DIETARY FACTORS AND DIABETES

BY

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DECLARATION

I hereby declare that this thesis entitled "Dietary factors and Diabetes" is a bonafied record of research and that the thesis has not formed the basis for the award to me of any degree, diploma, associateship, fellowship or other similar title of any other University or Society.

Vellayani,
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CERTIFICATE

Certified that this thesis entitled "Dietary factors and Diabetes" is a record of research work done independently by Kum. Saramma Abraham under my guidance and supervision and that it has not previously formed the basis for the award of any degree, diploma, fellowship or associateship to her.

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INTRODUCTION

Diabetes mellitus is a chronic clinical syndrome characterised by hyperglycemia due to deficiency or diminished effectiveness of insulin and affects the metabolism of carbohydrate, protein and fats (Davidson, et al., 1975). According to the data collected by the WHO (1985), diabetes is the third commonest disease in the world next to the cardiovascular and oncological disorders. Every fifth person in the world is suffering today from diabetes directly or indirectly. Although exact prevalence rate in India is not known, various surveys indicate that about 2 to 3 per cent of the population suffer from this disease.

Diabetes is of two types, Type I (Juvenile onset diabetes) is insulin dependent and occurs all over the world. Usually it is manifested before the age of 20 years. Type II (Maturity onset diabetes) is non insulin dependent and it is the most common form (Williams, 1984). 90 per cent of the diabetics belong to type II.

Diabetes has been established in modern medicine as an important single disease speciality with its multi-faceted nature and multi-system involvement demanding special clinical attention.

The management of diabetes is very important. Epidemiological studies have established the significant contribution of the factors such as heredity, dietary habits, viz., consumption of refined carbohydrate and a reduced intake of fibre, urbanization with associated affluence and the stress of life, in the aetiology of type II diabetes mellitus. Thus the dietary management is one of the major non pharmacological treatments of diabetes mellitus. The patients' education is very important in the management of diabetes mellitus. Much new information pertinent to the role of nutritional management of diabetes mellitus emerged between 1979 and 1985. Information on the different type of carbohydrate food exchanges and the glycemic value of different carbohydrates abounded. The nature of different forms of fibre had been elucidated; the role of fat studied in detail and even the importance of protein with their possible harmful effects on renal function and not escaped attention (Vinik, 1988).

Now-a-days the diabetic patient's education becomes much important and Funnel et al. (1988) developed a curriculum for the education of type II diabetics; they include keeping a food diary, planning meals using various techniques and the basic four food groups, balance of diet, exercise, more sophisticated meal plans and exchange system for meal planning.

The key to achieving effective meal plan is the education of a diabetic person regarding basic nutrition, food selection and preparation, daily food plans and the nutritional composition of food. The diet therapy for diabetics improves the overall health of the patients by attaining and maintaining optimum nutrition.

The present study was conducted in 150 families on the basis of the following objectives:

1. To study the dietary habits of the families of diabetic patients.
2. To study various factors, such as social, cultural, economic and educational background of the families of diabetic patients, which affects the dietary habits.
3. To assess the impact of diabetic clinic on the existing dietary pattern of the patients and their health conditions.
4. To correlate the dietary pattern and metabolic derangement of the major nutrients.

and

5. To impart diet counselling to patients and to assess the impact of the modified diet on serum profile.

REVIEW OF LITERATURE

REVIEW OF LITERATURE

PREVALENCE OF DIABETES

Diabetes mellitus is a genetically determined disorder or carbohydrate metabolism characterised by glucosuria, fasting hyperglycemia and development of microvascular complications and accelerated atherogenesis (Welborn, 1983). According to WHO estimation (1985) diabetes mellitus affects two per cent of the world population and the prevalence ranged from 1 to 2 per cent. In United States diabetes mellitus was the fifth leading cause of death and approximately 4.2 million person suffered from this disorder (Krall, 1984). According to the study of Cahell (1975) and Steinke and Soeldner (1977) the incidence of diabetes mellitu increased markedly with aging. Wadsworth and Jarret (1974) reported that in United States the prevalence of diabetes wa 1.4 per 1000 in person aged 16 years, 2.2 per 1000 at 20 yea of age and 3.4 per 1000 at 25 years of age. Christan et al., 1977 reported that the prevalence rates of insulin dependent diabetes in Denmark in 1973 ranged from 0.2 per 1000 in children aged 0 - 4; increasing progressively to 2.9 per 100 in the age group 20 to 24.

Every year the number of diabetics is increasing by 6.25 per cent in the Western countries (Ajgaonkar, 1982).

The President of the International Diabetes Federation, Dr Krall (1984) highlights that as a Nation becomes better developed, diabetes also increased and it is estimated that there are 50-75 million diabetics in the world.

Malnutrition diabetes was first reported some 30 years ago in Jamaica as type 'j' diabetes and now it is considered under a broader term, tropical diabetes (Khan, 1983). According to Zimmet (1982) Caucasion population had comparatively low prevalence rates of the disease, 2 to 4 per cent and high prevalence rates of 17.5 per cent were reported among Polynesians of New Zealand.

A recent study in Tanzania by Ahren and Corrigan (1985) showed that the incidence of diabetes varied from 0.2 to 2.1 per cent in adults in Tanzania. Zimmet (1986) said that the incidence of non insulin dependent diabetes increased from zero to 27 per cent with the adoption of modern life style with Western influences and specifically due to over nutrition.

Harris (1988) reported that gestational diabetes was one of the risk factors for non insulin dependent diabetes more prevalent among women meeting this criteria.

According to Butler et al. (1982) the incidence of diabetes was more prevalent in female than in male and this greater female prevalence for all age group was correlated with greater female obesity.

WHO (1980) reported various risk factors associated with the disease such as heredity, high birth weight, obesity, oral contraceptives, mental stress and trauma.

Along with the control of various communicable diseases, diabetes mellitus has become a common clinical entity even in developing countries (Dutta et al. (1987). Diabetes mellitus was an important health problem in India with an overall prevalence of 1.8 per cent (Ahuja, 1979). Ahuja and Kumar (1976) reported the prevalence of diabetes to be 2.1 per cent in the urban and 1.5 per cent in the rural population. As per Geevarghese and Abraham (1984), the prevalence of diabetes was 1.2 per cent in rural population and 2.4 per cent in urban population in India. The study further indicated that persons with sedentary work pattern like office workers were easier victims to this disease since 5.8 per cent of the diabetic patients belonged to this category. According to Sathe (1973) in the hospital series in India the incidence of diabetes was 2.5 per cent and it varied from 0.7 per cent of the admission

in Pondicherry to 11.3 per cent at Madras, 8.7 per cent in Trivandrum, Lucknow had 2.3 per cent, Delhi 2.26 per cent, Bombay 2.6 per cent, Hubli 2.2 per cent and Hyderabad 4.12 per cent. The study of Ahuja (1979) revealed that in India there was a greater incidence of diabetes in men than women, the ratio being 2.6 : 1.6.

WHO (1980) has reported that malnourished diabetes was more common in Kerala. As per the reports of WHO (1980) certain types of diabetes were related with malnutrition and this type is more prevalent in Kerala and Indonesia. In a study of diabetic mortality at the Medical College Hospital, Trivandrum during a period of 7 years, diabetes was fifth among 10 major cause of death (Roy, 1986).

INFLUENCE OF SOCIO ECONOMIC AND DIETARY PATTERN IN DIABETES

Improvement in dietary habits and socioeconomic status along with awareness of the necessity for frequent medical evaluation had led to increased overall prevalence of the disease which is still a complex phenomenon on account of the multifactorial origin (Tripathy et al., 1979). Mangal et al. (1983) and Alleyne et al. (1979) studied about social factors related to the control of diabetes and found that in mild diabetic patients, proper control was not influenced by any social variable examined, but in severe diabetics the control

an understanding of the disease. The study of Kerin O Dea, et al. (1988) in Australian aborigines, revealed that as the duration of urbanization increased the degree of susceptibility to type II or maturity onset diabetes increased.

Khan (1983) reported that tropical diabetes, emphasising the prevalence in tropical countries, had some association with unfavourable socioeconomic back ground. According to Krall (1984) there is evidence that as a nation becomes better developed diabetes also increased. Bonham and Brock (1985) reported that black individuals were slightly more likely to report diabetes than white individuals. An epidemilogical study of diabetes mellitus in a rural population of Uttar Pradesh was carried out by Srivastava et al. (1987) and it was found that the prevalence rates were significantly higher in subjects belonging to higher socioeconomic groups.

Mc Culloch et al. (1980) conducted study in 541 white diabetic men between twenty and fifty nine years and it was found that 15 per cent drank heavily and this may be the predominant factor causing symptoms of diabetes. American diabetes Association (1987) reported that restricting alcohol intake and cessation of smoking were also included in the basic non pharmacologic therapy of diabetes.

Food intake was determined on the basis of a 2 to 3 day semiquantitative dietary record by Keen et al. (1979) and concluded that both body mass and blood glucose levels were universely correlated with energy intake. Welborn (1984) reported that positive association was seen between excess energy consumption, obesity, dietary fat intake and urban factors in relation to prevalence of diabetes.

According to Mc Millian and Geevarghese (1979) the malnutrition diabetes was associated with specific dietary intake like dietary cyanide from cassava and other foods. Teuscher et al. (1987) revealed that existence of malnutrition related diabetes was not confirmed among the rural population in Africa, whose diet was found to be 84 per cent carbohydrates and 8 per cent proteins and cassava was eaten once in a day.

OBESITY AND DIABETES

Obesity and diabetes were reported to have the most frequent pathological association and over 70 per cent of diabetics were over weight and more than 50 per cent of patients with advanced obesity had reduced glucose tolerance (Thashev, 1986). Welborn (1984) reported a positive association

between obesity and diabetes. According to Butler et al. (1982) diabetes was more prevalent in obese females in all age groups. A recent study by Ramachandran (1988) had found that obesity was not a precipitating factor when it came to the prevalence of diabetes in Indian men but obesity was related to diabetes in Indian Women. A study conducted by Akintewe and Adetuyibi (1986) revealed that, of the diabetic patients attending the out patient hospital in Ibaadan, Nigeria, 29 per cent were obese. The report of the Framingham study by Kannel et al. (1979) suggested that high density lipoprotein cholesterol and triglycerides were inversely correlated with obesity; beta and pre beta lipo protein were positively correlated with obesity and the obese persons had a tendency to be most likely to have glycosuria and an increased prevalence of diabetes. Mcguire et al.(1979) revealed that the pattern of parameter changes seen with obesity was similar to that of maturity onset diabetes. According to Thashev (1986) the association between obesity and diabetes could be put down to overnutrition and to a hyper energy food and for obese diabetic patients, the normalization of body weight was the most important therapeutic measure. According to Lee (1981) and Nuttal and Gannon (1981) obesity was a major determinant in the etiology of non insulin dependent diabetes mellitus.

American Diabetes Association (1979) recommended that the key mode of therapy of diabetic patients with obesity was weight reduction. According to Wheeler et al. (1971) and West and Kalbfleesh (1987) diabetes was a major health problem highly correlated with obesity and therefore with over eating. The study of Gutzeit et al. (1979) concluded that spinymice on the Geneva diet had developed massive obesity and the liability of Geneva spinymice to develop diabetes may be caused by the obesity induced diet used in the colony. The fact that insulin resistance in spinymice, occur without the development of hyper insulinemia suggest that similar mechanism may operate in the development of glucose intolerance in human, low-insulin respondees. Young et al. (1979) revealed that, upper limits of normal glucose for glucose tolerance test in the obese were much higher than currently accepted criteria and the high insulin levels and delayed peak insulin occured in the majority of patients with normal glucose tolerance but were absent in many of the obese patients. According to Coleman (1978) the association of the disease diabetes with a liberal diet may depend on the development of obesity and diabetes as a complication in susceptible persons eating excess or there may be specific dietary factors which influenced the development of diabetes. Pelig (1975) has reported that the milder form of diabetes, the so called adult onset

variety was associated with obesity in 60 to 80 per cent of the patients: The pathogenic mechanism of diabetes and obesity was explained by Thashev (1986) and the study revealed that a relative insulin resistance takes place in obesity in peripheral tissues, mainly in adipose tissues, while the insulin excretion was normal or increased and this reduction in the sensitivity to insulin of the large adipocyte could be attributed to the decreased affinity of the insulin receptors or to a reduction in their number in the cell membrane. Ravussin and Zawadzki (1987) suggested that a reduced thermic effect of glucose causes or precipitates obesity in Non insulin dependant diabetes mellitus because a low thermic response was the consequence of the increased insulin resistance and opposed by greater increases in resting metabolic rate.

Harton (1988) revealed that the rationale for the use of exercise as part of the treatment in type II diabetes and that it may be prescribed as an adjustment to improve insulin sensitivity in the obese insulin resistant individuals. Hansen (1988) reported that individuals with an upper body form of obesity show greater association with higher glucose excursion, exacerbated insulin resistance, increased abnormality of lipoprotein, profile, and higher cardiovascular risk.

He again recommended that weight reduction and improvement in blood glucose control through dietary intervention for obese person with non insulin dependent diabetes was the greatest potential for reducing morbidity and mortality.

DIET AND DIABETES

Attempts to manage diabetes mellitus by diet were made by the physicians in India as early as 2500 years ago (Viswanathan, 1978). Wood and Bierman (1972) reported that the short term objective of present day diet therapy was preventing hyperglycemia and glucosuria and should also aim at helping to delay and minimise its fateful complication. American diabetes association (1979) and Vuksan (1984) recommended that physicians should continue to emphasize diet therapy as the prime form of treatment for maturity onset diabetes. Lestradet (1986) reported that a restricted diet remains the basic treatment for mature or obese patients with normal or high blood insulin; where as in diabetics with insulin deficiency, treatment was by carefully adjusted hormone substitution and a good balanced diet was appropriate.

According to Vuksan (1984) the patients should avoid fasting or feasting, their intake from day to day should be

maintained with adjustments for exercise and appetite. Vlachokosta et al. (1988) pointed out that the diet had an important role in insulin requirement in diabetes.

Calories

American diabetes Association (1979) and Pohl et al. (1984) are of the suggestion that, the diabetic diet should be nutritious, adjusted in calories content to achieve or maintain normal body weight. This recommendation was again stressed by the American Diabetes Association (1986) that the diet should be presented in an appropriate level of energy, including sufficient calories for normal growth and development. According to British Diabetes Association (1982) diet was the most important in the management of the diabetic patient and current recommendations focus on the importance of a total energy intake according to the patient's needs. Wing et al. (1984) suggested that the weight loss programme gave more importance in diabetic diets because the diabetic patients had more difficulty in losing weight than non diabetics.

The study of Bouch and Dempe (1976) revealed that the diet of diabetic patients should contain carbohydrate in a slowly absorbed form, protein of animal origin and fats rich in

poly unsaturated fatty acids. West (1976) recommended the modified diet which specified 50 to 60 per cent of the calories come from carbohydrate, 10 to 15 per cent from protein and 30 to 35 per cent from fat. American Diabetes Association (1986) recommended that the amount of carbohydrate should be liberalised ideally up to 55 to 60 per cent of total calories, protein 0.8 g/kg body weight, fat comprise 30 per cent of total calories and cholesterol 300 mg/day.

National Institute of Health (1987) reported that a weight reducing diet should be nutritionally complete with various foods; moderate calorie restriction of 500 to 1000 K cal below daily requirements may be optimal in producing gradual sustained weight loss.

