reduced cholesterol (Reckless, 1984). However, besan flour being a leguminous product produces flatulence. Also, while wheat chapati is generally prepared without any added fat, besan flour chapati is usually consumed buttered or oiled. This is an important consideration for diabetic diets as they should be low in fat.

Bittergourd or karela has also been the focus of research and evidence exists that it has a lowering effect on blood glucose levels. Clinical trials using dried extract of the fruit (Akhtar, 1982) or fresh juice (Welhinda, Arvindson, Gylfe, Hellman & Karlsson, 1982) support the presence of a hypoglycemic effect, possibly due to an insulin-like compound obtained from the plant (Baldwa, Bhandari, Pangaria & Goyal, 1977).

Fewer responses were received for beliefs on harmful foods, which are presented in Table 18:
Table 18

Foods believed to be harmful for diabetics by the respondents (n=101)

<table>
<thead>
<tr>
<th>Foods</th>
<th>Number of responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vegetables growing underground</td>
<td>30</td>
</tr>
<tr>
<td>Potato</td>
<td>29</td>
</tr>
<tr>
<td>Sweets</td>
<td>26</td>
</tr>
<tr>
<td>Rice</td>
<td>24</td>
</tr>
<tr>
<td>Sweet fruits</td>
<td>15</td>
</tr>
<tr>
<td>&quot;Baadi&quot; foods</td>
<td>13</td>
</tr>
<tr>
<td>Okra, zucchini</td>
<td>12</td>
</tr>
<tr>
<td>Mangoes</td>
<td>11</td>
</tr>
<tr>
<td>Maash dahl</td>
<td>11</td>
</tr>
<tr>
<td>Bananas</td>
<td>10</td>
</tr>
<tr>
<td>Cauliflower/ cabbage</td>
<td>4</td>
</tr>
<tr>
<td>Melon/ watermelon</td>
<td>3</td>
</tr>
<tr>
<td>Spices</td>
<td>3</td>
</tr>
<tr>
<td>Beef</td>
<td>2</td>
</tr>
<tr>
<td>Pumpkins</td>
<td>2</td>
</tr>
<tr>
<td>Fats</td>
<td>1</td>
</tr>
<tr>
<td>Grapes</td>
<td>1</td>
</tr>
<tr>
<td>Meat</td>
<td>1</td>
</tr>
<tr>
<td>Salad vegetables</td>
<td>1</td>
</tr>
<tr>
<td>Whitebread, naan</td>
<td>1</td>
</tr>
</tbody>
</table>

Note: As multiple responses were also given, the total number of responses exceeds n.

Avoidance of foods growing under ground has been a traditional advice for diabetic patients; the rationale is that it eliminates starchy vegetables and tubers. Another concept of Eastern medicine that has been popular (along with 'hot' and 'cold' philosophy) is that of foods being 'light' or 'heavy' to digest; the latter are known as 'Baadi' foods. The name implicates that they cause flatulence (Baad meaning wind). Table 19 lists some examples of such foods.
Table 19

Some Examples of 'Baadi' Foods

<table>
<thead>
<tr>
<th>Cereals and legumes</th>
<th>corn, oats, kidney beans, black lentils, maash lentils</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vegetables</td>
<td>beetroot, cabbage, cauliflower, carrot, okra, mushroom, onion, mustard greens, turnip, yam</td>
</tr>
<tr>
<td>Fruit and Nuts</td>
<td>almond, apple, apricot, banana, coconut, dates, figs, grapes, guava, mango, orange, peach, peanut, persimmon, pineapple, walnuts</td>
</tr>
<tr>
<td>Meat and Dairy</td>
<td>Beef, chicken, lamb, organ meats, cheese, cream, cow's milk</td>
</tr>
</tbody>
</table>

From Bajracharya (1982)

As it is apparent, the list goes across different food groups. A number of foods reported in the harmful list fall under the 'Baadi' classification, which may be an explanation for them being considered as harmful for diabetics.

A number of patients claimed that avoidance of 'Baadi' foods, and vegetables growing below the soil was part of the dietary advice that they were given by their care provider (Table 14). Obviously, such a restriction unnecessarily limits food choices for the diabetic person. Coupled with other restrictions, such as that of sweets, fruit and rice, it would make normal eating difficult if the patient were to remain adherent. This would also be an important concern in the case of the low socioeconomic level patients for whom food choices may already be limited. Diet is not only a cornerstone of diabetes care but also of everyday living. Excessive disruption to the normal pattern would prove to be a barrier to adherence.

The barriers to dietary adherence expressed by the patients in this population are given in the Table 20.
Table 20

Difficulties felt by patients in following their diet
(n= 123)

<table>
<thead>
<tr>
<th>Reported difficulty</th>
<th>Number of responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Miss eating sweets</td>
<td>37</td>
</tr>
<tr>
<td>Miss eating favourite foods</td>
<td>32</td>
</tr>
<tr>
<td>Difficult to eat away from home</td>
<td>26</td>
</tr>
<tr>
<td>Feel restricted in choices</td>
<td>18</td>
</tr>
<tr>
<td>Difficult to cook food separate from the family</td>
<td>14</td>
</tr>
<tr>
<td>Feel deprived</td>
<td>11</td>
</tr>
<tr>
<td>Can't afford recommended foods</td>
<td>11</td>
</tr>
<tr>
<td>Diet is difficult to follow</td>
<td>7</td>
</tr>
<tr>
<td>Don't know enough about the diet</td>
<td>7</td>
</tr>
<tr>
<td>Don't like recommended foods</td>
<td>5</td>
</tr>
<tr>
<td>Don't like tea without sugar</td>
<td>5</td>
</tr>
<tr>
<td>Hear conflicting advice</td>
<td>5</td>
</tr>
<tr>
<td>Feel hungry and unsatisfied</td>
<td>5</td>
</tr>
<tr>
<td>Miss eating fruits</td>
<td>4</td>
</tr>
<tr>
<td>Need someone to discipline me</td>
<td>2</td>
</tr>
<tr>
<td>Diet charts are rigid and not practical</td>
<td>2</td>
</tr>
<tr>
<td>Have trouble with teeth or swallowing</td>
<td>2</td>
</tr>
<tr>
<td>Besan flour chapati induces thirst</td>
<td>1</td>
</tr>
<tr>
<td>Have to depend on others, whatever they cook</td>
<td>5</td>
</tr>
</tbody>
</table>

As is apparent from the table, most of the barriers expressed relate to food choices (in italics). As already discussed, the stress of the dietary advice as recalled by the patients is also on particular foods, one which needs to be reviewed in keeping with the increased 'normalization' of a diabetic diet plan. Special restrictions may make a diet different from the regular family pattern. West (in Shillitoe, 1988, p. 29) noted that anything that increased the 'apartness' of a diet made it less likely to be
followed. It may place the diabetic person in a 'sick role', and one may be unwilling to adopt this role for every day living.