Carbohydrate

According to the recommendation of American Diabetes Association (1986) the diabetic diet should be individualized with the amount dependent on the impact on blood glucose and lipid levels and individual eating patterns. Kolterman et al. (1979) suggested that high carbohydrate diets led to a general increase in insulin's ability to promote glucose removal from plasma and the paradox of enhanced insulin sensitivity.

Bruenzell (1978) and Bohannon et al. (1978) opined that since carbohydrate was an integral part of diabetic diet, it should be varied as regulated rather than restricted. Akgun and Ertel (1985) and Bonhannen et al. (1978) reported that glucose increases post prandial blood sugar more than sucrose and much more than does fructose and some type of starch. Crapo et al. (1977) reported that starches from different foods resulted in different postprandial blood sugar level. Dilawari et al. (1987) revealed that diet with 75 g Carbohydrate mainly from legumes significantly decreased blood glucose concentration when compared with equivalent amount of carbohydrate taken in the form of cereals and dextrins. Gannon et al. (1986) reported that the plasma glucose response to ingestion of fruits and milk products could be predicted from the constituent carbohydrate. There were no medium term metabolic contradiction to using moderate amount of sucrose upto 28 g as a sweetner in the diabetic diet (Cooper et al., 1985).

Margaret and Davidson (1974) reported that there was no need to restrict disproportionality in the intake of carbohydrate in the diet of diabetic patients. Similarly Brunzell et al. (1974) showed that the improvement in oral glucose tolerance on high carbohydrate diet was actually more apparent in mild obese diabetes than in normals.

Thorn burn et al. (1987) conducted studies and showed that there was a good correlation between starch digestibility and plasma glucose response and the traditional carbohydrate diets digested and absorbed, was protective against diabetes. Vuksan (1984) opined that in all diabetics the amount and time of food intake, particularly the carbohydrate should be controlled to prevent fluctuations of blood glucose beyond normal level. Macdonald and William (1988) showed that at any glucose dose level the serum insulin response was approximately 40 per cent greater in men compared to women.

Protein

Rosett (1988) pointed out that the recommendation for protein in the management of diabetes was very important because of the role that dietary protein plays in over all health, in the control of diabetes, and in the risks to health posed by diabetes. National Institute of Health (1987) recommended that there was no need to change the standard 12 - 20 per cent protein content of the diet, providing RDA requirement were met except in those who have specific problem in which protein intake should be reduced. American diabetes Association (1986) recommended that protein allowance was 0.8 g/kg body weight for the diabetic patients. Rosett (1988) evaluated the protein requirement and recommended the same allowance.

Insulin secretion also appeared to be enhanced by specific amino acids such as leucine, which is not glucogenic and arginine which is known to be glucogenic (Floyd et al., 1970). Nambu et al. (1984) reported that the impaired glucose tolerance caused by the imbalance of α and β cell function in islets is stimulated by arginine. It has been suggested that high protein diet may benefit individuals with non insulin dependent Diabetes mellitus by enhancing insulin secretion (Nuttal, 1983).

Seino et al. (1983) suggested that the consumption of protein followed by carbohydrate to enhance diabetic control has been advocated. A protein sparing, low calorie high protein diet (1.5 g/kg) facilitating weight loss while protecting lean body tissue had been recommended for obese individuals with non insulin dependent diabetes mellitus (Bistrain et al., 1976 and Landau et al., 1981).

Nambu et al. (1985) conducted studies and concluded that 30 g of soy protein isolate may be excessive for adequate control of non insulin dependent diabetes mellitus. Cohen et al. (1987) found out that in insulin dependent diabetics with proteinuria, restriction of dietary protein had a beneficial effect on microalbuminuria.

Fat

Suzuki and Goto (1983) and Mark and Truswell (1985) reported a relationship between diabetic death rate and high fat diet. Nuttal (1979) suggested that the high saturated fat diets play an important role in the genesis of degenerative vascular disease. National Institute of Health (1987) reported that a diet reduced in total and saturated fat and cholesterol has been recommended for diabetic patients because they showed an increased risk for coronary heart diseases. American Diabetes Association (1986) recommended that total fat content of the diabetic diet was reduced and replacement of saturated fat with unsaturated fat may slow the progress of atherosclerosis and the addition of certain fats such as eicosapentanoic acid and monounsaturated fats may be acceptable. Arky et al. (1982) suggested that because of an increase of atherosclerotic heart disease in both types of diabetes, the recommendations has been made that total and saturated dietary fat and cholesterol be reduced, with replacement by equal calorie amounts of carbohydrates, in an attempt to reduce blood lipid levels. Piper et al. (1986) reported the occurence of essential fatty acid deficiency in individuals following a high carbohydrate and fat restricted diet. Dunn and Carrol (1988) revealed that the fat derived

calories do not alter short term basal or post prandial insulin requirements in type I diabetes. Kissebah and Schectman (1988) reported that the risk factors of diabetes including plasma lipids and lipoproteins were target for altered dietary habits, particularly regarding fat and a fat modified diet had some significant evidences in the relationship between diabetes and lipoprotein metabolism.

Fiber

Munoz et al. (1979), Parsons (1984) and Pohl et al.(1984) revealed that high fiber diet improved the glucose tolerance. Bose (1979) suggested that high fiber Bengalee diet was less prone to hyper glycemic in comparison to fiber free diets. Toma and Curtis (1986) found that the high intake of dietary fiber was good for diabetes and he suggested that food technologists must produce a wide variety of high fiber foods for diabetics. The same observation was reported by Trowell(1978) and Anderson and Ward (1979). Increased intake of dietary fiber in the diet resulted in lowered post meal plasma glucose, decreased glucosuria and decreased insulin requirement. According to Goulder et al. (1978) adding unabsorbable polysaccharides, gums and pectin produced post prandial decrease in blood glucose in normal and diabetic subjects. The fibers that is most effective were those with the highest viscosity (Jenkins et al., 1978).

Holt et al. (1979) revealed that the effectiveness of highest viscosity fiber may be related to an effect on the slowing of gastric emptying. Mann (1986) reported that the most consistent recommendation of several national diabetes organizations have been to achieve optimum energy intake and to increase fiber rich cereals and vegetable foods at the expense of fat. Trowell (1987) proved that prolonged consumption of fiber depleted white rice was diabetogenic. Paisy et al. (1987) reported that in the gestational diabetic patients the physiological viscous fiber of leguminous and cereal fiber appeared to be necessary to maintain normal blood glucose level. Stevens et al. (1985), American Diabetes Association (1986) and Vinik and Jenkins (1988) suggested that high fiber diets especially soluble variety and soluble fiber produced some effects like improvement in carbohydrate metabolism and low density lipo protein and have other beneficial effect in patients with non insulin dependent Diabetes mellitus. The same result was obtained by Majemmike et al. (1985) with the diet containing guar. Toma et al. (1988) confirmed that a significant reduction of post prandial hyperglycemia and moderate less significant reduction of insulinemia after the high fiber meal. Nadar et al.(1988) pointed out that the use of soyabean and fenugreek as source of fiber reduced plasma glucose in obese and diabetic rats and human subjects.

Special food items

Sharma (1987) reported that fenugreek seeds, a common condiment in India, decreased hyparglycemia serum cholesterol and serum triglyceride in diabetics. Munari et al. (1988) showed that the stems of opuntia (Cactus), a particular variety caused a hypoglycemic effect in patients with non insulin dependant diabetes. Debry et al. (1986) suggested that it was too early to make practical application of the result of recent scientific studies that suggest major dietary modification and further study was necessary to acertain whether long term use of the new diets would bring more benefit than inconvenience to diabetes.

FOOD EXCHANGE LIST AND MENU SUITABLE FOR DIABETES

Diabetic food exchange list was meant to simplify the planning of varied diabetic diets and foods were grouped together on the basis of their composition of carbohydrate, protein and fat for a designated serving size (Suitor and Hunter, 1980). Crapo and Vinik (1987) reported that a task force appointed by American diabetes Association suggested the optimum carbohydrate, protein and fat intakes for diabetics, the use of fibre, the role of the glycemic index and its relation to food exchanges. Franz (1988) emphasized that exchange lists were one of the best methods of diabetic education.

Franz et al. (1987) reported that a committee composed of American Dietetic Association and American Diabetes Association has reviewed exchange lists for meal planning and initiated a plan for field testing and evaluation. Recommendations made by American diabetes Association (1986) for meal planning for a diabetic patient were based on an updated version of the food exchanges supplemented with information on low glycemic index selections. Wolever et al. (1985) opined that an approach to classify foods according to physiologic effects may play useful role in planning meals and diets in which specific blood glucose profiles were required. Kendall et al. (1987) compared the effectiveness of nutrient based (diet guide) with food group (exchange list) methods of diabetic diet in improving dietary compliance, glycemic control and biochemical indications of heart disease risk and concluded that both diet planning methods were effective in reducing the percentage of energy intake from saturated fat.

Uribe et al. (1985) suggested that various dietary regimens had been advocated in the treatment of patients with diabetes Wedman (1980) emphasised the importance of avoiding convenience foods in the menu of diabetic patients, since such foods often sacrifice nutrients during processing,

packaging and were expensive. FDA (1980) recommended that the nutritional labelling provides information which could be used by health professionals and diabetics to increase the variety of convenience foods which may be used. Franz et al. (1987) reported that the American Dietetic Association and American Diabetes Association had developed a simplified meal planning tool, healthy food choices to be used for initial 'survival' level education. American Diabetes Association (1986) suggested that appropriate traditional ethnic and cultural foods could be encouraged in diabetic menu.

Nowalk et al. (1986) studied the impact of tasting food samples on the use of recipies distributed in nutrition counselling and found out that most of the patients had tried the recipe and among them, women were more likely to use recipies they had tasted. Lardinois et al. (1988) reported that mixed meals containing poly unsaturated fatty acids evoked a greater insulin response.

Hall frisch et al. (1988) tested the acceptability of a 7 day high carbohydrate, low fat menu which contained 50 per cent carbohydrate (complex 35 per cent, simple 15 per cent) 35 per cent fat and 15 per cent protein; 100 mg cholesterol, 1g Na and 14.5 g neutral detergent fiber per

1000 k cal and most subjects rated the menu as good as their usual diets. Ross et al. (1987) reported that the processed foods like short bread, biscuits, puffed wheat, crisp bread and wheat starch based custard showed two fold difference in glycemic response as well as insulin response. Viswanathan et al. (1988) found out the glycemic and insulin responses of some breakfast item in diabetic subjects; containing 300 k cal of which complex carbohydrate contribute 68 to 81 per cent protein 12 to 14 per cent and fat 8 to 19 per cent of total calorie, while the dietary fiber content varied from 3.8 to 7.4 g and the result indicated that pongal, uppuma and iddli were suitable for diabetics because their glycemic responses was low and bread was considered unsuitable due to high glycemic response as that of glucose.

Ireland et al. (1985) conducted studies among six men 50 to 69 years old with type II diabetes and reported that diets that consisted mostly of unfefined cereals, legumes, fruits and vegetables, improved metabolic control and a decrease in fasting cholesterol and triglyceride concentration, whereas the diet containing full cream, dairy products, eggs, fatty meats, butter, margarine and oil increased glucose tolerance. Gannon and Nuttal (1987) and Jenkins et al.(1988) recently determined the circulatory glucose concentration after the ingestion of various individual foods and mixed meals.

Mani and Mani (1987) reported that wheat bran supplementations resulted in a transient reduction in fasting and 8 hr post prandial blood sugar. Crapo (1986) concluded that it was necessary to work toward a system that allowed dietary recommendation to be made on glycemic index. Cloulston and Hollenbeck (1988) and Chew et al. (1988) suggested that the glycemic index approach would be useful in planning diets for individuals with diabetes. Jenkins et al. (1988) reported that different starchy foods produce different glycemic responses when fed individually, and there was some evidence that this also applies in the context of the mixed meat. The glycemic response of different foods was examined and the lower response for parboiled rice, where as higher results was obtained in a center that fed regular rice. Crapo et al. (1980), Crapo et al. (1981) and Jenkins et al. (1983).

It was demonstrated that parboiled cereals like wheat, rice etc. were notable in resulting in relatively flat blood glucose profile (Jenkins et al. (1986), Wolever et al. (1986) and Goddard et al. (1984) reported that varieties of long grain rice may be higher in amylose starch and consequently gave a flatter blood glucose response than the amylo pectin rich short grain varieties. Coolings et al. (1981) revealed that cooking would enhance the degree of gelatinization of starch and hence the degree to which it raised the blood glucose.

Coulston et al. (1984), Ogunwole et al. (1987), Thomas et al. (1988) and Viswanathan et al. (1988) suggested that a number of parameters like the mode of cooking and processing, the form of food and the difference in food processing and the difference in food constituents which affected the digestion, absorption and metabolism seem to influence the glycemic and insulin responses. Seshiah et al. (1986 a) reported that the consistency of food, whether liquid, puree or solid, raw or cooked affected starch digestibility and there by glucose response.

Studies on the effects of dietary starch on post prandial plasma glucose and insulin responses conducted by Afloay et al. (1986) and Colaguin et al. (1986) indicated that there were differences in responses to different starchy foods owing possible to difference in the rate of digestion and absorption. Post prandial plasma insulin response was known to be partially dependent on the ability of food constituents like protein and fat to stimulate the generation of a number of gastrointestinal insulinogenic hormones (Kerin O' Dea et al., 1980; and Krezowski et al., 1987).

Wolever et al. (1987) examined the glycemic effect of canned beans and reported that it significantly lowered glycemic indices than those of white bread. Jenkins et al.(1988)

identified potentially and clinically useful starchy foods producing relatively flat glycemic responses and included legume's pasta; grains such as barley, parboiled rice and bulgar (cracked wheat) and whole grain breads; which were associated with reduction in low density lipoprotein cholesterol, and triglyceride levels in hyper lipidemia and with improved blood glucose control in insulin dependent patients.

Hollen beck et al. (1988) indicated that the day long plasma glucose response did not vary substantially when patients with noninsulin dependent diabetes mellitus consumed meals of widely different glycemic potency, providing further evidence that there was relatively little clinical benefit to be gained by designing meals based on the glycemic index of carbohydrate rich foods. Schade et al. (1980) claimed that high carbohydrate meals containing 60 per cent carbohydrate, 14 per cent protein and 20 per cent fat should be administered to the maturity onset diabetes patients during breakfast and lunch and should avoid simple sugar in the afternoon. Bouch and Dempe (1976) suggested that the diabetics should increase the number of times of daily portion and he reported that 5, 6 or 7 daily portions were advantageous than decreasing the number of times of daily portions.

METABOLIC DERANGEMENT OF MAJOR NUTRIENTS

Diabetes mellitus is associated with derangement of glucose, protein and lipid metabolism (Anderson et al., 1987). According to Suitor and Hunter (1980) hyperglycemia is a metabolic derangement which has higher mortality rate (60-70 per cent) than does diabetic keto acidosis. Walshe et al. (1987) studied about the energy restriction in non insulin dependent diabetes mellitus and the result indicated that 3 months of reduction of energy intake with weight loss in newly diagnosed Non Insulin Dependent Diabetic patients improved Cell responsiveness to glucose, but had no effect on liver glucose output or on peripheral insulin action. Unger and Orci (1977) reported that hyperglycemia was a key aetiologic component in the development of the micro angiopathie complications of diabetts mellitus. Margaret and Davidson (1974) reported that precautions against the deleterious metabolic derangement of diabetes like hyper glycemia and glucosuria helped to prevent the gradual development of atherosclerotic disease in all diabetics. Papadakis and Grunfeild (1986) revealed that ketonuria accompanied by significant hyperglycemia was present in hospitalized diabetic patients with Non Insulin Dependent Diabetes Mellitus. Steel et al. (1987) found out that out of 208 young women with insulin dependent diabetis, 7 per cent had anorexia nervosa and a long history of poor glycemic control.

According to suitor and Hunter (1980) hypoglycemia occured when the supply of insulin was so high that all the glucose moves from the blood in to the cells. Jackson et al. (1988) revealed that age related glucose intolerance that developed despite slowed glucose absorption, was characterised by delays in peripheral glucose uptake, but was predominantly the result of impaired peripheral glucose utilization. Paris Bockel et al. (1987) reported that glucose tolerance decreased with age and that the decrease affected post prandial values more than fasting plasma glucose concentrations.

Gurcia et al. (1974) indicated that cardio vascular mortality and morbidity from atherosclerosis were increased two fold in patients with diabetes mellitus. American Diabetes Association (1967) and Sprafka et al. (1988) reported that hypertension and diabetes were commonly associated. Eaton (1979) reported about lipids and diabetes and reviewed the epidemiology of macrovascular disease and diabetic lipedemia, the lipid link to atherogenesis, the possible reversibility of atherogenesis and dietary treatment and demonstrated the feasibility of reducing plasma cholesterol and triglyceride concentration by way of dietary means.

Study of Gaal et al. (1988) demonstrated an association of excess abdominal fat, even without obesity, with worse diabetic metabolic control, cardiovascular complications, and blood lipid levels which were actually considered to pay an important role in atherogenesis. A cross sectional study conducted by Markkulaakso et al. (1988) on the prevalence of atherosclerotic vascular disease and its risk factors in the non insulin dependent diabetic and non diabetic subjects was carried out in East and West Finland and concluded that in both areas and in both sexes the prevalence of coronary heart disease, stroke and intermittent claudication was higher in diabetic than non diabetic subjects. Although there was an excess number of deaths among diabetic subjects compared with normal subjects and subjects with impaired glucose tolerance there was no significant association between cause of death and diabetes (Zimmet et al. (1988).

Kerin O' Dea et al. (1988) reported that among diabetic Australian aborigines, plasma triglyceride levels were high particularly in men of 35 years old but cholesterol levels were not elevated. Anderson et al. (1987) found out the effect of a high protein and low fat diet versus a low protein and high fat diet on blood glucose, serum lipo protein and

cholesterol metabolism in diabetic patients and the diabetic patients were hyperglycemic, very low density lipo protein values were lower than the control. The same abnormalities of fat metabolism was reported by Wahlquist et al. (1986) that arterial compliance values were significantly higher in both and women with type II diabetes. The findings of Kasama et al. (1987) revealed that the risk factors increased in normolipaemic diabetics.

Lesli et al. (1986) studies on young offsprings of non insulin dependent diabetics have indicated that extensive metabolic changes including impaired glucose tolerance may be expected; associated with hyper insulinaemia and hyperglucagonaemia. Gibbons (1986) reported about the abnormalities in plasma lipo protein composition in diabetes which predisposes premature athero sclerosis due to hyperlipaemia. Reaven (1987) revealed that the defects in lipo protein metabolism was a prominent feature of diabetic syndrome. Falko et al. (1987) reported that the reduced HDL cholesterol and HDL_2 cholesterol occur in noninsulin dependent diabetes mellitus, but persons with impaired glucose tolerance did not have the dramatic alterations in HDL levels.

Cohen et al. (1987) studied the relationship of dietary protein and renal functions in diabetes and found that a restricted protein intake had a beneficial effect in the control of albuminuria and glomerular filteration rate. Rosett (1988) reported that one third of individuals with insulin dependent diabetes and one fifth of them with non insulin dependent diabetes developed nephropathy. Campaigne et al. (1987) suggested that acute exercise in insulin dependent diabetes mellitus patients may perturb glyceamic control and adjustment of insulin and diet might be required to avoid post exercise hypoglycemia.

ROLE OF DIABETIC CLINIC AND DIET COUNSELLING

The nutrition sub committee of the medical advisory committee of British Diabetes Association (1987) reported that the practical assessment and education play an essential role in the management of the diabetic condition. Home and Walford (1984) revealed the role of specialist diabetic clinic as opposed to the newer shared care and miniclinic system. An assessment was made by Singh et al. (1984) of the degree of metabolic control in diabetic patients attending a hospital clinic compared with matched patients at a general practices minicline, and found that glycemic control was comparable. Hayes and Harries (1984) reported that routine care of the general practitioner for type II diabetes was found less satisfactory than that in hospital clinics. A survey

conducted by Truswell et al. (1975) of the dietary policy and management in British diabetic clinic showed that there was a great variation in the ideal dietary policy for diabetics and in the best way of helping patients to follow the prescribed regimen. Coulston and Hollenbeck (1988) recommended that dietary guidelines for patients with non insulin dependent diabetes mellitus be issued only when the data for which the dietary changes was being recommended.

Eno (1979) reported that the Canadian Diabetic Association was concerned about the distribution of printed diets to diabetic patients and they were asked to seek personalized dietary counselling from qualified dietitian. Beebe (1987) reported that the primary goal of diabetic management was to maintain blood glucose, there fore the dietitians plays an integral role in identifying patterns in blood glucose profile and assisting the patients in making intelligent dietary choices to improve diabetes control. Crapo and Vinik (1987) suggested that the nutrition education for minority population about diabetes was necessary. White et al. (1986) reported that group management of obese out patient diabetes mellitus was more effective than advice education method. American diabetes association (1984) strongly supports and encourages outpatient education and nutritional counselling. White house et al. (1979) opined that basic diabetic education reinforced by following sessions favourably

Alfrod and Tibbets (1971) reported that group feeding along with an education programme was a valuable method of improving food behaviour. Suzuki (1976) reported that the Key role was played by the patient himself in diabetic control, so the need of education and psychosomatic treatment was stressed. Funnel et al. (1988) developed a curriculum for type II diabetes education, which included all the details about diabetes and the importance of its therapy and the methods of dietary treatment in different levels.

Itamar Raz et al. (1988) evaluated the efficacy of educational group meetings with non insulin dependent diabetic patients on improving their knowledge of the disease and on disease management after twelve month following of the interview group and concluded that educational group therapy could improve diabetes control in patients with non insulin dependent diabetes mellitus. Rosenquist et al. (1986) evaluated the comprehensive programme for diabetic care and reported that several organizational changes had taken place as a result of the programme. According to Gohdes (1988) diet programmes must be tailored to the cultural frame work and traditional foods with desirable characteristics could be encouraged.

According to White et al. (1986) individualization of counselling remained the cornerstone of an effective treatment

plan. Zimmet (1988) suggested that primary prevention of both insulin dependent and non dependent diabetes became increasingly important because of their mortality and morbidity.

Samanta et al. (1987) opined that for dietary advice to be successful, emphasis must be placed on specific types of food eaten together with an understanding of the sociocultural implication of eating practices. According to Grabauskas(1988) the prevention programme of diabetes expanded on the experience gained by WHO investigators in community programmes and proposed a co-operative effert globally in community based programming. American Diabetes Association (1986) recommended that educational tools that were appropriate for the individual should be selected, taking into account age and educational level as well as the level of existing nutritional knowledge. According to American Diabetes Association (1986) a registered dietitian with experience in diabetes management was the ideal member of the multidisciplinary team to provide this education and counselling to the diabetic patients. Hauenstein et al.(1987) reported that skills of the provided dietitian could improve health care by developing further professional expertise in the area of counselling patients with diabetes.

MATERIALS AND METHODS

MATERIALS AND METHODS

The study on the dietary factors and diabetes was based on assessment of:

1. the dietary habits of the families of diabetic patients;
2. social, cultural, economic and educational back ground, of the families of diabetic patients, which affect the dietary habits;
3. the impact of diabetic clinic on, the existing dietary pattern of the patients and their health conditions;
4. the correlation between dietary pattern and metabolic derangement of the major nutrients;
5. imparting diet counselling in which diets were planned making use of food exchange lists to be followed for a period of six months and its impact on the urine and serum profile.

Area of the study

Trivandrum city and suburbs, with the samples mainly obtained from the diabetic clinic of the Medical College and from known cases in and around the Vellayani Campus of the College.

Selection of Samples

A sample is a fraction of a population (Gill, 1979). In this study the samples were selected from the patients attending the diabetic clinic of Trivandrum Medical College. Totally 625 maturity onset diabetic patients are registered in the diabetic clinic.

The maturity onset diabetic patients were selected for the study because this type II or non insulin dependent diabetes is a major health problem, highly correlated with obesity and therefore over eating (Wheeler et al., 1987). 150 samples were selected through simple random sampling. According to Gupta (1985) simple random sampling is the technique in which each and every unit of the population has an equal opportunity of being selected in the sample.

Six patients were selected to be followed up as case studies by purposive sampling. In such cases the samples were drawn according to the requirement of the investigator (Cochran, 1977). These patients were not attending the clinic regularly and were willing to follow a modified diet for the prescribed period of study (six months).

Development of tools

To elicit information regarding the socio economic and dietary pattern of the families as well as patients, interview schedules were developed.

These schedules were formulated in Malayalam keeping in mind the fact that this will be more easy for the interviewer as well as for the patients. The schedules are given in Appendix I and II. In order to study the actual food intake of the family members of the diabetic patients as well as the patients selected as case studies, food weighment survey was also conducted with suitably structured questionnaires as given in Appendix III.

Survey of the socio economic and dietary pattern of the family of diabetic patients.

A socio economic and dietary survey was conducted to collect information regarding the size of the families, occupation, income, educational level and food habits of the family of the diabetic patients. Interview method was selected for collecting data because it could proceed systematically and the information could be recorded as quickly

as possible, and in an informal interview, the answers to one question may lead to other questions which will further clarify the first answer or elicit more information (Bass et al., 1979)

Dietary pattern of the families of the diabetic patients was collected by one day recall method. According to Swaminathan (1974) 24 h recall method is a reliable method to quantify food intake. By this method the investigator collected information, from the subject, about the type and amount of foods consumed by the family. Information regarding the purchase and consumption of various food items by the family was also collected.

Diet survey of the Diabetic patients.

By interview method the data regarding the dietary as well as some personal habits regarding the use of liquor, tobacco etc. were also collected from the patients. Assessment regarding body weight and height were also done. The information regarding the frequency of use of various food items were also collected. Frequency of using sugar, jaggery, salt and different types of cooking oils were also collected. The pattern of eating food outside and the type of exercise by the patients were also collected.

Observation of diet counselling imparted in the diabetic clinic.

The clinic was a speciality clinic and therefore the patients got more care there. According to Hayes and Harries (1984) the routine care in general practice for the type II or maturity onset diabetic patient was found less satisfactory than that in hospital clinic. By interviewing the patients and through observation, the investigator was able to study the impact of the existing diet counselling at the clinic on, the dietary pattern and health condition of the patients. And by interviewing the personnel it was possible to the determine functioning of the clinic.

Dietary pattern of the selected families through food weighment survey.

The dietary assessment method by means of 24 h dietary recall alone is of minimal value in identifying a patient's usual food intake (James et al., 1981). So a food weighment survey was carried out in selected ten families (Appendix III). Food consumption survey provide information on dietary intake and the refinement can be achieved through food weighment survey (Austin, 1980). This method involves actual weighment of raw foods before cooking and this has been considered to be

accurate for assessing food consumption but, it is laborious and time consuming and much dependent on the availability of foods at home (Thimmayamma and Parvathy Rao, 1987).

Individual weighment survey was conducted in six diabetic patients who were selected as case studies to get detailed and accurate records regarding their actual food intake. As all the patients were from the urban area three day weighment of foods was done. The nutritive value of food consumed was calculated using food composition table (ICMR, 1981).

Changes in blood glucose, cholesterol and triglyceride levels in the selected patients.

From the food weighment survey the actual consumption of various food items by the patients were calculated using food composition tables. The heights and weights of the selected patients were recorded. The type of activity of the patient also was taken into consideration. Using these data the investigator worked out whether the patients were over weight or under weight when compared to their ideal body weight, based on the calculations for ideal body weights for diabetic patients recommended by Seshiah et al.(1986 a) which is given in Appendix IV.

Blood, serum and urine profile were estimated as detailed below:

Estimation of blood and urinary glucose.

Blood glucose was analysed by the procedure of Asatoor and King (1954) with the modification that low alkaline copper reagent was used. The urinary glucose was analysed qualitatively. This was estimated because diabetes [illegible] is a disorder of carbohydrate metabolism which in its fully developed clinical expression is characterised by glucosuria, and fasting hyperglycemia (Welborn, 1983). Details of the procedure are given in Appendix V.

Estimation of cholesterol and Triglyceride.

Clinical intervention studies in diabetic patients amply demonstrate the feasibility of reducing plasma cholesterol and triglyceride concentration by way of dietary treatment (Eaton, 1979). Anderson et al. (1987) suggested that diabetes is associated with abnormalities in lipid metabolism. Cholesterol was estimated by the method of Abell (1952).

The details of the procedure of cholesterol estimation is given in Appendix VI.

The serum triglycerides were estimated by the method of Van Handel and Zilver Smit (1957) with the modification that florisil was used to remove phospholipids. The details of the procedure has been given in Appendix VII.

Diet counselling for the case studies.

The American Diabetes Association (1984) strongly supports and encourage reimbursement of out patient education and nutritional counselling that meet accepted standards for persons with diabetes. This however, is not prevalent in India to the desirable extent. So the investigator imparted diet counselling as an experimental measure to study its effect in six selected cases (fig 1 and 2). The investigator contacted the patients individually and convinced them regarding the importance of a modified diet to maintain good health in diabetic condition. They were made aware of various food items to be included in the diet, foods to be restricted, quantity of foods to be consumed and also the food exchange lists which help them to select food items considering their personal choice and to add variety to their modified diets and at the sametime to maintain their body weight 5 per cent less than their ideal body weight (Antia, 1973).

Diabetic food exchange lists are meant to simplify the planning of varied diabetic diets, and foods are grouped together on the basis of their composition of carbohydrate, protein and fat for a designated serving size (Suitor and Hunter, 1980). So the importance of this food exchange list was taught to the patients and the information dessiminated as given in Appendix VIII.

Planning of one week menu.

After imparting diet counselling by the investigator, the patients were convinced and voluntarily followed the modified diet as worked out by the investigator.

The calculations were done considering the distribution of energy from carbohydrate, fat and protein for each person. Individualization in meal planning is important because it provides more flexibility (American Diabetes Association, 1987). Present recommendations of diabetic diet include 60 to 65 per cent of the calories as carbohydrate, 15 to 25 per cent of total calories with fat and protein provide 15 to 20 per cent of the total calories as recommended by Seshiah et al. (1986 a).

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The recommendations of total calories for each patient was calculated by considering the height, weight and activity of each individual patients as given in Appendix IX. The proportion of energy from carbohydrate, fat and protein and conversion of these recommendation for each patient selected as case study has been given in Appendix X.

One week menu was planned by the investigator using food exchange list. The menu has been given in Appendix XI. The foods include low cost easily available fiber rich foods. These foods include legumes, lentils, tubers, greenleafy vegetables, all type of whole grain cereals and fruits (American Diabetes Association, 1987). All the case studies selected were non vegetarians, so the diet was planned accordingly.

Before administering the menu, each item included in the menu was prepared quantitatively by the investigator and was then converted into cups and spoon measurements. The quantity of food items in one day's menu for each patient has been given in Appendix XII. This will help the patient to follow the diet more easily. Measuring cups and spoons were also provided to each patient. The planned menu was adviced to be followed for a period of six months.

Observation of the biochemical profiles

After following the prescribed diet for six months the blood and urine of the casestudies were analysed for glucose, cholesterol and triglycerides as described before. Body weight was also recorded.