While specific food 'groups' may be emphasized, a diabetic person can consume most food items. The important consideration is the limitation of quantity and frequency, rather than an absolute ban. The fact that the current diabetic diet recommendations are very similar to those made for the general population can bring the diet of the patients closer to that of their family, thereby removing an important barrier to adherence. In other words, the main guidelines may be followed by the entire family and not just the patient. While this would require much educational effort, it appears from the family support reported that some families would be willing to make such changes. The majority of the sample (82%) said that they received family help in following their diabetes care regimens. Table 21 points out the ways in which they reported receiving it.

Table 21

<table>
<thead>
<tr>
<th>Family help reported by the patients (n= 164)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type of help</strong></td>
</tr>
<tr>
<td>1 Remind and check patient</td>
</tr>
<tr>
<td>2 Cook meals for patient</td>
</tr>
<tr>
<td>3 Eat the same foods and avoid desserts</td>
</tr>
<tr>
<td>4 Accompany to the clinic</td>
</tr>
<tr>
<td>5 Learning about diabetes</td>
</tr>
<tr>
<td>6 Motivate or join in exercise</td>
</tr>
<tr>
<td>7 Administer medicine/ perform tests on time</td>
</tr>
<tr>
<td>8 Hide restricted foods</td>
</tr>
<tr>
<td>9 Pay special attention to patient's food</td>
</tr>
<tr>
<td>10 Help with the workload</td>
</tr>
<tr>
<td>11 Protect from stress and unhappy situations</td>
</tr>
<tr>
<td>12 Buy special equipment or materials</td>
</tr>
</tbody>
</table>

*Note. As some patients gave multiple responses the total number of responses exceeds n.*
The levels of self-care behaviors in this patient population appear to be inadequate for satisfactory diabetic control as indicated by objective measures (Glycosylated haemoglobin, BMI, presence of complications, emergency hospitalization) as well as subjective measures (self-reports).

A considerable proportion of the sample suffered from complications and other medical problems. Incidence of overweight and obesity was also high. HbA1c tests on a sub-sample of the population showed poor blood glucose control levels.

The majority of the respondents said that they were advised care activities, although not all of them followed the advice. However, 80% of the sample described themselves as compliant. Self-reports of glucose tests show that approximately one third of the respondents underwent a blood glucose test once in two months or less often, while another one quarter were tested once a month or more often. Urine testing for glucose was not conducted at all by nearly half of the patients and only 31% did it more than once a month.

Clinic visits may be considered as quite frequent with two-thirds of the respondents visiting a clinic at least once a month. It is not known whether the purpose of the frequent visit is to keep follow-up appointments, as a result of health problems, or just to obtain medication supply. Thus, a comment is difficult to make as to whether the clinic visits may be considered as a satisfactory situation or otherwise.

Exercise levels were found to be low in this population with 40% of the respondents reported doing no exercise during the previous week. Of those who did exercise, the activity undertaken was very light, mostly slow walking.
A considerable proportion (64.5%) of the sample reported fasting during the last month of Ramadan. Approximately two-thirds of these did it without consulting their physicians or in defiance of the proscription.

Comparatively speaking, tablet taking was reportedly undertaken as advised. Similar results have been reported in the literature (Irvine, 1989). However there appears to be a trend towards self-adjustment of dose, or its discontinuation when generally feeling well. Apparently some patients do not understand that the tablets are to be taken every day.

While deviation from the individual reported dietary advice was noted in one-third of the sample, a cursory examination of the dietary intake reveals several consumption patterns which need alteration.

The inadequate care levels as implicated by unsatisfactory health status can be a result of either factors related to (a) patients, or (b) the health care.

The diabetes regimen is a complex one and consists of various aspects. The factors affecting the adherence are also numerous. The statistical models point towards a few of them. As the care behaviors were analysed as separate dependent variables, patients with low levels of a range of behaviors could not be identified.

Duration of disease appeared as a positive predictor of HbA1c levels as well as knowledge scores. The elevated levels of HbA1c with increased duration of disease possibly depict the worsening of the disease process with time. Case studies reported by Goldstein et al. (1982) show similar trends. The relationship of increased duration with increased
knowledge is understandable as increased experience with the disease should lead to improved knowledge and understanding. Education attempted at the time of diagnosis could be effected by high levels of anxiety. As increased duration is also linked to worsening diabetic control (as measured by HbA1c), it is possible that the worsening of health has an impact on motivating knowledge seeking. Other research also point towards the possibility of such a relationship (Irvine, 1989).

Socioeconomic status was linked to more frequent blood testing and higher diabetes knowledge scores which may lead one to assume that a better diabetes knowledge leads to more frequent blood testing. However, a higher socioeconomic level is a negative predictor of exercise as is the level of general education. A higher socioeconomic level is a positive predictor of dietary deviation too. As exercising and following a diet require behavioral and lifestyle changes, knowledge alone may not suffice to bring about the change. No association of knowledge scores was found with the studied care behaviors. Motivational factors such as perceived severity of disease or risk of complications need to be present. Dunn (1990) has pointed towards the importance of inclusion of motivational components in diabetes education programs.

Poor health whether actual or perceived can also influence self-care behaviors. Presence of a complication or associated medical condition positively predicted urine testing, while a perception of moderate severity of disease is positively linked to exercise. This result is consistent with the predictions of the Health Belief Model that adherence increases as a function of perceived severity of illness. Similar results were noted by Dunn, Beeney, Hoskins and Turtle (1990).
Poor health however would be expected to decrease the ability to engage in care activities; for instance a person suffering from aching legs would find it difficult to exercise. Not surprisingly, presence of more than one complication and perception of one's diabetes as being very severe appear as negative predictors of urine testing and exercise, respectively. The number of diabetes related emergencies is likewise linked to fasting.

Interestingly, satisfaction with treatment has a negative relationship to urine testing. It could be that the patients who are satisfied with their treatment are those with fewer health problems and consequently do not feel the need for frequent testing. Treatment satisfaction is also linked with less dietary deviation. The satisfaction of patients with their health care is summarized in Table 22.

**Table 22**

<table>
<thead>
<tr>
<th>Patients' Perspective on their Health Care</th>
<th>% responding yes</th>
</tr>
</thead>
<tbody>
<tr>
<td>See the same doctor every visit</td>
<td>50</td>
</tr>
<tr>
<td>Doctor criticises patient</td>
<td>36</td>
</tr>
<tr>
<td>Satisfied with time at clinic</td>
<td>68</td>
</tr>
<tr>
<td>Satisfied with treatment</td>
<td>65.5</td>
</tr>
</tbody>
</table>

Nearly one-third of the subjects expressed dissatisfaction with three aspects of their health care. Although the majority said that they were satisfied, it has to be kept in mind that most of the subjects were interviewed at their clinic, and may be unwilling to express dissatisfaction despite the assurance of confidentiality. This means that the reports of satisfaction may be overreported, although it can not be established.
Surprisingly, perceived family support did not appear as a predictor of care behaviors. In the regression models it was entered as the main response rather than as specific components. A detailed analysis of particular types of help may be more predictive of the effect on specific care behaviors.

BMI is positively linked to dietary deviations, suggesting that persons with a higher BMI were more likely to deviate from their dietary prescription, and perform urine tests less often. While a direct relationship is not valid as dietary deviations were noted in comparison to individual reported dietary prescriptions which varied greatly and may not even have a weight control component. However it may suggest that people who deviated from their prescription also had food habits that contribute to a higher BMI. Absence of a relationship of BMI with exercise may be due to low exercise levels. The beneficial effects of exercise are short term, so the actual frequency is also important.

Self image of compliance was negatively linked with dietary deviation suggesting that patients who considered themselves as compliant deviate less from their diet. As treatment satisfaction is similarly linked to diet deviation, a possible assumption is that satisfied patients are also the compliant ones.

As reported earlier, patients do not necessarily follow the advice of their care providers exactly, yet frequency of glucose testing and clinic visit appear to be related to advised frequency of these activities. It suggests that people who reportedly engaged in these activities twice a month or more often were likely to be those who were advised a high frequency. The advice of testing urine every day is linked with frequent testing although less than half of the people advised that frequency performed the
test every day. If it is assumed that patients advised a higher level perform the care activity more often than those who are advised a low level, it raises the question as to whether the advice should be of the maximum desirable level in order to achieve maximum possible adherence levels (even if they fall short of the desirable levels).

Apart from the above mentioned, the levels of care may also be a function of the quality of the advice received or even its very presence. As reported earlier in Table 9, a number of patients reported receiving no advice whatsoever regarding various care activities. Six patients even claimed that they had received no dietary instruction. A large proportion were not given any advice regarding fasting. The lack of detailed advice may be due to the amount of time available for the patient if the clinic is busy. More than half of the patients in this sample said that less than five minutes were spent with them when explaining their care regimen to them for the first time.

The quality of the advice when offered is also an important consideration. Great variation is reported in this sample. While the medication prescription is entirely individualized, the frequency of glucose testing and clinic visits also appears to be so, depending on the clinic procedures, the patient's condition and the need for follow up. The PMRC clinic protocol (Haider, 1982) recommends a follow up clinic visit and random blood glucose test every three months for stable patients and more often for other patients, which is in agreement with those suggested by Tattersall and Gale (1990) for stable NIDDM patients. Self monitoring during the intermittent period is regarded as desirable, although more so for IDDM patients. Blood glucose tests are more reliable than urine tests and a urine test is not needed if a
blood test is done at a given time. Up to four blood tests a day are recommended by some experts. But obviously in the absence of personal glucometers, and the expense and inconvenience of visiting a health facility for the test, such advice can not be given universally. Urine testing however can be performed at home, and at a low cost if the Benedict's method is used (Diabetic Association of Pakistan, 1992). Once a day urine testing is recommended by the Diabetic Association of Pakistan (Malik, June 1992, personal communications). However, this recommendation is not reflected in the advice reported by this sample.

While the above mentioned care components may well be individualized, a lack of uniformity is also apparent in the dietary advice. The frequently reported features are the total or partial restriction of sugar, starchy foods, potatoes, rice and fruit and advice of a higher meat intake. Some of the advice reported also includes outdated ideas such as the total restriction of vegetables growing below the soil. As the difficulties expressed in following a diet prescription related mostly to food choices, it is suspected that it may arise from the emphasis of the dietary advice on specific food items. It is recognized that the dietary prescription documented is the patient's perception of it rather than an objective account. So it is possible that an advice of 'avoiding' a food may be taken as a complete ban. Likewise, a general suggestion of inclusion of a food in diet may be perceived as an indicator of special status of the particular food item. It is difficult to verify this assumption in the absence of an objective measure of the actual advice.

A possible result is that the perception of a diabetic diet may become limited to ideas such as "just avoiding sweets" as reported by Cerkoney and
Hart (1980). The responses offered by the patients in this sample who reported feeling no difficulty in following their diet (n=77) suggest that this may well be the case. Half of these patients said that the reason they felt no difficulty was that they did not like sweets anyway, while three said that it was an easy diet with just three restrictions (namely sweets, potatoes and rice). The rest did not offer any reasons.

The lack of awareness of the newer concept of a high-carbohydrate, high-fibre (HCF) diabetic diet are also suggested by the knowledge tests where 86% of the patients did not know at all what was meant by high fibre foods, and an additional 7.5% had mistaken ideas. Similarly meats were considered as freely consummable foods by 39%, an idea popular in the era of low-carbohydrate, high-fat diets. Another deficiency noted in knowledge was that nearly half of the patients did not realize the importance of eating at regular intervals for diabetics. Missed meals were noted in thirteen of the dietary recalls.

Seventy five percent of the patients said that their dietary advice was unchanged since they were first diagnosed. The duration of disease in this group ranged from 1-25 years (mean=5.9). The concept of the HCF diet gained popularity in the early 80's and became part of diabetic advice as early as 1982 in some developed countries (Horwath & Worsley, 1991). While presence of old diet concepts may be explainable in patients diagnosed before that time, their popularity with comparatively recently diagnosed patients point towards the shortcomings in the source of the information, either in the content or in the method of communication.

Doctors are reported as the health professionals who were not only responsible for advising the
regimens to the majority of the patients (96.5%), but were also reported as the major source of the patients' diabetes related knowledge.

Unfortunately, doctors have been reported as ineffective educators as discussed in the literature review. In Pakistani doctors, nutrition knowledge deficiencies, both general and diabetes related have been documented (NIH, 1988a; Ahmad, 1989). Khan (1991) notes the absence of nutrition training of medical personnel at all levels. Teaching hospitals tend to appoint newly qualified house-job trainees to out patient care. A British study described newly qualified doctors as 'extremely incompetent' at giving patients information or advice (Maguire, Fairbairn & Fletcher, 1986). From the patients' point of view another disadvantage is the non-continuity of care from the same doctor.

Time available for consultation may also be one of the problems as suggested by patient reports. Estimates quoted by the clinics in this study suggest that a doctor may see between 10 to 20 patients in a typical 5 hour working day (Personal communications). Although it is beyond the scope of this study to examine administrative procedures in detail, they may influence patient adherence by their effect on patient-provider relationship (Meichenbaum, 1987). Time available for patients is related to treatment satisfaction in this study, which in turn predicts less dietary deviation. One suggestion to improve availability of time for patients is to maintain longer followup intervals (Burr, 1990). Use of fixed time appointments instead of block scheduling is another strategy which reduces waiting time for patients and lets them see the same doctor on repeated visits. Moreover, Dunbar and Agras (1980) noted that in a block system, physicians came to the clinic at least 35 minutes late. The feasibility of
any particular organizational structures may be determined by appropriate research in the area.