Statistical Analysis

The data given in the tables are average values in each case ± SEM. Statistical significance was calculated using students' 't' test (Bennet, 1967).

RESULTS

RESULT

A. Socio-economic and food consumption survey conducted in 150 families of the diabetic patients

Socio-economic and dietary habits of the families of the diabetic patients were determined by assessing the:

1. socio-economic pattern of the families

and

2. food consumption pattern of the families.

1. Socio-economic pattern of the families.

The socio-economic pattern of the families of the diabetic patients with particular reference to area of residence, religion, size of family, age and sex of family members, educational level, occupation, income and expenditure pattern of the families were collected.

Table 1

AREA OF RESIDENCE

Residential area	Number of families	Percentage
Rural	49	32.7
Urban	101	67.3
Total	150	100

As shown in Table 1, among the 150 families surveyed, 32.7 per cent were living in the rural area and 67.3 per cent resided in the urban area.

Table 2

RELIGION OF THE FAMILIES

Religion	Number of families	Percentage
Hindu	89	59.3
Christian	40	26.7
Muslim	21	14.0
Total	150	100

Table 2 reveals that about 59.3 per cent of the families surveyed were Hindus 26.7 per cent were christians and only 14.0 per cent belonged to Muslim community.

Table 3

SOURCE OF INCOME OF THE FAMILIES

Source of income	Number of families	Percentage
Permanent job	69	46.0
Pension	31	20.7
Temporary job	14	9.3
Agriculture	18	12.0
Business/Rent/ Interest from bank	18	12.0
Total	150	100

Table 3 describes the source of income of the families of the diabetic patients. The major source of income for 46 per cent of the families was from permanent jobs. 20.7 per cent of the families received pension as their main source of income. About 12 per cent of the families depended on agriculture for income and again 12 per cent received their income from business/ rent/bank interest etc. Only 9.3 per cent of the families lived on income from temporary jobs.

Table 4(a)

EDUCATIONAL STATUS OF THE FAMILY MEMBERS

Educational status	Number of population	Percentage
Illiterate	9	1.3
Know to read and write	13	2.0
* L.P.S.	61	9.3
** U.P.S.	76	11.6
*** H.S.	202	30.8
College	282	43.0
Children before school going age	13	2.0

* Lower Primary School
** Upper Primary School
*** High School

As revealed in table 4, 1.3 per cent of the population were found to be illiterate while 2.0 per cent knew to read and write. However 43 per cent of the population were College educated and 30.8 per cent had high school education. LPS and UPS level of education comprised 9.3 per cent and 11.6 per cent of the population respectively. 2.0 per cent comprised children below school going age.

Table 4(b) reveals the percentage of family members included in each group of the education level.

Table 4(b)

EDUCATIONAL STATUS OF THE FAMILY MEMBERS

Range of percentage of members	Percentage of families included						
	Before Schooling	Illiterate	Know to read & write	L.P.S.	U.P.S.	H.S.	College
10-15	0.7	—	2	1.3	4	1.3	—
15-20	1.3	2.7	1.3	7.3	10	6.7	2.7
20-25	0.7	—	—	4.7	6	9.3	6
25-30	0.7	—	—	—	1.3	—	—
30-35	—	—	—	6.7	1.3	6	6.7
35-40	—	—	0.7	4.7	7.3	19.3	9.3
40-45	0.7	—	—	—	—	0.7	—
45-50	1.3	0.7	—	0.7	4.7	11.3	12.7
50-55	—	—	—	—	—	—	—
55-60	—	—	—	—	—	4.7	16
60-65	—	—	—	—	2	—	—
65-70	—	—	—	2	0.7	—	4.7
70-75	—	—	—	—	—	3.3	3.3
80-85	—	—	—	—	—	—	—
85-90	—	—	—	—	—	—	2
90-95	—	—	—	—	—	—	—
95-100	—	—	—	1.3	3.3	2.7	12

There were 12 per cent families having 95-100 per cent of the members with college education. Another 12 per cent families having 45-50 per cent of the family members with College education.

The economic status of the families was studied and details are given in table 5 and fig.

Table 5

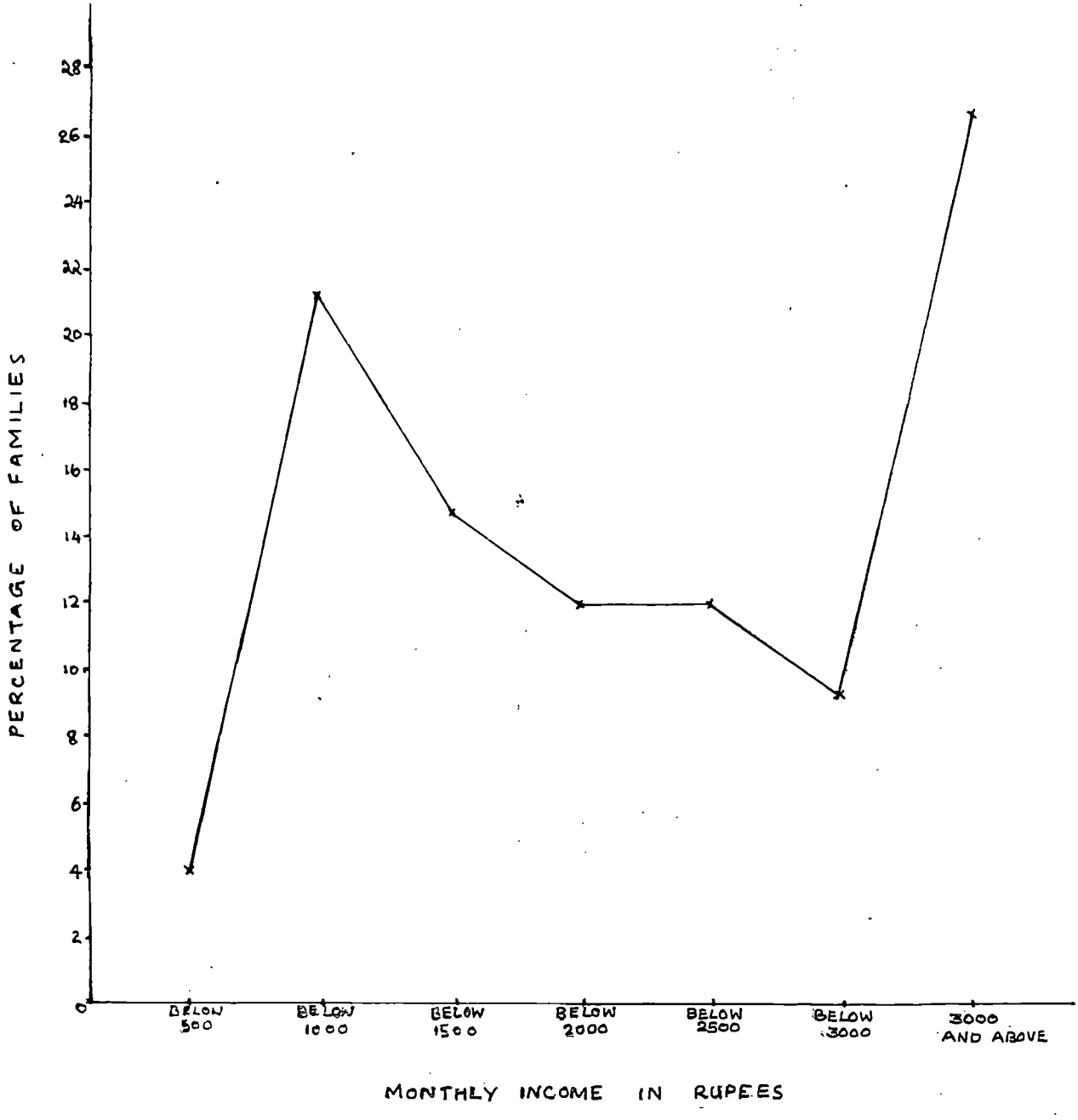
ECONOMIC STATUS OF THE FAMILIES

Income (Rupees per month)	Number of families	Percentage
Below 500	6	4
Below 1000 (500-999)	32	21.3
Below 1500 (1000-1499)	22	14.7
Below 2000 (1500-1999)	18	12
Below 2500 (2000-2499)	18	12
Below 3000 (2500-2999)	14	9.3
3000 and above	40	26.7
Total	150	100

As depicted in table 5 majority of the families (26.7 per cent) surveyed belonged to the high income group.

FIGURE 3

ECONOMIC STATUS OF THE FAMILIES



Only 4 per cent of the families were found to have an income below Rs.500/- per month. 21.3 per cent had a monthly income below Rs.1000/- 14.7 per cent had a monthly income between Rs.1000 and 1500/- 12 per cent had an income between Rs.1500/- and Rs.2000/- and another 12 per cent between Rs.2000/- and Rs.2500/- 9.3 per cent of the families came under the group with monthly income between Rs.2500/- and Rs.3000/-

Table 6

DETAILS OF FAMILY SIZE

Size of the family	Number of families	Percentage
Below 3 members	24	16
3-5 members	93	62
6-8 members	31	20.7
9-11 members	2	1.3
Total	150	100

Details of the family size of the 150 families surveyed are presented in table 6. As indicated in the table, most of the families (62 per cent) consisted of 3 to 5 members. 16 per cent consisted of below 3 family members,

20.7 per cent constituted of 6 to 8 family members and only 1.3 per cent of the families surveyed consisted of 9 to 11 members.

Table 7

AGE-WISE DISTRIBUTION OF THE FAMILY MEMBERS

Age	Percentage of total members	Percentage of male members	Percentage of female members
Below 3 years	2.0	0.9	1.1
Children upto 12 years (3-12)	8.7	5.5	3.2
Adolescents (13-18 years)	14.5	5.5	9.0
Adults (able 18 years)	74.8	37.6	37.2
Total	100	49.5	50.5

Table 7 indicates that among the total families surveyed majority were adults (74.8 per cent) without much variation between male and female population (37.6 and 37.2 per cent respectively). 14.5 per cent were teenagers, in which female population exceeded the male population (9.0 per cent and 5.5 per cent respectively). Children upto 12 years constituted 8.7 per cent and only 2.0 per cent belonged to the age group below 3 years.

Table 8

ECONOMIC DEPENDANCY OF THE FAMILY MEMBERS

Status	Number of members	Per-centage	Economic dependency ratio (EDR)
Economic independent	239	36.4	--
Economic dependent	417	63.6	1.8

Table 8 indicated that of the 656 members of 150 families only 239 members had jobs and were economically independent. The rest 417 members compressing 63.6 per cent of the total were economically dependent.

The monthly expenditure pattern of the families was divided in to various range from 0to5 per cent to 76 to 80 per cent of the total income. Monthly expenditure pattern of the families surveyed is given in table 9. No family spent less than 15 per cent of the income on food. Among the 150 families studied more than 50 per cent of the families (53.3 per cent) spent between 16 to 50 per cent of their monthly income on food while 6.7 per cent families spent more than 75 per cent on food.

Table 9

MONTHLY EXPENDITURE PATTERN OF THE FAMILIES

Range of monthly expenditure in percentage	Percentage of families spending on different items							
	Food	Clothing	Shelter	Education	Entertainment	Health	Saving	Miscellaneous
0-5	—	30.7	29.3	6.7	70.7	48	18.7	24
6-10	—	50.7	52.0	30.7	21.3	36	21.3	30.7
11-15	—	16.0	8.0	16.0	5.3	6.7	14.7	9.3
16-20	1.3	2.7	8.0	5.3	—	5.3	9.3	4.0
21-25	1.3	—	2.7	6.7	—	4	2.7	2.7
26-30	8.0	—	—	—	—	—	1.3	4
31-35	5.3	—	—	—	—	—	1.3	—
36-40	16.0	—	—	—	—	—	—	—
41-45	13.3	—	—	—	—	—	—	—
46-50	8.0	—	—	—	—	—	—	—
51-55	9.3	—	—	—	—	—	—	—
56-60	13.3	—	—	—	—	—	—	—
61-65	8.0	—	—	—	—	—	—	—
66-70	10.0	—	—	—	—	—	—	—
71-75	4.0	—	—	—	—	—	—	—
76-80	2.7	—	—	—	—	—	—	—

Regarding the expenditure on clothing, majority of the families (81.4 per cent) spent only upto 10 per cent of their income on clothing and no family spent more than 20 per cent on this item.

81.3 per cent of the families spent 10 per cent of their income for housing and the expenditure for this never exceeded 25 per cent of the family income.

Among the 150 families surveyed, only 65.4 per cent of the families incurred expenditure on education, of which most of the families (37.4 per cent) spent upto 10 per cent and 6.7 per cent of families spent 25 per cent of their monthly income on education.

Regarding the expenditure on entertainment, majority of the families (70.7 per cent) spent only 0 to 5 per cent of their income.

Expenditure on health in most of the families (84 per cent) was between 0 to 10 per cent. About 4 per cent of the families spent 25 per cent of their income on health aspects.

69.3 per cent of the families had monthly savings, of which most of the families (54.7 per cent) saved 0 to 15 per cent of their monthly income. About 1.3 per cent of the families managed to save upto 35 per cent of their income. However no family saved more than 35 per cent of their monthly income.

Table 10

PERCENTAGE OF INCOME SPENT ON FOOD BY FAMILIES UNDER DIFFERENT INCOME GROUPS

Percentage of income expenditure on food	Percentage of families with monthly income						
	Below 500	500-999	1000-1499	1500-1999	2000-2499	2500-2999	3000 and above
16-20	—	—	—	—	—	—	1.3
21-25	—	—	—	—	—	—	1.3
26-30	—	—	—	—	—	—	8.0
31-35	—	—	—	—	—	—	5.3
36-40	—	—	—	—	1.3	9.3	5.3
41-45	—	—	2.7	—	2.7	—	8
46-50	—	—	4.0	—	4.0	—	—
51-55	—	—	2.7	6.7	—	—	—
56-60	—	8.0	3.3	—	—	2	—
61-65	—	2.7	1.3	4.0	—	—	—
66-70	2.0	8.0	0.7	—	—	—	—
71-75	1.3	2.7	—	—	—	—	—
76-80	2.0	0.7	—	—	—	—	—

Table 10 reveals that in low income families (Rs.1000/- 60 to 80 per cent of the income was spent on food. As income increased (Rs.1000 to Rs.2000/-) the expenditure on food for most of the income. In the Rs.2000 to 3000/- monthly income group families, the food expenditure was between 35 to 50 per cent and in the high income group families (Rs.3000/-) majority of them (10.7 per cent) spent only 30 to 40 per cent of their income on food.

2. Food consumption pattern of the families.

Table 11

FOOD HABIT OF THE FAMILIES

Group	Number of families	Percentage
Non vegetarians	138	92
Vegetarians	12	8
Total	150	100

Table 11 indicates that among the 150 families surveyed 92 per cent were non vegetarian families and the rest 8 per cent were vegetarians.