4.10 Diabetes Education

While diabetes education and improved knowledge by itself does not guarantee adherence, it is a necessary first step, without which there is no basis for change.

Shillitoe (1986, 85) notes that disease related information is of value only if it:

1. Reduces uncertainty or anxiety,

2. Results in a more accurate appraisal of the potential harm caused by the disease,


Effective diabetes education encompasses an understanding of the disorder, its short term and long term complications, self-care and monitoring activities including glucose testing, exercise, and foot care. But perhaps the most important aspect of diabetes education for NIDDM patients is diet and nutrition education as it effects every day living of the patient. Bollag (1983) recommends that the nutritional advice for the diabetic person in a developing country should concentrate on two main points, namely

i: Prevention of obesity, and

ii: Fibre content of carbohydrate

The results from this study support the relevance of this advice as both obesity as well as fibre
content of the diet appear as areas of concern in this population. The proportion of fat in the diet as well as the type consumed are also areas of concern. The need for improved diabetes education is also supported by the general diabetes knowledge test scores as well as specific areas of deficiency.

In the developed countries, increasingly the responsibility for care and education of diabetic patients is being shared by health professionals other than doctors (hence the term 'health care providers'), such as dietitians and nurse educators. Such an approach may be difficult for Pakistan at present as there is an acute shortage of skilled nurses who are outnumbered by doctors (Harner, Amarsi, Herberg & Miller, 1992). The concept of a dietitian is recent and very few skilled professionals are available.

In the face of limited human and monetary resources, diabetes education programs as conducted in the developed countries are hardly feasible. Novel approaches to the problem as used in other developing countries need to be explored. Krall (1985, p. 481) cites examples such as 3-minute films for teaching in Cuba that are followed by nurses and dietitians answering questions. In Egypt, food models are used for dietary guidance, while in Dominican Republic, nurse educators teach small groups of patients without much visual aid materials.

Patients reported being given their dietary advice in a number of different formats. Future research can help determine their comparative efficacy with reference to a low literacy level population. Exchange lists are the most commonly used teaching format in the developed countries but at least six other approaches have also been suggested (Pastors, 1992). Whether any one or a combination of these
approaches is practicable needs to be investigated. Simple diet guides have been produced locally (Agha Khan Hospital Dietetic Department, 1992; Diabetic Association of Pakistan Karachi, 1992) but their contribution to patient understanding has not been examined.

Video may also be a potential medium for patient instruction. It is reported that video instruction may be just as effective as one-to-one advice for diabetic patients (Bethea, Stallings, Wolman & Ingram, 1989) as well as for patients with heart disease (Brandao et al, 1992). It has the advantage that time of professionals is saved. Milton (1991) also regards the method as cost effective. Another example of an imaginative use of the medium is India's rural 'video on wheels' initiated by a politician. These equipped vans project basic health care messages and are reported as a success (Fabian, 1993).

Fortunately, support organizations such as diabetic associations are already established in the country to provide a platform for diabetes related activities, services and support.
V. VALIDITY OF RESULTS:

As it is not possible to assess the degree to which this study sample is representative of the Pakistani diabetic population, which in turn is inadequately described, the degree to which generalization may be made from these results is limited. Although the study sample is non-random in nature, it meets the criteria of sample selection given by Haynes, Taylor, Snow and Sackett (1979) for the evaluation of compliance based studies. Equal evaluation points are given to a random population sample and one based on three or more hospitals/clinics in a given geographical area, or a regional referral centre*. The group also includes considerable diversity in age and duration of diabetes and includes subjects from different socioeconomic groups.

Any extrapolations of the findings need to be made with caution, as the study is based on a cross-sectional design which does not permit causal inferences. The results of the statistical analysis may not be regarded as cause and effect relationships but rather as possible predictive indicators. Long term prospective studies may determine the causal significance of any self-care model more reliably. Other variables or combination of variables may be more appropriate predictors than the one used. A detailed examination of different sets of variables may offer a more accurate explanation of care behaviors than is possible with the present data set.

The investigation relied mainly on patient self-report measures, which are considered more prone to

* Provided that at least four demographic characteristics are described from age, sex, race, marital/family status, and socioeconomic level.
measurement errors as compared to non-obtrusive monitoring. Self-reports are also subject to response bias by over reporting adherence (Ary, Toobert, Wilson & Glasgow, 1986).

It is also not possible to determine the proportion of people who reported their care behaviors accurately, although the researcher believes that a good rapport was developed with nearly all respondents. Still, it is possible that respondents gave answers that they thought the researcher would like to hear. This error is likely to reduce the appearance of non-adherence in a population. However, non-adherence is frequently reported in the present population. Assuming the presence of the error, it can only mean that the actual rates of non-adherence may be even higher.

The sample consisted predominantly of lower socioeconomic level subjects, and perceptions and priorities of patients with higher socioeconomic levels may be different. However, this group is important as it forms the bulk of the general population. A reported 32% of the urban Pakistani population is below the poverty level (Galway, Wolff & Sturgis, 1987). Moreover, type II diabetes which is the more frequently occurring type (nearly 75% of all cases) is believed to be more common in lower socioeconomic groups (Hamman, 1983), although the proportion in Pakistan is not known.
VI. CONCLUSIONS AND FUTURE WORK:

The findings from the study indicate that care levels in the studied population are inadequate for satisfactory diabetic control as indicated by weight status, glycosylated haemoglobin and reported complications. Dietary intake data points towards trends that are in contrast to the current recommendations for diabetic diets. This, along with the reported levels of diabetes care activities, low diabetes knowledge levels and reported food beliefs implies a need for improved patient education.

Limitations notwithstanding, the implications of the findings of this study may aid in stimulating future research and practice in order to improve diabetes care.

1. The pattern of food advice should be shifted from specific food item orientation to guidelines for selection from various food groups. The dietary advice should emphasize that although it is important for the patient to follow it, the diet pattern is essentially a healthy pattern which may be followed by the whole family. Special or separate meal preparations for the diabetic person should not be necessary or encouraged.

2. Alternative methods of dietary teaching should be explored and their effectiveness examined.

3. Standards of levels of self-care advice relevant to the Pakistani diabetic patients should be set out in detail, including dietary advice which is practical and in reference with the local food patterns.

4. Few of the traditionally held beliefs regarding beneficial foods for diabetics have been scientifically examined. If harmful effects are
not associated, the patient may be allowed to follow them. However, if such pursuit causes undue hardship and limitations without any demonstrated benefits, then it should be discouraged.

5. Feasibility of clinical procedures which improve patient satisfaction should be investigated.

6. Diabetes education courses organised periodically for physicians currently place a greater stress on the medical aspects of the disorder. They should also include 'non-medical' aspects such as a nutrition component including diet teaching techniques, patient communication skills and introduction to determinants of patient adherence.

7. A study of the doctors' beliefs and understanding of diabetic diets should be conducted in order to assess whether erroneous beliefs of patients originate from their health care providers, and to identify the education needs of the educators.

8. Future research may use a longitudinal design and more homogenous populations for an in-depth study of determinants of care behaviors.

9. More detailed diet assessment methods may be employed to investigate the macro nutrient and fibre content of urban Pakistani diets.
VII. REFERENCES:


Agha Khan University Hospital Dietetic Department: Dietary instructions for diabetic patients. Hoechst Pakistan Ltd., P.O. Box 4962, Karachi, 1992


References - 132


Brandao JJ, Brademan GM et al., : Effectiveness of videotaped dietary instruction for patients hospitalized with cardiovascular disease. Journal
of American Dietetic Association 92:10, 1268-70, 1992


Cleave TL, Campbell GD, Painter NS: Diabetes, coronary thrombosis and the saccharine disease. 2nd ed., John Wright, Bristol, 1969, p.15


Computer Models: SODA version 4.1[Computer program], Computer Models, P.O. Box 423, Cottesloe WA, Australia, 1990

Coulston AM, Hollenbeck CB, Donner CC, Williams R, Chion YA, Reaven GM: Metabolic effects of added dietary sucrose in individuals with non-insulin-dependent diabetes mellitus (NIDDM). Metabolism 34:10, 962-6, 1985


Diabetic Association of Pakistan: Policy statement 1992. Issued at the International Conference and 85th training course on diabetes mellitus, King Edward Medical College, Lahore, April 18-23, 1992


Dunn SM, Beeney LJ, Hoskins PL, Turtle JR: Knowledge and attitude change as predictors of metabolic improvement in diabetes education. Social Science and Medicine 31:10, 1135-41, 1990

Dunn SM, Bryson JM, Hoskins PL, Alford JB, Handelsman DJ, Turtle JR: Development of the diabetes knowledge (DKN) scales: forms DKNA, DKNB, and DKNC. Diabetes Care 7:1, 36-41, 1984


Government of Pakistan: Food Composition Table for Pakistan. Ministry of Planning and Development, Planning and Development Division with Department of Agricultural Chemistry and Human Nutrition, NWFP Agricultural University, Peshawar, 1985


Gupta OP, Dave DM, Rawal ML, Sutaria VM, Bodiwala NK, Parikh HK, Parikh NK, Shah BS, Gupta PS, Joshi MN, Agarwal SB: In Diabetes Mellitus in Asia, Suji


Home P: Glycosylated haemoglobin revisited. Diabetic Medicine 7:385-6, 1990


Jenkins DJ: Dietary fibre, diabetes and hyperlipidemia, Lancet 2:8155, 1287-90, 1979


References - 142

Maguire P, Fairbairn S, Fletcher C: Consultation skills of young doctors, II: most young doctors are bad at giving information. British Medical Journal 292: 1576-8, 1986

Maillet JO: Historical perspective part 2: diabetes and diet; the last 50 years. Topics in Clinical Nutrition 7:1, 9-17, 1991


Mann JI: Lawrence lecture: lines to legumes: changing concepts of diabetic diets. Diabetic Medicine 1:3, 191-8, 1984


References - 143


Nasco: Life-form replicas. Nasco, 901 Jansville Ave., P.O. Box 901, Fort Atkinson 53538, U.S.A.


National Institute of Health: Nutrition Education in Pakistan: A Gap in Medical Education. NIH and UNICEF, Islamabad, March 1988a


Pastors JG: Alternatives to the exchange system for teaching meal planning to persons with diabetes. Diabetes Educator 18:1, 57-63, 1992


Rogers MA, Yamamato C, King DS, Herberg JM, Ehsani AA, Holloszy JO: Improvement in glucose tolerance after 1 week of exercise in patients with mild NIDDM. Diabetes Care 11:8, 613-8, 1988


Roth HP, Caron HS: Accuracy of doctors' estimates and patients' statements on adherence to a drug regimen. Clinical pharmacology and Therapeutics 23:3, 361-70, 1978

Sackett DL: The magnitude of compliance and non-compliance. In Compliance with Therapeutic


Schlenk EA, Hart LK: Relationship between health locus of control, health values and social support and compliance of persons with diabetes mellitus. Diabetes Care 7:6, 566-74, 1984

Schneider SH, Ruderman NB: Exercise and NIDDM. Diabetes Care 13:7, 785-9, 1990


Schofield WN: Predicting basic metabolic rate: new standards and review of previous work. Human Nutrition Clinical Nutrition 39c: supp 1, 5-41, 1985


Smego RA, Barrett PV: Health care and the private sector in the Third world. Academic Medicine 65:2, 100, 1990


Wing RR: Don't throw out the baby with the bath water: a commentary on very-low-calorie diets. Diabetes Care 15:2, 293-6, 1992


Zaidi SA: The urban bias in health facilities in Pakistan. Social Science and Medicine 20:5, 473-82, 1985


**APPENDIX A**

<table>
<thead>
<tr>
<th>Costs of Diabetes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. <strong>Mortality</strong> excessive by a factor of 2-3.</td>
</tr>
<tr>
<td>2. <strong>Heart disease and stroke</strong> excessive by a factor of 2-3</td>
</tr>
<tr>
<td>3. <strong>Blindness</strong> - 10 times more common than in the general population</td>
</tr>
<tr>
<td>4. <strong>Gangrene and amputation</strong> - about 20 times more common than in the general population</td>
</tr>
<tr>
<td>5. Second leading cause of <strong>fatal kidney disease</strong></td>
</tr>
<tr>
<td>6. Causes <strong>chronic disabilities</strong> e.g. neuropathy, infections and sexual dysfunction</td>
</tr>
<tr>
<td>7. <strong>Hospitalization</strong> increased about twofold as compared to age matched elements of the general population</td>
</tr>
<tr>
<td>8. Direct cost to medical system include professional time, drugs and rehabilitative services (e.g. the diabetic blind), other services and materials</td>
</tr>
<tr>
<td>9. Other costs to society include cost of medical services, pensions, loss of productivity due to morbidity, disability and premature death.</td>
</tr>
<tr>
<td>10. Lifetime risk of diabetes 2-12% (variation by country)</td>
</tr>
</tbody>
</table>

WHO expert Committee on Diabetes mellitus (1980)
APPENDIX B:

PAKISTAN : Basic facts

<table>
<thead>
<tr>
<th>Category</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area</td>
<td>804,000 sq.km.</td>
</tr>
<tr>
<td>Population</td>
<td>122 million (1991 estimate)</td>
</tr>
<tr>
<td>Density</td>
<td>154 persons per sq km</td>
</tr>
<tr>
<td>Per Capita Income</td>
<td>US$ 370</td>
</tr>
<tr>
<td>Major languages</td>
<td>Urdu, English, Punjabi, Sindhi, Pashto, Baluchi</td>
</tr>
<tr>
<td>Population under 15 years of age</td>
<td>45%</td>
</tr>
<tr>
<td>% of GNP spent on Health care</td>
<td>1%</td>
</tr>
<tr>
<td>% of GNP spent on Education</td>
<td>2%</td>
</tr>
<tr>
<td>Literacy rate</td>
<td>27%</td>
</tr>
<tr>
<td>Number of doctors</td>
<td>1 registered physician per 2133 persons</td>
</tr>
<tr>
<td>Ratio of doctors to nurses</td>
<td>1 nurse for 4 physicians</td>
</tr>
</tbody>
</table>

Public Health System Design:

- **Basic Health Unit (BHU):** Provides preventative and simple curative services to a target population of 10,000. Staff should include one physician, several paramedical technicians and one trained community health worker from each village served, who will refer cases to the BHU as needed.

- **Rural Health Centre (RHC):** A referral centre for 4 to 10 BHUs, an RHC is responsible for planning, management and supervisory support for rural health services in its catchment area. Staff should include
one female and two male physicians, and ten auxiliaries. A typical RHC has 10 to 25 patient beds.

- **Tehsil Hospital**: A referral centre for 3 to 4 RHCs, the Tehsil Hospital covers a population of 350,000 to 400,000. Surgical, medical, laboratory and radiographic facilities are available. The Tehsil Hospital supports primary health care activities of its health centre and affiliates by providing education, supervision, referral, drugs and equipment supply, and orientation of new physicians. Patients who cannot be treated in the Tehsil Hospital are sent to the area's district hospital.

- **District and Teaching Hospitals**: Rounding off the basic system, each district hospital serves approximately 1.5 million people. Bed capacity ranges from 30 to 300, and all major medical and surgical specialties are available. Besides district hospitals, all the provinces in Pakistan have major teaching hospitals associated with the country's 17 medical colleges.

Harger, Amarsi, Herberg and Miller (1992)
**APPENDIX C:**

**List of Visual Aids used in the dietary interview:**

**i. Food Models**

<table>
<thead>
<tr>
<th>Item</th>
<th>Weight/Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beef mince</td>
<td>113g</td>
</tr>
<tr>
<td>Bread</td>
<td>25g</td>
</tr>
<tr>
<td>Butter</td>
<td>1 teaspoon</td>
</tr>
<tr>
<td>Cauliflower</td>
<td>1/2 cup, 120ml</td>
</tr>
</tbody>
</table>
| Chapatis      | Diameters of 19, 22, & 25 cm  
Three thicknesses of each. |
| Chicken breast| 85g            |
| Chicken drumstick | 85g            |
| Cornflakes    | 3/4 cup        |
| Orange        | Small          |
| Orange Juice  | 120ml          |
| Peach         | 114g           |
| Peas          | 1/2 cup, 120ml |
| Potato        | 200g (Divided into four 50g portions) |
| Rice          | 1/3 cup        |
| Steak         | 99g            |

**ii.** One set of metric spoons and measuring cups.

Serving sizes and weights are as specified on the models by the manufacturer. All models except Chapatis are from Nasco.
APPENDIX D:  QUESTIONNAIRE

Code no: ______________

I:
1. AGE ________________ years  2. SEX M ___ F ___
3. HEIGHT ________________ cm
4. WEIGHT ________________ Kg
5. Diabetes duration __________________________

6. Current treatment:
   a. ___ Diet only       b. ___ Diet with tablets

7. Complications or accompanying medical condition:
   a. ___ None           b. ___ Eye problems
   c. ___ Neuropathy     d. ___ Foot problems
   e. ___ Kidney problems
   f. ___ Hypertension   g. ___ Heart disease
   h. ___ Skin infection
   Other__________________________

9. Marital status:
   a. ___ Married  b. ___ Single  c. ___ Widowed
d. ___ Divorced

10. Monthly family income range:
    a. ___ < Rs. 1500     b. ___ Rs. 1500 - 3000
    c. ___ Rs. 3000 - Rs. 6000  d. ___ Rs. 6000 - 10,000
e. ___ > Rs. 10,000

11. Total number of family members living together __________________________

12. Level of formal Education:
    a. ___ None           b. ___ None, but can read Urdu
    c. ___ Primary        d. ___ Secondary e. ___ Intermediate
    f. ___ Higher         g. ___ Professional degree

13. Occupation: __________________________

14. Active hobbies: __________________________
15. WHAT REGIMEN WERE YOU ADVISED TO FOLLOW?

a. __ Avoid Sugar/ Sweet foods
b. __ Avoid starchy foods
c. __ Lower total energy intake: Level/day? 

d. __ Reduce weight: Goal weight? 

e. __ Tablets: Per day? 

f. __ Urine testing: How often? 

g. __ Blood testing: How often 

h. __ Visiting clinic: How often? 

i. __ Exercise: Hours per week? 

j. __ Fasting in Ramadan? Yes/No/Restricted

Other

16. SELF CARE CHECKLIST:
a. How much conscious exercise did you engage in last week? 

b. Do you test blood for sugar? __ Yes __ No
   If Yes, how often? 

c. Do you test urine for sugar? __ Yes __ No
   If Yes, how often? 

d. How many tablets do you usually take per day? __

e. How many of your last four appointments at the clinic did you miss? 

f. Do you try to fast during Ramadan? __ Yes __ No
   If Yes, how many days last year? 

17. Who advised you about your regimen?

a. __ Doctor  b. __ Dietitian  c. __ Nurse

Other

18. In what form did you receive your dietary instruction?

a. __ Oral  b. __ Printed dietary guidelines  c. __ Diet charts Other 

19. Has there been any change in the dietary advice since you were first diagnosed? __ Yes __ No

20. How much time was spent with you when explaining your regimen for the first time? 

21. How often do you visit the clinic?

a. __ More than once a month  b. __ Once a month

c. __ Once every two months  d. __ In case of a problem
22. Do you see the same doctor every time?  __ Yes __ No
23. Does your doctor criticize you?  __ Yes __ No
24. Do you feel that your doctor generally spends enough time with you?  __ Yes __ No
25. Are you satisfied with your understanding of diabetic diets?  __ Yes __ No
26. Are you satisfied with your present medical treatment?  __ Yes __ No

27. What has been your major source of information about diabetes?
   a. __ Doctor  b. __ Clinic personnel
c. __ Family and friends
d. __ Mass media (Radio, TV, newspapers, magazines)
e. __ Specialized publications on diabetes

28. Does a family member other than you suffer from an illness requiring diet modification?
   a. __ No  b. __ Yes, Diabetes
   Other

29. Do you get help from your family in following your diet?
   a. __ Yes  b. __ No

30. If Yes, how?
   a. __ Eating the same foods
   b. __ Cooking meals for you
c. __ Avoiding desserts
d. __ Reminding and checking
e. __ Learning about diabetes
f. __ Coming to clinic with you
g. __ Motivating or joining you in exercise

   Other

31. Do you find any difficulty in following your diet?
   a. __ Yes  b. __ No
   If Yes, what do you think, is the reason?