Table 12

FREQUENCY OF PURCHASE OF VARIOUS FOOD ITEMS

Food items	Percentage of families purchasing food				
	Daily	Weekly	Monthly	Occasionally	Never
Wheat and rice	3.3	46.7	50	—	—
Other cereals	—	8.7	26.7	48.7	16
Pulses	2	43.3	54.7	—	—
Green leafy vegetable	24	54	3.3	18.7	—
Roots & Tubers	7.3	52	8.7	32	—
Other vegetables	10	90	—	—	—
Fruits	8.7	24	55.3	12	—
Milk	100	—	—	—	—
Fish	62	20	—	10	8
Meat	—	52	24	16	8
Egg	5.3	52	5.3	29.3	8
Oil seeds	6	28	45.3	20.7	—
Fats & Oils	—	32	56	12	—
Sugar & Jaggery	—	36.6	63.3	—	—
Spices & condements	—	30	70	—	—
Bakery items	10	32	13.3	42.7	—

Table 12 shows the frequency of purchase of various food items by the families. Most of the families studied, purchased food items such as wheat and rice, pulses, fruits, oil seeds especially coconuts, sugar and jaggery, fats and oil and spices and condiments on a monthly basis. Roots and tubers, other vegetables, meat and eggs were weekly purchased by most of the families. Daily purchase was limited to food items such as green leafy vegetables, milk and fish. 16 per cent of the families were not in the habit of buying cereals other than wheat and rice. While 48.7 per cent purchased other cereals occasionally. 10 per cent of the families studied, purchased bakery items daily while 42.7 per cent purchased bakery items occasionally.
8 per cent of the families did not purchase non vegetarian foods such as fish, meat and eggs.

Table 13(a) indicates that food items such as Rice, Wheat, Green gram, Black gram fruits mainly in the form of banana and vegetables were included in the daily diet of majority of the families. 70 per cent of the families did not use ragi at all and 1.3 per cent included ragi daily.

Table 13(a)

FREQUENCY OF USE OF VARIOUS FOOD ITEMS BY THE FAMILIES

Foods	Percentage of families using different food items					
	Daily	Weekly Once	Weekly Twice	Weekly Thrice	Occasionally	Never
Rice	100	--	--	--	--	--
Wheat	73.3	8	10.7	4	4	--
Ragi	1.3	--	2.7	--	26	70
Rava	8	12.7	7.3	10	42	20
Maida	4.7	5.3	4	10	52	24
Green gram	34	16	31.3	6.7	12	--
Bengal gram	4	20	35.3	4.7	36	--
Red gram	8.7	10.7	42.7	4	34	--
Black gram	35.3	14.7	15.3	34.7	--	--
Potato	6.7	9.3	13.3	2.7	58	--
Tapioca	4	10.7	2.7	4	70.7	8
Colocasia	--	4	9.3	2	67.3	17.3
Yam	--	3.3	6.7	2	63.3	24.7
Carrot	2.7	11.3	15.3	6.7	60	4
Beet root	2	8.7	13.3	6	64	4
Amaranth	23.3	13.3	14.7	11.3	36.7	--
Chekkurmanis	--	9.3	13.3	2.7	52.7	22
Drumstick leaves	12.7	10	13.3	4	56.7	3.3
Fruits	60	--	12	5.3	22.7	--
Other vegetables	92	--	2.7	5.3	--	--

Other food items like rava, maida, tapioca, colocasia and drumstick leaves were not used by some of the families surveyed. Majority of the families included all food items in their diet occasionally.

Table 13(b)

FREQUENCY OF USE OF VARIOUS FOOD ITEMS BY THE FAMILIES

Foods	Percentage of families using different food items					
	Daily	Weekly Once	Weekly Twice	Weekly Thrice	Occasionally	Never
Milk	100	—	—	—	—	—
Curd	80.7	4.7	2.	5.3	7.3	—
Butter milk	56.7	2	4.7	6	30.7	—
Cheese	—	—	—	—	8	92
Chicken	—	8.7	3.3	—	80	8
Duck meat	—	—	—	—	61.3	38.7
Beef	—	13.3	10	8.7	47.3	20.7
Mutton	—	6.7	2.7	8.7	5.3	8
Fish	70	5.3	2.7	8.7	5.3	8
Hen's egg	40	3	5.3	12.7	28	8
Duck's egg	4	—	—	2	14.7	79.3
Oils	100	—	—	—	—	—
Ground nut	10.7	7.3	12	2	68	—
Sesamum	—	8	—	—	84	8
Coconut	100	—	—	—	—	—
Sugar	100	—	—	—	—	—
Jaggery	—	—	—	—	100	—
Processed foods	52	5.3	12.7	18	12	—
Bakery items	10	3	3.3	10	70.7	—

Table 13(b) shows that all the families included milk, oils, coconut and sugar daily in their diet. While majority of the families consumed food items such as curds, butter milk, fish, egg and other processed foods like pickles and jam daily. Almost all the families (92 per cent) were not in the habit of using cheese, and some families did not use any of the non vegetarian foods. All other food items were used occasionally by many of the families.

Table 14

INCLUSION OF VARIOUS FOOD ITEMS IN THE MENU

Foods	Percentage of families including different food items during			
	Break fast	Lunch	Evening tea	Dinner
Cereals	100	100	14	100
Pulses	41.3	45.3	22	12.7
Leafy vegetables	--	49.3	--	20
Roots & tubers	10.7	38	9.3	12
Other vegetables	6	86	2	56
Fruits	54.7	1.3	26	2.7
Milk & milk products	100	82	100	61.3
Meat	6	21.3	--	6
Fish	--	85.3	--	42.7
Egg	40	8.7	8	4.9
Fats & oils	100	100	24	100
Sugar/Jaggery	100	--	100	7.3
Processed foods	--	36.7	24	--
Bakery foods	4.7	--	47	--

The daily inclusion of various food items in the menu is shown in table 14. Among the 150 families studied all of them included cereals along with milk, sugar and fats and oils, while some families (41.3 per cent) supplemented the cereal based breakfast with pulses and most of them had fruits and eggs (54.7 and 40 per cent respectively) during breakfast time. This indicates that majority of the families studied followed a breakfast pattern mainly cereals based supplemented with pulses, milk and fruits. Regarding lunch, all families had rice supplemented with pulses (41.3 per cent) and all other food groups. Foods such as fruits and eggs were not used during lunch time (1.3 and 8.7 per cent). For tea time all families included milk and milk products with sugar and most of the families (47 per cent) consumed bakery items such as cakes, biscuits and other snacks and fried items during tea time. Dinner pattern was same as that of lunch. Many of the families included vegetables and fish preparation along with rice for dinner (56 and 42.7 per cent). A small percentage of families took pulses, green leafy vegetables and roots and tubers during dinner time (12.7, 20 and 12 per cent respectively). Most of the families surveyed took milk products during dinner and used oil as a cooking medium during breakfast, lunch and dinner.

Table 15

COOKING OILS AND FATS USED BY THE FAMILIES

Fats/Oils	Number of families	Percentage of families
Coconut oil	9	6
Palm oil	46	30.6
Sanola	8	5.3
Ground nut oil	4	2.7
Coconut oil and palm oil	69	46
Palm oil and groundnut oil	4	2.7
Sanola, Palm oil and Coconut oil	4	2.7
Palm oil, Vanaspathi and Coconut oil	4	2.7
Gingelly oil and Coconut oil	2	1.3
Total	150	100

The use of various fats and oil by the families are given in table 15. It was seen that majority of the families (46 per cent) used coconut oil along with palm oil. 30.6 per cent of the families used only palm oil. 6 per cent of the families used coconut oil alone and sanola was used by 5.3 per cent of the families. 2.7 per cent of the families used groundnut oil for cooking. Other combination of oils used

for cooking by the families were palm oil, groundnut oil and sanola (2.7 per cent), palm oil and groundnut oil (2.7 per cent), palm oil, coconut oil and vanaspathi (2.7 per cent) and coconut oil with gingelly oil (1.3 per cent).

Methods of cooking applied for different foods by the families are revealed in table 16 and it was found that most of the families (about 63.3 per cent) used the boiling and straining method for cereal cookery. 76 per cent of the families used the boiling and absorption method for cooking pulses. Majority of the families (72.7 per cent) made curry with roots and tubers. Almost all the families used boiling and absorption method for cooking leafy vegetables and other vegetables 42 per cent of the families used steamed fruits. 58.7 per cent of the families used egg both in the boiled and fried forms.

Daily consumption of sugar, salt and oil by family members are shown in table 17. Regarding sugar consumption in most of the families (55.3 per cent), individuals consumed more than 30 g of sugar per day, among which, in 47.7 per cent of the families sugar consumption was too high (50/ g/person). In 72 per cent of the families the salt consumption was between 10 to 30 g/person.

Table 16

METHOD OF COOKING OF VARIOUS FOOD ITEMS

Foods	Percentage of families adopting different methods of cooking								
	Boiling		Steaming	Frying	curry	Boiling and frying	curry boiling frying	Broiling straining frying	Steaming frying
	Absorption	Straining							
Cereals	—	63.3	—	—	—	—	—	36.7	—
Pulses	76	—	—	—	—	—	24	—	—
Roots & tubers	—	5.3	22	—	72.7	—	—	—	—
Leafy vegetables	100	—	—	—	—	—	—	—	—
Other vegetables	62.7	—	—	—	—	6.7	—	28	—
Fruits	—	—	42	—	—	—	—	—	—
Fish & Meat	—	—	—	—	26.7	—	73.3	—	—
Egg	—	—	16	25.3	—	—	—	—	58.7

Table 17

DAILY USE OF SUGAR, SALT AND OILS BY THE FAMILIES

g/day/ person	Sugar		Salt		Oil	
	Number	Percentage	Number	Percentage	Number	Percentage
Below 10	3	2	15	10	--	--
10-20	28	18.7	91	60.7	55	36.7
20-30	36	24	37	24.7	47	31.3
30-40	23	15.3	7	4.7	26	17.3
40-50	38	25.3	--	--	20	13.3
Above 50	22	14.7	--	--	2	1.3

Majority of the families (68 per cent) restricted fat consumption within 30 g while in some families (30.7 per cent) fat consumption was between 30 to 50 g. In 1.3 per cent of the families fat consumption was too high (50 g per day).

Diet during special occasions in the family.

Among the 150 families studied almost all the families (94.7 per cent) celebrated birth days by making special sweet preparations like payasam. Marriage was celebrated by arranging feasts by all families. On the occasion of death many families (42.7 per cent) made kanji with pulses. Religious festivals were also celebrated by all families accordingly.

Diet during special physiological conditions.

Regarding the dietary pattern of the family members during special physiological conditions, almost all families considered that toddlers needed more milk and eggs in their diet. For school children and adolescents, eggs were given daily. During pregnancy and lactation no special foods were included in the diet. It was same as that of the usual family diet but with an added quantity.

For old age people the diet was mainly in the born of a cereal porridge, in almost all families.

B. Food intake of the family members assessed by weighment method

Dietary intakes of the family members of diabetic patients viz., adult men and adult women was assessed by three day weighment method. Comparison of their diets were made with the recommended daily allowance of ICMR (1981).

Table 18

AVERAGE QUANTITY OF FOODS CONSUMED BY THE MALE FAMILY MEMBERS

N=10

Food groups	RDA	Amount consumed(g)	Percentage of RDA
Cereals	400	386.0	96.5
Pulses	55	67.5	119.1
Leafy vegetables	100	132.0	132.0
Roots and Tubers	75	26.0	34.7
Other vegetables	75	42.5	56.7
Fruits (mainly Banana)	30	81.0	270.0
Milk and milk products	100	628.0	628.0
Fats and Oils	40	48.0	120.0
Meat and Fish	30	126.5	421.7
Eggs	30	32.0	106.7
Sugar	30	49.5	165.0

Table 18 reveals the actual quantity of various food items consumed by the male members of the families, of selected diabetic patients. It was seen that on an average their cereal consumption was satisfactory, which met about 96.5 per cent of the RDA, but regarding the consumption of pulses, it was more than the RDA (119.1 per cent).

Food groups such as roots and tubers and other vegetables did not meet the recommended allowances (34.7 and 56.7 per cent of RDA respectively). Inclusion of other food groups like milk and milk products, fats and oils, flesh foods and sugar far exceeded the recommended allowances.

Table 19

NUTRIENTS CONSUMED BY THE MALE FAMILY MEMBERS

N = 10

Nutrients	RDA	Amount consumed	Percentage of RDA
Protein (g)	68	94.5	138.9
Energy (K cal)	2600	2653.8	94.8
Calcium (g)	0.4-0.5	1.2	240
Iron (mg)	20	30.6	153
Vitamin A (Retinol ug)	750	742.6	99
Thiamin (mg)	1.4	1.6	114
Ribo flavin (mg)	1.5	1.9	126.7
Niacin (mg)	19	18.2	95.8
Vitamin C 9(mg)	50	208	416

The average nutrient consumption of the male family members of selected diabetic patients was calculated from their food intake and is shown in table 19. It was found that

energy consumption, was 94.8 per cent of the recommended daily allowance. Vitamin A intake was 99 per cent of the recommended allowance and Niacin 95.8 per cent. All the other nutrients like protein calcium, iron, thiamin, riboflavin and vitamin C exceeded the recommended allowance.

Table 20

QUANTITY OF FOODS CONSUMED BY THE FEMALE FAMILY MEMBERS

N=10

Food groups	RDA	Amount consumed (g)	Percentage of RDA
Cereals	300	228	96
Pulses	45	44.2	98.2
Leafy vegetables	125	45.9	36.7
Vegetables	75	90	120
Roots and Tubers	50	42.5	85
Fruits (Mainly Banana)	30	97.5	325
Egg	30	26	86.7
Flesh foods	30	53	176.7
Milk & milk products	100	619	619
Sugar	30	43.3	144.3
Fats and oils	35	39	111.4

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Table 20 shows the average quantity of foods consumed by the female members, of the selected families of diabetic patients. Regarding the quantity of cereals and pulses 96 and 98.2 per cent respectively of the recommended daily allowance was met. Consumption of leafy vegetables, roots and tubers and eggs were below the RDA. Consumption of other items such as vegetables, fruits mainly in the form of banana, flesh foods, milk and milk products, sugar and fats were very high when compared to RDA.

Table 21

NUTRIENTS CONSUMED BY THE FEMALE FAMILY MEMBERS

N=10

Nutrients	RDA	Amount consumed	Percentage of RDA
Protein (g)	51	72.2	141.6
Energy (K cal)	2200	2451	111.4
Calcium (g)	0.4-0.5	1.3	260
Iron (mg)	30	29.1	97
Vitamin A (Retinol ug)	750	733	97.7
Thiamin (mg)	1.1	1.2	109
Riboflavin (mg)	1.2	1.9	158
Nicotinic acid (mg)	15	11.2	74.7
Vitamin C (mg)	50	109.6	219.2

Table 21 shows the average consumption of nutrients by the female members of selected families of diabetic patients. The intake of nutrients like iron and vitamin A met 97 and 97.7 per cent of the RDA. There was a deficiency of nicotinic acid in their diet which met only 94.7 per cent of the RDA. Regarding other nutrients like protein, calories, calcium, thiamin, riboflavin and vitamin C all exceeded the RDA.

C. Personal characteristics and dietary pattern of the diabetic patients

The personal characteristics and dietary pattern of the diabetic patients were analysed and the results are described in the following tables.

Table 22

MALE AND FEMALE POPULATION OF DIABETIC PATIENTS SURVEYED

Sex	Number of people	Percentage
Male	76	50.7
Female	74	49.3
Total	150	100

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Table 22 depicts that among the 150 diabetic patients surveyed, 50.7 per cent were male patients and 49.3 per cent were female patients.

Table 23

OCCUPATIONAL STATUS OF THE PATIENTS

Status	Number	Percentage
Retired	32	21.3
Full time job	46	30.7
Temporary job	9	6
Business	7	4.7
Unemployed house-wives	56	37.3
Total	150	100

Table 23 reveals the occupational status of the patients. About 30.7 per cent of the diabetic patients had full time job, 21.3 per cent of patients were pensioners, 6 per cent had tem-porary job, 4.9 per cent were business men, while 37.3 per cent of the patients were unemployed house-wives.