32. How severe do you think your diabetes is?
   a. __ Very severe  b. __ Somewhat severe
c. __ Not severe
33. In the last twelve months, how many times did you have to go to a hospital or a clinic because of a diabetes related emergency?

34. Do you think you are likely to develop any complications because of diabetes?
   a. __ Hypertension       b. __ Blindness
   c. __ Kidney disease     d. __ Heart disease
   e. __ Cataract           f. __ Numb feet
   g. __ Aching legs        h. __ Gangrene

35. What benefits, if any, do you think one gets if the blood sugar is well controlled?

36. Which particular foods do you believe are good for diabetics (if any)?

37. Which particular foods do you believe are not good for diabetics (if any)?

38. On the whole, how compliant do you consider yourself in following your regimen?
   a. __ Very much so       b. __ Generally compliant
   c. __ Not very compliant d. __ Not at all compliant
DIABETES KNOWLEDGE:

1. It is better for diabetics to have very low blood sugar.  a. ___ True  b. ___ False

2. Being overweight has no effect on people with diabetes.  a. ___ True  b. ___ False

3. Heart disease is one of the possible complications of uncontrolled diabetes.  a. ___ True  b. ___ False

4. Some people have sugar in their urine only, and some have it in the blood too.  a. ___ True  b. ___ False

5. Diabetics need to take special care of their:  
   a. ___ Hands  
   b. ___ Face 
   c. ___ Feet 
   d. ___ Don't know

6. The desirable range for fasting blood glucose is:  
   a. ___ 60 - 80 mg/100ml  
   b. ___ 80 - 115 mg/100ml  
   c. ___ 120 - 200 mg/100ml 
   d. ___ Don't know

7. A person can feel it without testing if their blood sugar has gone up.  
   a. ___ True  b. ___ False  c. ___ Don't know

8. Insulin is:  
   a. ___ A kind of drug  
   b. ___ A hormone found in the body  
   c. ___ Some kind of injection  
   d. ___ Don't know

9. Diabetics can take which of the following kinds of foods freely?  
   a. ___ Lettuce, cabbage cucumber  
   b. ___ Meats  
   c. ___ Fresh fruit  
   d. ___ Don't know

10. A person on a diabetic diet should eat:  
    a. ___ Only when very hungry  
    b. ___ At regular intervals  
    c. ___ Whenever it is convenient  
    d. ___ Don't know

11. What are fibre rich foods?  
    a. ___ Vegetable and plant foods  
    b. ___ Meats  
    c. ___ Don't know  
    Other __________________
II. LIST ALL FOOD ITEMS THAT YOU CONSUMED YESTERDAY:

<table>
<thead>
<tr>
<th>TIME</th>
<th>FOOD</th>
<th>HOW COOKED</th>
<th>QUANTITY</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>

IIc. What kind of fat do you use in cooking?
   a. __ Vegetable oil b. __ Banaspati ghee
   c. __ Desi ghee

Other __________________________

IID. What quantity of this fat is utilized in your household every month/week? __________________________
**APPENDIX E:**

**Socioeconomic Scale Used to Classify Population**

<table>
<thead>
<tr>
<th>Classification</th>
<th>Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower-lower</td>
<td>- No income, dependent on Zakat*, welfare etc.</td>
</tr>
<tr>
<td></td>
<td>- Income &lt; Rs.1500, 5 dependents or more</td>
</tr>
<tr>
<td>Lower</td>
<td>- Constant but meagre income &lt; Rs.1500, 4 dependents or less</td>
</tr>
<tr>
<td>Lower-middle</td>
<td>- Income Rs.1500-3000, 4 dependents or less</td>
</tr>
<tr>
<td></td>
<td>- Income Rs.3001-6000, 5 dependents or more</td>
</tr>
<tr>
<td>Middle</td>
<td>- Income Rs.3001-6000, 4 dependents or less</td>
</tr>
<tr>
<td></td>
<td>- Income Rs.6001-10,000, 5 dependents or more</td>
</tr>
<tr>
<td>Upper-middle</td>
<td>- Income Rs.6001-10,000, 4 dependents or less</td>
</tr>
<tr>
<td></td>
<td>- Income Rs.10,000+, 5 dependents or more</td>
</tr>
<tr>
<td>Upper</td>
<td>- Income Rs.10,000+, 4 dependents or less</td>
</tr>
</tbody>
</table>

* A type of religious charity.

Socioeconomic scale developed by Diabetic Association of Pakistan, Karachi (Ahmad, 1989, p.93)
APPENDIX F:

Schofield Equation for Calculation of BMR (Basic Metabolic Rate)

<table>
<thead>
<tr>
<th>Age 30-60 years:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Males:</strong></td>
<td>$\text{BMR} = 0.048 \text{wt} - 0.011 \text{ht} + 3.670$</td>
</tr>
<tr>
<td><strong>Females:</strong></td>
<td>$\text{BMR} = 0.034 \text{wt} - 0.006 \text{ht} + 3.530$</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Age 30-60 years:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Males:</strong></td>
<td>$\text{BMR} = 0.038 \text{wt} + 4.068 \text{ht} - 3.491$</td>
</tr>
<tr>
<td><strong>Females:</strong></td>
<td>$\text{BMR} = 0.033 \text{wt} + 1.917 \text{ht} + 0.074$</td>
</tr>
</tbody>
</table>

BMR is given in MJ/24 hr

Ht = Height in meters, Wt = Weight in kilograms

Energy Requirement = BMR * Activity factor

- Resting in bed: 1.0-1.2
- Sedentary: 1.3-1.4
- Light work: 1.5-1.6
- Moderate work: 1.7-1.8
- Heavy work: 1.9-2.1

From Schofield (1985)

Examples of Activity Levels

- **Light activity**: Office workers, shopkeepers, professionals such as lawyers, doctors, teachers. Housewives doing light work
- **Moderately active**: Students, workers in light industry and farming, fishermen, soldiers not on active duty, housewives
- **Very active**: Agricultural, mining and steel workers, labourers, athletes

From Khan (1980)
APPENDIX G:

Example SODA Printout for a subject

Diet 131

Analysis of Diet

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Qty</th>
<th>Unit</th>
<th>RDI</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protein</td>
<td>71.8</td>
<td>g</td>
<td>44</td>
<td>163% ++</td>
</tr>
<tr>
<td>Fat</td>
<td>87.0</td>
<td>g</td>
<td>70</td>
<td>124% +</td>
</tr>
<tr>
<td>Carbohydr</td>
<td>230.6</td>
<td>g</td>
<td>280</td>
<td>82% -</td>
</tr>
<tr>
<td>Energy</td>
<td>8123.9</td>
<td>kJ</td>
<td>8654</td>
<td>94% .</td>
</tr>
<tr>
<td>Calcium</td>
<td>1270.5</td>
<td>mg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phosph</td>
<td>1263.2</td>
<td>mg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Iron</td>
<td>19.0</td>
<td>mg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sodium</td>
<td>2215.3</td>
<td>mg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Potass</td>
<td>2256.2</td>
<td>mg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bcarotn</td>
<td>596.9</td>
<td>Ig</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Retinol</td>
<td>455.4</td>
<td>Ig</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Retn Ac</td>
<td>554.9</td>
<td>Ig</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thiamin</td>
<td>0.5</td>
<td>mg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Riboflvn</td>
<td>1.9</td>
<td>mg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Niacin</td>
<td>5.5</td>
<td>mg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Niacin Eq</td>
<td>17.4</td>
<td>mg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asc Acid</td>
<td>61.7</td>
<td>mg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alcohol</td>
<td>0.0</td>
<td>g</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water</td>
<td>1179.0</td>
<td>g</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sugars</td>
<td>39.5</td>
<td>g</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Starch</td>
<td>0.0</td>
<td>g</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fibre</td>
<td>13.0</td>
<td>g</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nitrogen</td>
<td>5.0</td>
<td>g</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Magnesium</td>
<td>156.5</td>
<td>mg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zinc</td>
<td>5.5</td>
<td>mg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cholest</td>
<td>258.8</td>
<td>mg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sat Fat</td>
<td>17.9</td>
<td>g</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mono Fat</td>
<td>10.4</td>
<td>g</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poly Fat</td>
<td>1.1</td>
<td>g</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Energy Source

Protein  15.0%
Fat      39.6%
Carbohydr 45.4%
Alcohol  0.0%
Other    0.0%
## APPENDIX G (cont.)

### Foods In Diet

<table>
<thead>
<tr>
<th>Qty</th>
<th>Code</th>
<th>Source</th>
<th>Food</th>
</tr>
</thead>
<tbody>
<tr>
<td>500.0</td>
<td>J1500</td>
<td>UK</td>
<td>Milk whole</td>
</tr>
<tr>
<td>55.0</td>
<td>X0083</td>
<td>Own</td>
<td>Fried egg</td>
</tr>
<tr>
<td>60.0</td>
<td>X0023</td>
<td>Own</td>
<td>Bread, white, double-roti</td>
</tr>
<tr>
<td>244.0</td>
<td>X0064</td>
<td>Own</td>
<td>Lassi</td>
</tr>
<tr>
<td>240.0</td>
<td>X0001</td>
<td>Own</td>
<td>Bread, chapati</td>
</tr>
<tr>
<td>100.0</td>
<td>X0061</td>
<td>Own</td>
<td>Potato bhujia curry</td>
</tr>
<tr>
<td>65.0</td>
<td>X0038</td>
<td>Own</td>
<td>Mutton curry</td>
</tr>
<tr>
<td>35.0</td>
<td>X0033</td>
<td>Own</td>
<td>Cucumber</td>
</tr>
<tr>
<td>125.0</td>
<td>X0084</td>
<td>Own</td>
<td>Kachoomer, Onion, tomato, cucumber salad</td>
</tr>
<tr>
<td>170.0</td>
<td>J1910</td>
<td>UKA</td>
<td>Yoghurt, plain</td>
</tr>
</tbody>
</table>
APPENDIX H:

Glossary of Foods

Baadi foods- A class of foods believed to be difficult or 'heavy' to digest. Some examples are cauliflower, some root vegetables, Maash daal.

Besan flour- Flour made out of chickpeas or grams.

Besan flour chapati- An unleavened chapati made either entirely out of Besan flour or a combination of Besan and wheat flour. It is usually served buttered or oiled.

Chapati or Roti- Flat, unleavened bread made usually of wheat flour, cooked on a girdle.

Ghee- Collective term for most solidified cooking fats. Desi ghee is clarified butter fat, while Banaspati ghee is the solidified shortening obtained from commercial saturation of vegetable oils.

Lassi- A drink made usually from yoghurt or milk, blended with water with sugar or salt added.

Pakoray- Fritters made out of besan flour batter. Vegetables such as onions or potatoes are dipped in the batter and deep fried.
Diet and Self-care in Pakistani diabetic Patients

Mona Hanif Sheikh

A thesis submitted in fulfilment of the requirement of the Master of Science (Honours)

School of Food Sciences
Faculty of Science and Technology
University of Western Sydney (Hawkesbury)

1993
PLEASE NOTE

The greatest amount of care has been taken while scanning this thesis,

and the best possible result has been obtained.
DECLARATION:

The author certifies that this thesis represents her own original work and has not been submitted in any form for another degree or diploma at any university or other institute of tertiary education. Information derived from published or unpublished work of others has been acknowledged in the text and a list of references is given.

The research was approved by the Human Research Ethics Committee of the University of Western Sydney, Hawkesbury (HREC RA.91-9).

Signature..................

Mona Hanif Sheikh
Publication from this work:


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(iv)

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SUMMARY

Two hundred non-insulin dependent diabetic patients, predominantly from three health facilities in Lahore, Pakistan were assessed for metabolic control, weight status, diabetes knowledge, and six areas of diabetes self-care activities as well as dietary intake.

The main study tool was a questionnaire administered in an interview format followed by a 24-hour recall of dietary intake. Glycosylated haemoglobin status were determined on ninety subjects.

The care levels in the studied population appear to be inadequate for satisfactory diabetes control.

Only 5 subjects had HbA1c levels within the normal range (3.5-5.5), while 21 showed extremely high levels (>10). Complications and associated medical conditions were present in more than half of the sample. Diabetes knowledge averaged 4 correct responses out of a total of 11. Considerable variation was noted in the reported care regimens including the dietary regimen, as well as the patients' reported adherence to them.

Logistic regression analysis revealed a number of areas of concern including high fat intake apparently of saturated fat; and a low intake of leafy vegetables, pulses and fruit which along with nutrient analysis results suggests a low fibre intake.

The data from the study points towards the need for improved diabetes education at all levels and identifies several areas of concern to be addressed.