Table 24

EDUCATIONAL STATUS OF THE PATIENTS

Level	Number of patients	Percentage
Illiterate	—	—
Know reading & writing	7	4.7
L.P.S.	18	12
U.P.S.	22	14.7
H.S.	47	31.3
College	56	37.3
Total	150	100

The educational status of the patients is given in table 24. It was found that 37.3 per cent of the patients were college educated, where as 31.3 per cent were high school educated. LPS and UPS educated patients comprised 12 and 14.7 per cent respectively. 4.7 per cent knew only to read and write and no one was illiterate.

Table 25

AGEWISE DISTRIBUTION OF THE DIABETIC PATIENTS

Age range	Male	Percentage	Female	Percentage
31-35	2	1.3	4	2.7
36-40	2	1.3	9	6
41-45	5	3.3	7	4.7
46-50	13	8.7	14	9.3
51-55	14	9.3	11	7.3
56-60	21	14	16	10.7
61-65	7	4.7	7	4.7
66-70	7	4.7	2	1.3
71-75	5	3.3	4	2.7
Total	76	50.6	74	49.4

Table 25 reveals the various age groups to which the patients belonged. Majority of the male and female patients studied (32 and 27.3 per cent respectively) belonged to the age group between 46 to 60. Female patients were more (13.4 per cent) in the age group 31 to 45 when, compared to male patients (5.9 per cent) in the same age group. However between the age range 61 to 75 there were more male patients (12.7 per cent) compared to female patients (8.7 per cent).

The age at onset of the disease was studied and the details are given in table 26 and fig. 4

Table 26

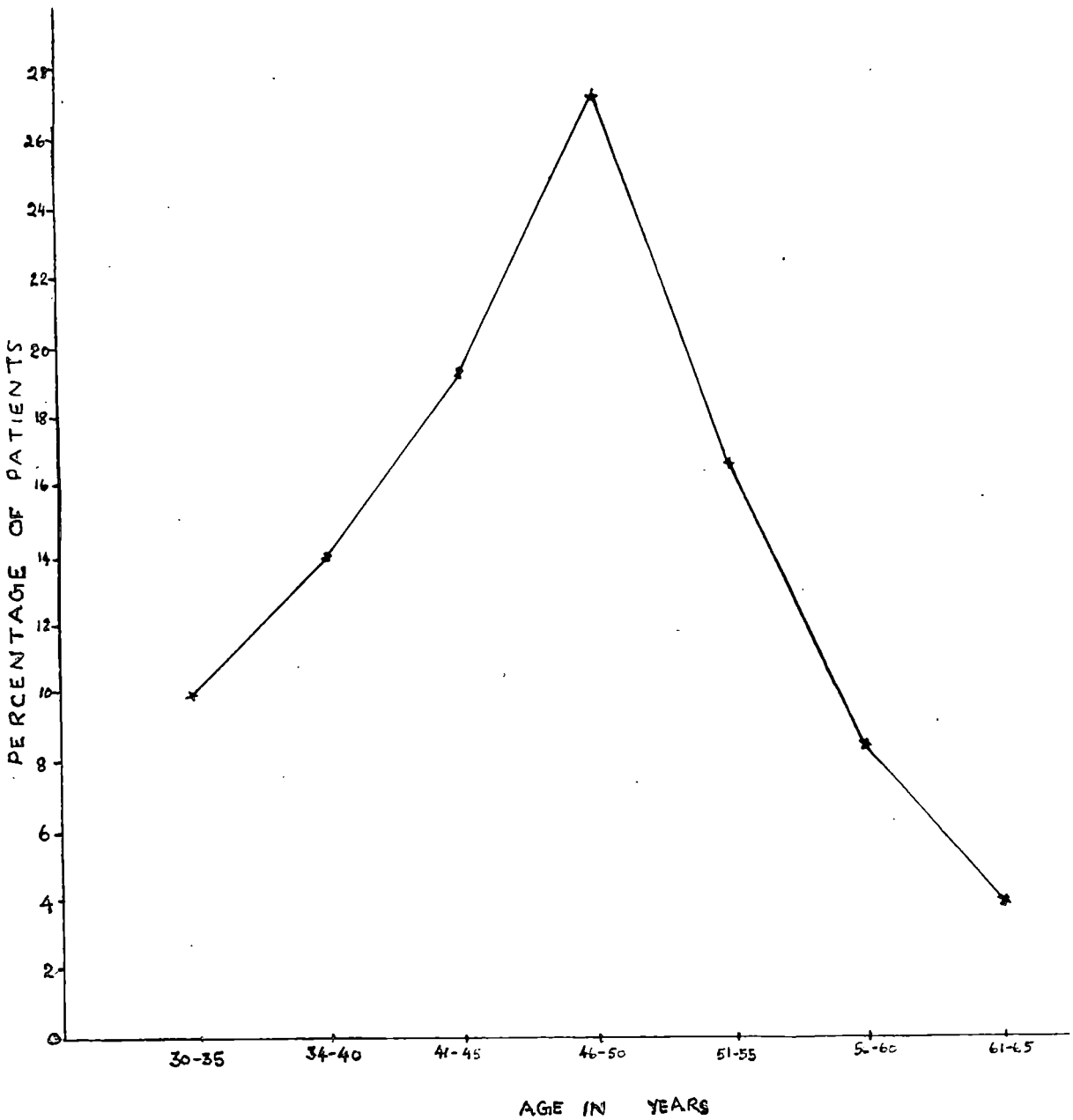
AGE OF INCIDENCE OF DIABETES

Age	Number of person	Percentage
30-35	15	10.0
36-40	21	14.0
41-45	29	19.3
46-50	41	27.3
51-55	25	16.7
56-60	13	8.7
61-65	6	4.0
Total	150	100

Table 26 depicts the age at which diabetes was first diagnosed in patients. Among 150 patients studied majority of them (63.3 per cent) developed the disease between the age 41 to 55, of which 27.3 per cent developed at the age between 46 to 50. 10 per cent of the patients developed the disease at a very early age of 30 to 35. But as the age increased beyond 55, the occurance was less (12.7 per cent).

FIGURE 4-

AGE AT ONSET OF DIABETES



Only 36 per cent of the patients knew their blood groups, of which majority came under the group O positive.

The incidence of various diseases among the relatives of the diabetic patients were analysed and the details are given in table 27.

Table 27

DISEASE HISTORY OF RELATIVES OF THE PATIENTS

Diseases	Percentage of patients whose relatives having the diseases								
	Father	Mother	Father and Mother	Brother	Sister	Father Brother/ Sister	Mothers Brother/ Sister	No history of disease	Not knowing about the incidence
Diabetes	19.3	8.7	4	4.7	4	6	4.7	24.7	24
Obesity	2.7	4	-	1.3	4.7	-	-	63.3	24
Heart disease	3.3	1.3	-	4	2.7	2-7	1.3	62	24
B.P.	3.3	10	-	1.3	4	-	-	57.3	24
Kidney disease	1.3	1.3	-	-	-	-	-	73.3	24
Asthma	1.3	-	-	-	1.3	-	-	73.3	24

Majority of the patients (52 per cent) reported the incidence of diabetes among their relatives. The incidence was more among fathers (19.3 per cent) when compared to mothers (8.7 per cent). The same pattern was seen with paternal relatives (6 per cent) when compared to maternal relatives (4.7 per cent).

Among the patients with a family history of obesity (12.7 per cent) and high blood pressure (28.7 per cent), the incidence was more among the female members of the family. The incidence of obesity being 4 per cent among mothers and 4.7 per cent among sisters when compared to fathers and brothers (2.7 and 1.3 per cent respectively). The rate of incidence of high blood pressure among mothers and sisters was also high (10 and 4 per cent respectively) when compared to the incidence among fathers and brothers (3.3 and 1.3 per cent respectively).

Among the patients who were reported to have a family history of cardio vascular disease (14 per cent), the incidence was more among fathers when compared to mothers and sisters (1.3 and 4 per cent respectively). Majority of the patients did not have a family history of asthma or kidney diseases.

Incidence of other diseases among diabetic patients is revealed in table 28.

Table 28

INCIDENCE OF OTHER DISEASES AMONG DIABETIC PATIENTS

Diseases	Number of patients	Percentage
High blood pressure	34	22.6
High cholesterol	3	2
Heart diseases	13	8.7
Asthma	3	2
Arthritis	5	3.3
Goitre	1	0.7
Not having any diseases	91	60.7
Total	150	100

Majority of the patients (60.7 per cent) were reported to have no associated diseases. However 33.4 per cent of the patients had vascular diseases such as high blood pressure (22.6 per cent), heart diseases (8.7 per cent) and high cholesterol levels (2 per cent). Some patients were reported to have asthma (2 per cent), arthritis (3.3 per cent) and goitre (0.7 per cent).

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The body weight of the diabetic patients was studied to find out whether they were under weight, normal or over weight persons. The result is shown in table 29.

Table 29

BODY WEIGHT OF THE DIABETIC PATIENTS

Group	Number	Per-centage	Male	Per-centage	Female	Per-centage
Under weight	32	21.3	12	8	20	13.3
Normal weight	74	49.3	44	29.3	30	20
Over weight	44	29.3	20	13.3	24	16

Among the 150 families studied, majority (49.3 per cent) were normal weight patients. 29.3 per cent of the patients were over weight and the incidence of obesity was more among female patients (16 per cent) when compared to male patients (13.3 per cent). Among under weight patients (21.3 per cent) also the incidence was more among female patients (13.3 per cent)

The waist measurement of the diabetic patients were studied to find out the extent of obesity in patients and it is shown in the table 30.

Table 30

WAIST MEASUREMENT OF THE PATIENTS

Measurement in inches	Number of person	Percentage
28-30	12	8
31-33	18	12
34-36	28	18.7
37-39	76	50.7
40-42	16	10.6
Total	150	100

It was found that majority of the patients (50.7 per cent) had the waist measurement between 37. to 39 inches. 18.7 per cent of the patients had the measurement between 34 to 36 inches, 8 per cent had the waist measurement between 28 to 30 inches, while 10.6 per cent had it between 40 to 42 inches.

Details regarding the alcohol consumption tobaco chewing and smoking habits of the diabetic patients were studied and is given in table 31.

Table 31

ALCOHOLISM, SMOKING AND TOBACCO CHEWING HABITS OF THE DIABETIC PATIENTS

Group	Alcohol consumption		Smoking		Tobacco Chewing	
	Number	Percentage	Number	Percent	Number	Percentage
Users	3	2	26	17.3	11	7.3
Abstainers	27	18	21	14	18	12
Non users	120	80	103	68.7	121	80.7
Total	150	100	150	100	150	100

Among the 150 patients studied majority were not in the habit of drinking, smoking or tobacco chewing (80, 68.7 and 80.7 per cent respectively) Many of the patients stopped drinking (18 per cent) smoking (14 per cent) and tobacco chewing (12 per cent) after the onset of the disease. But still 17.3 per cent of the patients were in the habit of smoking, while alcohol consumption (2 per cent) and tobacco chewing (7.3 per cent) were reduced.

The details of the coffee or tea consumption habits of the diabetic patients are given in table 32.

Table 32

HABIT OF DRINKING COFFEE OR TEA BY THE DIABETIC PATIENTS

Number of time in a day	Percentage of patients using tea/coffee					
	With milk and sugar		No sugar no milk		Without sugar with milk	
	Coffee	Tea	Coffee	Tea	Coffee	Tea
1	2.7	--	--	--	2	5.3
2	--	4	--	2	1.3	14.7
3	--	--	--	--	12	26.7
4	--	--	--	--	5.3	8
5	--	--	--	--	2	8
6	--	--	--	--	--	6

Among the 150 diabetic patients studied majority (38.7 per cent) were in the habit of consuming coffee (12 per cent) and tea (26.7 per cent) without sugar but with milk thrice a day. The consumption of these beverages with milk and sugar did not exceed twice a day for majority of the patients. But without sugar 29.3 per cent consumed coffee and tea upto 6 times a day and 23.3 per cent consumed it only twice a day.

Among the patients (26.7 per cent) reduced the frequency of consumption of coffee and tea. When enquired about the reasons for doing so, majority (15.3 per cent) suggested that as they had to stop using sugar they reduced the consumption of these beverages. Some patients (8 per cent) reduced the frequency due to the occurance of the disease and others (3.3 per cent) to avoid disturbances during sleep.

The initial symptoms noted by the diabetic patients were studied and the details are given in table 33.

Table 33

INITIAL SYMPTOMS OF DIABETES IN PATIENTS

Symptoms	Number of patients	Percentage
Fatigue	32	21.3
Thirst and hunger	30	20
Frequent urination	16	10.7
Fatigue/thirst and hunger	25	16.7
Appearance of abcess	18	12
Frequent urination	6	4
Thirst and frequent urination	12	8
Fatigue, thirst, hunger and frequent urination	11	7.3

The above table indicated that fatigue (21.3 per cent) followed by thirst and hunger (20 per cent) were experienced by the patients before diagnosing the disease. Other major initial symptoms were appearance of abcess (12 per cent) and frequent urination (10.7 per cent).

Details regarding the diagnosis of the disease by the patients were studied and is presented in table 34.

Table 34

DIAGNOSIS OF DIABETES

Type of test	Number	Percentage
Urine test	38	25.3
Blood test	10	6.7
Urine and blood test	102	68
Total	150	100

Majority of the patients (68 per cent) diagnosed the disease through both urine and blood test. 25.3 per cent diagnosed the disease through urine test along while some patients (6.7 per cent) diagnosed diabetes through blood test.

The type of medical care followed by the diabetic patients after diagnosis of the disease was analysed and is given in table 35.

Table 35

MEDICAL CARE AFTER DIAGNOSIS

Type of medical care	Number of patients	Percentage
1. Hospital speciality clinic	126	84
2. Hospital general clinic + speciality clinic	11	7.3
3. Speciality clinic + Medical practitioner	7	4.7
4. Speciality clinic + Ayurvedic medicine	6	4
Total	150	100

84 per cent of the patients attended the hospital's speciality clinic after the diagnosis of the disease. 7.3 per cent got advice from a general clinic besides the speciality clinic. Only about 4.7 per cent of the patients approached medical practitioners in addition to the speciality clinic. 4 per cent of the patients followed Ayurvedic treatment besides attending the hospital speciality clinic.

The different methods by which the patients controlled the disease after diagnosis was studied, which is described in table 36.

Table 36

CONTROL OF THE DISEASE AFTER DIAGNOSIS

Type of treatment	Number of patients	Percentage
Diet control	11	7.3
Oral drugs	8	5.3
Diet control and oral drugs	119	79.3
Diet control and injection	4	2.7
Diet, oral drugs and injection	2	1.3
Ayurvedic medicine	6	4
Total	150	100

Majority of the patients (79.3 per cent) were on diet control and oral drugs, where as 7.3 per cent of the patients depended only on diet control. 5.3 per cent of the patients controlled diabetes with oral drugs, while 4 per cent used ayurvedic medicines.

Frequency of visiting the hospital clinic and the dietary advice in the hospital

All the 150 patients surveyed were reported to visit the hospital regularly once in every month. They obtained information regarding dietary control of the disease from the hospital's diabetic clinic. Majority of the patients followed the dietary advice from the hospital. Some patients did not, the reason being due to negligence on their part. Some patients were not satisfied with the quantity of various food items suggested in the clinic, which was too little for them.

Other sources which influenced to bring a change in the diet of diabetic patients were studied and described in table 37.

Table 37

OTHER SOURCES OF INFORMATION REGARDING DIET CONTROL

Sources	Yes		No	
	Number	Percentage	Number	Percentage
Education	68	45.3	72	54.7
Medical campus	9	6	141	94
Articles from News paper, magazines	46	30.7	104	69.3
Radio/TV programmes	33	22	117	78
Friends/Neighbours/ relatives	126	84	24	16
Other diabetic patients	126	84	24	16

It was clear that among the various sources which brought about a change in dietary habits, the greatest influence was of friends, neighbours, relatives and conversation with other diabetic patients.

Diabetic patients were asked to list out some foods which according to their knowledge are to be restricted during diabetes and the results are given in table 38.

Table 38

KNOWLEDGE REGARDING FOODS TO BE RESTRICTED BY DIABETIC PATIENTS

Foods	Number of patients agree	Percentage
Roots and tubers	92	61.3
Sugar	99	66
Fruits	22	14.7
Rice	8	5.3
Wheat	6	4
Alcohol	4	2.7
Fish and meat	3	2
Oils and fats	2	1.3

According to the opinion of the patients sugar (66. per cent) and roots and tubers (61.3 per cent) were the most important foods to be restricted. A few patients (1.3 per cent) suggested a restriction in fats and oils. About 14.7 per cent of the patients were of the view that fruits mainly banana should be restricted in the diet. Only 5 per cent followed a restriction on rice in the diet.

The patients were asked about some foods of special importance to be included in their diet and the results are given in table 39.

Table 39

FOODS OF SPECIAL IMPORTANCE TO BE INCLUDED IN DIABETIC DIETS

Food items	Number of patients suggested	Percentage
Leafy vegetables	106	70.7
Vegetables	46	30.7
Cereals	51	34
Milk and curds	25	16.7
Pulses	18	12
Fish and meat	5	3.3

Leafy vegetables (70.7 per cent) and vegetables (30.7 per cent) were identified by majority of the patients to be included in large amounts in their diet. Cereals ranked next (34 per cent) followed by milk and curds (16.7 per cent).

Knowledge about food exchange tests

When enquired about food exchange lists only a small group of the patients (24 per cent) were aware of it. All those who knew about the food exchange lists had heard about it from the hospital speciality clinic.

The habit of taking regular exercise by the patients were studied and the results are given in table 40.

Table 40

HABIT OF TAKING REGULAR EXERCISE BY THE PATIENTS

Type of exercise	Number of people doing	Percentage
Walking	55	36.7
Yoga	2	1.3
Running	5	3.3
Cycling	6	4
House hold works	47	31.3
Not taking exercise	35	23.3
Total	150	100

Among the 150 diabetic patients studied 23.3 per cent of them were not in the habit of taking regular exercise. Most of the patients (36.7 per cent) took walking as regular exercise while the house wives (31.3 per cent) considered their daily household chores as regular exercise for them. Only a few patients resorted to specific exercises such as cycling (4 per cent) running (3.3 per cent) and yoga (1.3 per cent).

The time spent by the patients in sleeping was studied and discussed in table 41.

Table 41

SLEEPING TIME OF THE PATIENTS

Range of number of hours/day	Number of patients	Percentage
5-6	15	10
6-7	32	21.3
7-8	73	48.7
8-9	28	18.7
9-10	2	1.3
Total	150	100

This reveals that the duration of sleep for majority of the diabetic patients (48.7 per cent) was 7 to 8 hours. 21-3 per cent had 6 to 7 hours sleep, while 18.7 per cent had 8 to 9 hours sleep per day.

Frequency of getting up at night by the patients

In order to find out whether the patients were getting sound undisturbed sleep at night, they were asked about the frequency of getting up in between their sleep. It was found that only some patients (18 per cent) had sound undisturbed sleep during night. Majority of the patients (32.7 per cent) got up twice in between their sleep while some patients (13.3 per cent) got up thrice at night. About 2.7 per cent of the patients had a very disturbed sleep that they got up about 5 times in between their sleep.

Uneasiness experienced by the patients early in the morning

The patients were enquired about experiencing any type of uneasiness or discomfort while getting up in the morning. It was found that majority of the patient (70 per cent) did not experiance any sort of uneasiness while 10 per cent of the diabetic patients experienced body pain, 5.3 per cent

experienced fatigue, 2 per cent felt increased heart beat and 1.3 per cent experienced nausea and breathlessness.

The mode of travelling by the patients to their work place was studied and the details are given in table 42.

Table 42

MODE OF TRAVELLING TO THE WORK PLACE

Means of transport	Number of people	Percentage
Walking	27	18
Bus	16	10.7
Cycle	2	1.3
Scooter by self driving	4	2.7
Car by self driving	4	2.7
Train	2	1.3

Among the 150 patients studied, only 36.7 per cent were employed. Out of which most of them (18 per cent) used to walk to their work place. 10.7 per cent travelled by bus some patients used their own vehicles such as Scooter (2.7 per cent) and car (2.7 per cent). Only very few patients (1.3 per cent) depended on train to reach their work place.

The number of major meals taken by the patients was studied and the results are given in table 43.

Table 43

DAILY MEAL PATTERN OF THE PATIENTS

Number of times/day	Number of people	Percentage
1	--	--
2	--	--
3	103	68.7
4	47	31.3
Total	150	100

Table 43 shows that most of the patients (68.7 per cent) used to take 3 major meals a day. While others (31.3 per cent) took four major meals a day.

Table 44

NIBBLING HABITS OF DIABETIC PATIENTS

Number of times/day	Percentage of patients			
	Tea	Snacks	Fruits	Porridge
1	28.7	20	9.3	1.3
2	13.3	47	1.3	--
3	2.7	--	--	--
4	1.3	--	--	--

Table 44 indicates the nibbling habits of the diabetic patients in between major meals. 17.3 per cent did not eat anything in between meals. The main food items that are taken in between meals by the patients were identified as tea, snacks, fruits and porridge. Majority of the patients took tea in between meals, the number being about 1 to 4 times a day (28.7, 13.3, 2.7 and 1.3 per cent respectively). 20 per cent of the patients were in the habit of eating snack preparations once in between meals, while some patients (4.7 per cent) ate snacks twice a day. Fruits (9.3 per cent) and porridge (1.3 per cent) were also consumed once in between meals by the patients.

The frequency of having meals outside the home by the diabetic patients were studied and details are given in table 45.

Table 45

MEALS TAKEN OUTSIDE BY THE DIABETIC PATIENTS OUTSIDE THE HOME

Frequency	Number of patients	Percentage
Daily	18	12
Weekly	6	4
Fortnightly	4	2.1
Monthly	13	8.7
Occasionally	95	63.3
Never	14	9.3

Among the 150 patients studied majority (63.3 per cent) of the patients had meals outside home only occasionally. However 12 per cent of the patients took their meals daily outside the home. Very few patients went outside for their meals monthly (8.7 per cent) and weekly (4 per cent). 9.3 per cent of the patients did not take meals outside home.

The patients desire to eat sweet preparations and fried items were studied and the results are indicated in table 46.

Table 46

GRAVING FOR SWEETS AND FRIED ITEMS

Group	Number of patients	Percentage
1. Those who had desire to eat sweets/fried items	58	38.7
2. Those who had the desire to eat but did not eat sweets/fried item	26	17.3
3. No desire to eat sweet/ fried items	66	44
Total	150	100

38.7 per cent of the diabetic patients consumed se sweets and fried foods when they had the desire for it. 44 per cent of the patients never had a desire to eat sweets or fried foods.

Change in dietary pattern of the family.

Change in the dietary pattern of the family members due to a change in the diet of diabetic patients were noted. Most of the families (80.7 per cent) did not change their dietary pattern while 19.3 per cent of the families changed their dietary habits to adjust to the dietary pattern of the diabetic patients in the family.

The patients' habit of taking some indigeneous foods which are supposed to have hypoglycemic effect was studied and is discussed in table 47.

Table 47

USE OF INDIGENEOUS HYPOGLYCEMIC AGENTS

Items	Number of people taking	Percentage
1. Bitter gourd	81	54
2. Fenu greek	20	13.3
3. Green gram	2	1.3
4. Amla	4	2.7
5. Red onion	1	0.7
6. Kovakkai	1	0.7
7. Banana stem	2	1.3
8. Wild aniseed (Black)	1	0.7
9. Egg	1	0.7
10. Not using any	37	24.7
Total	150	100

The list of items suggested by the patients are given in the table. Majority of the patients (54 per cent) took bitter gourd and fenugreek (13.3 per cent) as hypoglycemic agents.

Most of them used bitter gourd in the boiled form, some used it in the raw form as juice. 24.7 per cent of the patients did not take any special foods as hypoglycemic agents.

The fats and oils used for cooking the diabetic diets were studied and is presented in table 48.

Table 48

USE OF OILS BY DIABETIC PATIENTS

Type of oil/fat	Number of patients	Percentage
Ground nut oil	4	2.7
Sanola	10	6.7
Coconut oil	8	5.3
Palm oil	48	32
Palm oil and coconut oil	63	42
Sanola and Palm oil	3	2
Ground nut oil and palm oil	4	2.7
Senola, palm oil & coconut oil	4	2.7
Vanaspathi and palm oil	4	2.7
Gingelly oil and coconut oil	2	1.3
Total	150	100

Majority of the diabetic patients studied (42 per cent) used Palm oil and Coconut oil in preparing their diets. Some patients (32 per cent) used only Palm oil on their dietaries. Other major cooking oils used by the diabetic patients were sanola (6.7 per cent) and Coconut oil (5.3 per cent).

Use of Sugar, Jaggery, Honey and Salt by the diabetic patients.

Among the 150 patients studied only a few patients (5.3 per cent) restricted the use of sugar to the minimum quantity. Honey and jaggery were consumed occasionally by the diabetic patients. 2 per cent of the patients studied, completely avoided salt in their diet.

Special foods prepared in the family for the diabetic patients were studied and is given in table 49.

Table 49

SPECIAL FOODS PREPARED IN THE FAMILY FOR THE DIABETIC PATIENTS

Special food items	Number of persons	Percentage
1. Broken wheat (porridge/kanji)	19	12.7
2. Wheat flour (puttu/dosai)	29	18.3
3. Green gram (Steamed)	7	4.7
4. Green leafy veg. (thoran)	13	8.7
5. No special foods	82	54.7
Total	150	100

Among the 150 patients studied, majority of the patients' (54.7 per cent) families did not prepare any special food for the diabetic patient. Many patients (32 per cent) received special wheat preparations such as puttu or dosai (19.3 per cent) and wheat porridge or Kanji (12.7 per cent). Other special foods prepared in the family for diabetic patients were green leafy vegetables (8.7 per cent) and steamed green gram (4.7 per cent).

Frequency of use of various food items by the diabetic patients were studied and the inclusion of cereals, pulses, leafy vegetables, roots and tubers, vegetables and fruits are given in table 50(A).

Table 50(a)

FREQUENCY OF USE OF VARIOUS FOOD ITEMS BY THE DIABETIC PATIENTS

Food items	Daily	Weekly			Occasionally	Never
		Once	Thrice	More than thrice		
Rice	100	--	--	--	--	--
Wheat	86	4.7	5.3	4	--	--
Maida	4	5.3	4.7	--	--	--
Broken wheat	10	4	2	9	60	7
Ragi	1.3	2	--	--	12	84.7
Green gram	48	12.7	17.3	20	2	--
Red gram	16	16	28	21.3	18.7	--
Black gram	44.7	9.3	22	16	8	--
Bengal gram	3	18	22.7	17.3	38	--
Potato	1.3	6.7	4	6.7	20	28
Carrot	1.3	8.7	10.7	2	60	17.3
Beet root	1.3	6	3.7	1.3	54.7	28
Tapioca	0.7	6	1.3	--	54.7	37.3
Yam	6.7	12	4.7	--	54.7	22
Colocasia	--	0.7	0.7	--	54.7	34
Colease	--	1.3	--	--	58.7	40
Amaranth	17.3	23.3	10.7	24.7	26	--
Cabbage	12	20	23.3	16	28.7	--
Drumstick leaves	7.3	22.7	14	12	42	2
Mint leaves	--	--	--	--	7.3	92.7
Bitter gourd	32	17.3	10.7	20	18.7	1.3
Ladies finger	12	20	11.3	28.7	24	4
Drumstick	12	25.3	20.7	24	22	--
Beans	8	32	22.7	23.3	14	--
Pea	12	36.7	18.7	20	12.7	--
Fruits	30	16.7	6.7	2.7	30.7	13.3

Food items such as rice, wheat, green gram, black gram bitter gourd and fruits were included in the daily diet of majority of the patients. Many patients did not consume ragi (84.7 per cent) and potato (28 per cent). All other food items were consumed occasionally by most of the patients.

Frequency of use of milk and milk products, flesh foods, eggs, fats and oils, sugar, processed foods and bakery items by the patients are given in table 50(b).

Teble 50(b)

FREQUENCY OF USE OF VARIOUS FOOD ITEMS BY THE DIABETIC PATIENTS

Food items	Daily	Weekly			Occasionally	Never
		Once	Thrice	More than thrice		
Milk	97.3	--	--	2.7	--	--
Curd	82.7	--	2	8.7	25.3	1.3
Butter milk	32	--	18	10.7	39.3	--
Chese	--	--	--	--	4	96
Mutton	--	8	1.3	-	82.7	8
Chicken	--	4	--	--	54	42
Beef	--	53.3	0.7	--	44	50
Fish	64	13.7	7.3	7	--	8
Hen's egg	18	7	4	12	15	24
Duck's egg	2	2	--	--	30.7	65.3
Ghee	--	--	--	--	72	28
Oil	98	--	--	--	2	--
Sugar	1.8	--	--	--	24	74.7
Squash	--	--	--	--	9	92
Jam	--	--	--	--	10	9.0

Food items such as milk, curds, butter milk, fish and cooking oils were included in the daily diet of majority of the patients. Foods like cheese, beef, egg, sugar and processed foods such as jams and squash were not consumed by most of the patients. All other food items were included occasionally in the diet by almost all the patients.

D. The impact of diabetic clinic on the existing dietary pattern of the patients.

Functioning of a local diabetic clinic and the diet counselling imparted in this clinic was studied by the investigator through observation and by conversing with the personnel and the patients.

In the clinic, diet was not calculated based on individual patients' requirements. A general diet sheet was prepared for all the patients, without considering the body weight or other physiological conditions, and these diet sheets were supplied to the patients during their first visit to the clinic.

The recommended intake for both the vegetarians as well as for the non vegetarians were given in the diet sheet.

The existing dietary habits of the patients were not taken into consideration while planning the diet. However the commonly consumed popular items, were included in the menu by following the food exchange lists.

Patients did not visit the clinic regularly. Body weight weight of the patients were recorded during each follow up visit. Blood samples were analysed during every follow up but urine analysis was done only once in six months. When enquired about the patients' co-operation, it was informed that all the patients were not co-operative regarding their regular follow up visit to the diabetic clinic.

By conversing with the patients, an assessment of, the information obtained from the diabetic clinic regarding, the dietary regulations to be followed by diabetics was made. It was found that 97.3 per cent of the patients knew the types of foods to be included by diabetics, without knowing the need for restricting some nutrients. A marginal few (53 per cent) had heard about the importance of including fiber in the diabetic diet. 21.3 per cent of the patients had an idea about the type of cereals to be included in the diet, like rice, wheat or ragi. All the patients knew that sugar should be strictly restricted. 12 per cent of the

patients studied, knew that inclusion of pulses in the daily diet was good for diabetics. 70.7 per cent of the patients agreed that green leafy vegetables are good for diabetics. Vegetables are suggested as good for diabetic diet by 30.7 per cent of the patients. 16 per cent of the patients had heard about saturated and unsaturated fats and the role of unsaturated fats in the diet. Only 9.3 per cent of the patients knew that alcohol had a harmful effect on diabetics. 24 per cent of the patients had heard about food exchange lists from the diabetic clinic. 14 per cent of the patients held the opinion that the quantity of various foods as recommended in the clinic was not enough for satisfying their hunger and of the rest of the patients. 23.3 per cent did not follow the diet strictly.

E. <u>The impact of diet counselling and a modified diabetic diet on blood and urine profile</u>.

Six diabetic patients who were willing to co-operate, agreed to follow the prescribed modified diet for a period of six months. Actual food intakes of these patients were assessed by conducting weighment survey. Initial blood and urine profile were also studied. Then diet counselling was imparted to these patients and also the use of food exchange lists, to avoid the monotony of a static diet sheet.

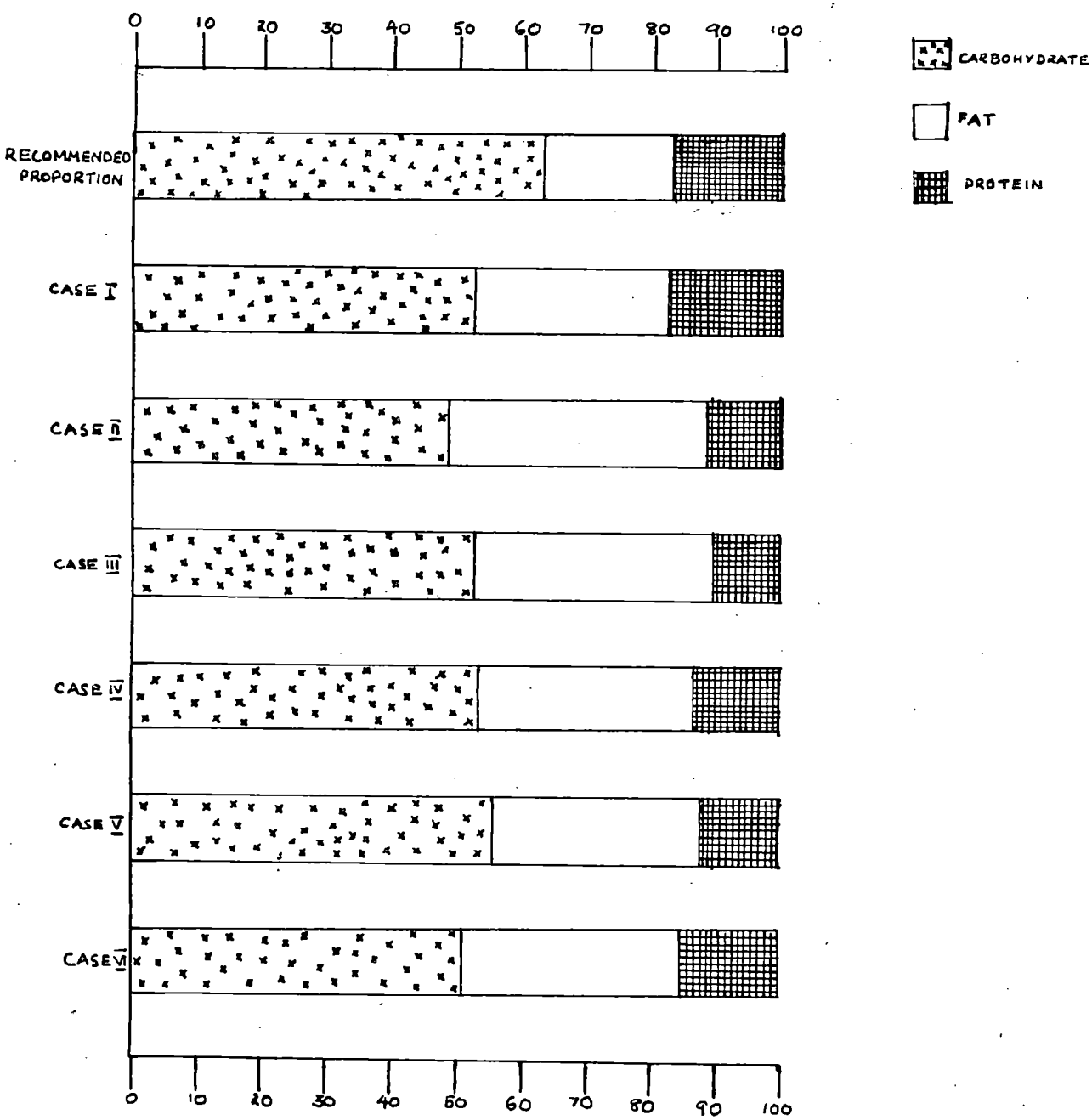
The modified diet was asked to be followed for a period of six months. As adherence to a diabetic regime demands self discipline and a sense of purpose, more time was spent by the investigator on the education of each patient, so that he understood the object of each aspect of his dietary treatment and had sufficient knowledge toundertake the day to day management of the disease. After six months, biochemical investigations were carried out on these patients, to find out whether they are maintaining a normal metabolic state. Each patient was observed as a case study and numbered as I, II, III, IV, V and VI and the results are presented below.

CASE STUDY: I

Adult male	-- Height 5'6"
Body weight	-- 63.5 kg
Ideal body weight	-- 64 kg
Type of activity	-- Sedentary
Sleeping pattern	-- 8 h/day
Regular exercise	-- Nil
Age at on set of the disease	-- 46

FIGURE 5

RECOMMENDED PROPORTION OF CALORIES FROM CARBOHYDRATE, FAT AND PROTEIN AND THE ACTUAL INTAKE OF THE CASE STUDIES



Dietary pattern

He used to take three major meals per day consisting of breakfast, lunch and dinner. For breakfast and lunch he used mainly rice and for super wheat preparations. He had the habit of eating fried foods during evening tea time. He experienced easy fatigue as the main initial symptoms of the disease.

The average actual intake and proportion of major nutrients like carbohydrate, fats and proteins of case study I was studied in details and was compared with the calculated recommended values. The results are given in table 51 and fig. 5.

Table 51

ACTUAL INTAKE OF MAJOR NUTRIENTS COMPARED TO CALCULATED RECOMMENDED VALUES OF CASE STUDY-I

	Calculated recommended value	Average actual intake/day
Total energy (K cal)	1905	2071.5
Energy (K cal) from:		
Carbohydrate	1143-1238	1084
Fat	286-476	629
Protein	286-381	358
Amount of:		
Carbohydrate (g)	286-310	271
Fat (g)	32-53	79
Protein (g)	71-95	89.5

The total calorie intake was higher when compared to the recommended value calculated based on body weight. Regarding the distribution of total calories, only the proportion of calories supplied from protein was found to be adequate. The calories supplied from carbohydrate was less and that from fat for exceeded the recommended value. Regarding the quantity, protein was adequate where as the amount of fat consumed was very high when compared with the amount of fat consumed was very high when compared with the recommended value. The carbohydrate content of the diet was not satisfactory.

The initial and final metabolic state of case study-I was analysed and is given in table 52, fig.6, 7 and 8.

Table 52

INITIAL AND FINAL METABOLIC STATE OF CASE STUDY-I

Parameters	Normal value	Initial value	Final value	t value
Body weight (kg)	64	63.5±1.27	63±3.15	0.147
Blood Glucose (fasting) mg/dl	60-100	200 ± 6.0	120±3.0	11.93*
Urine glucose	Nil	Traces	Nil	—
Cholesterol (mg/dl)	150-280	253 ± 7.05	195±3.9	4.964*
Trigly ceride (mg/dl)	10-150	100 ± 3	78 ± 1.95	4.148*

* Significant at 1 per cent level.

FIGURE 6

INITIAL AND FINAL VALUES OF BLOOD GLUCOSE IN THE CASE STUDIES

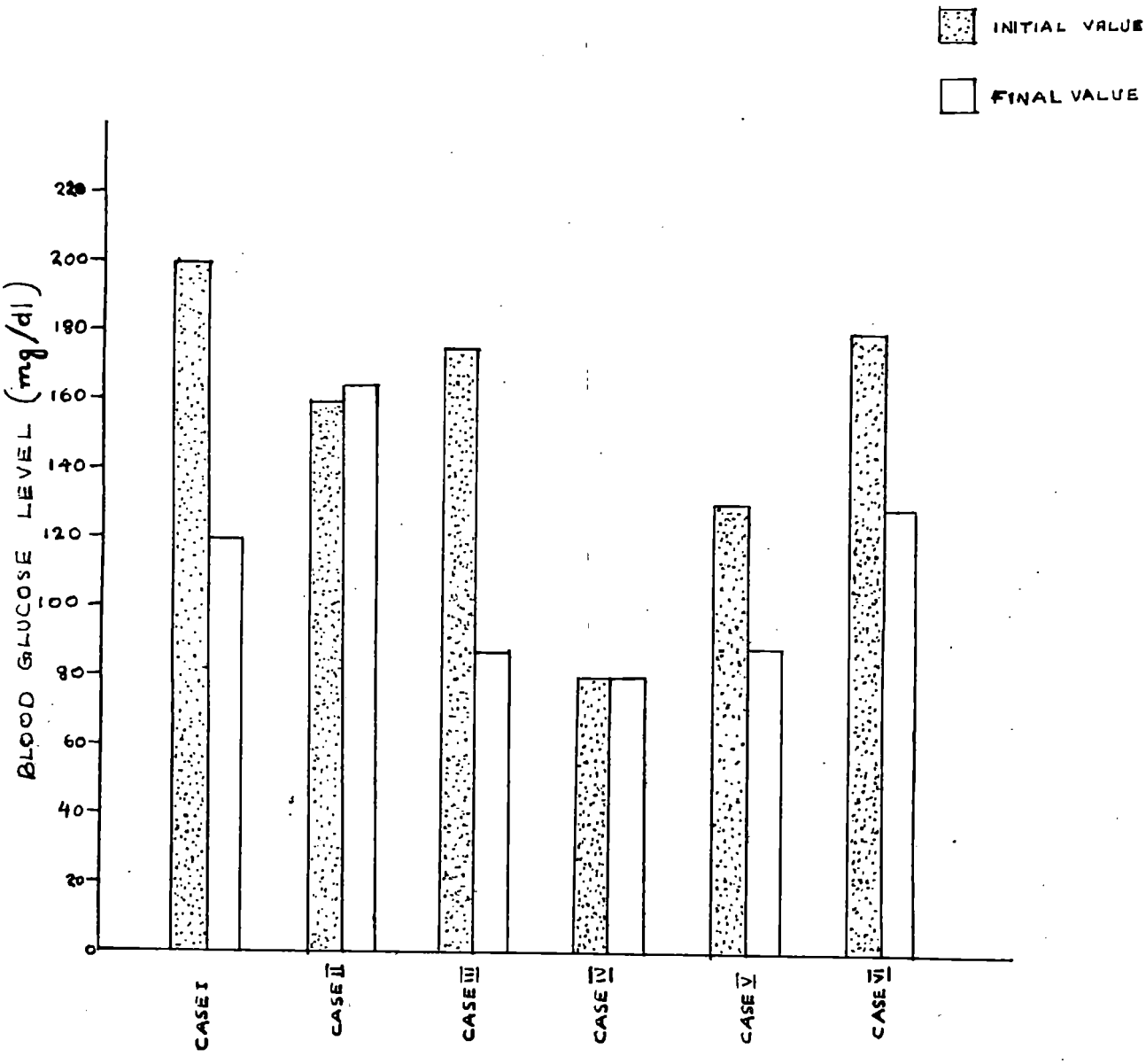


FIGURE 7

INITIAL AND FINAL VALUES OF CHOLESTEROL IN THE CASE STUDIES

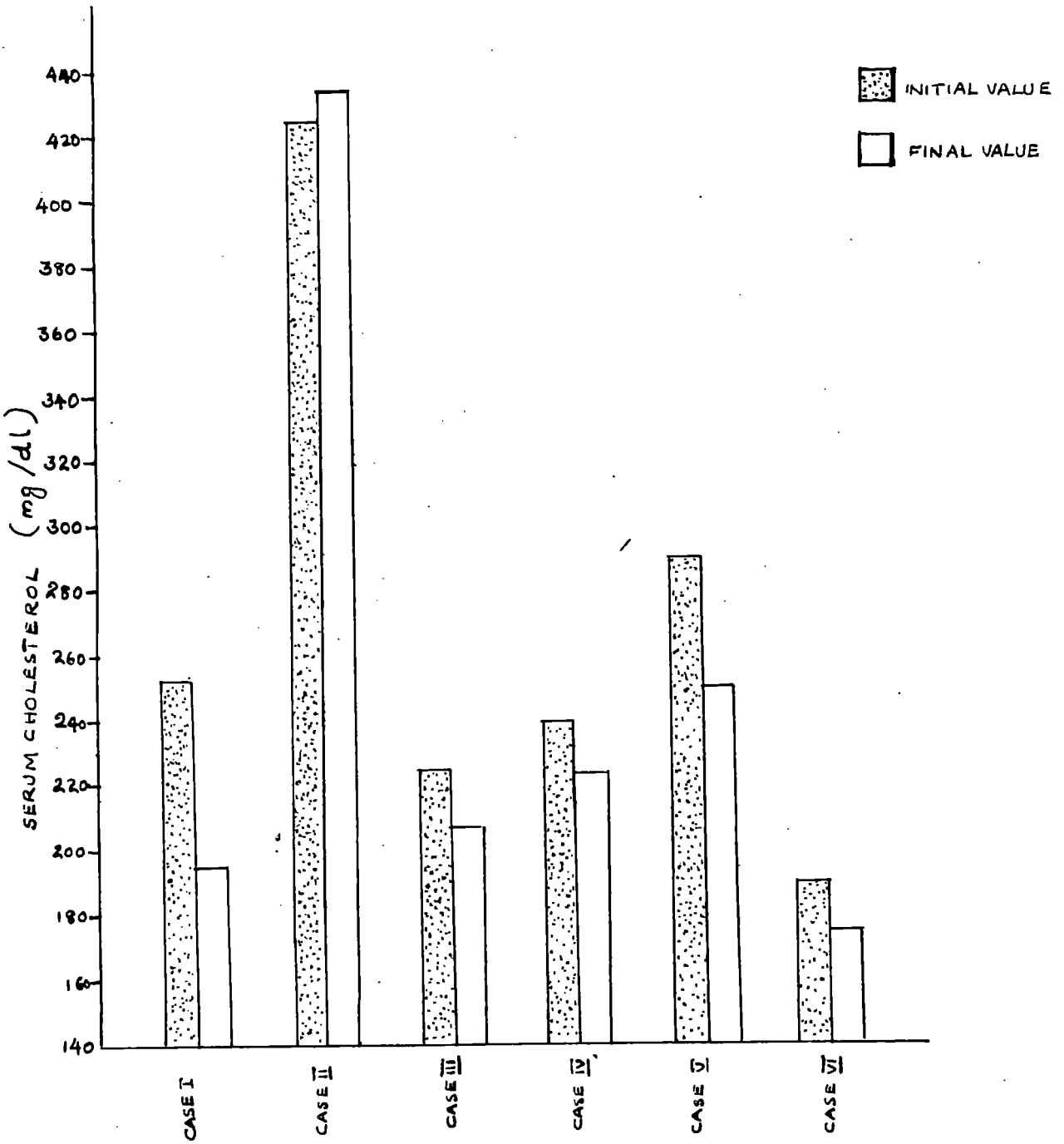


FIGURE 8

INITIAL AND FINAL VALUES OF TRIGYCERIDE IN THE CASE STUDIES

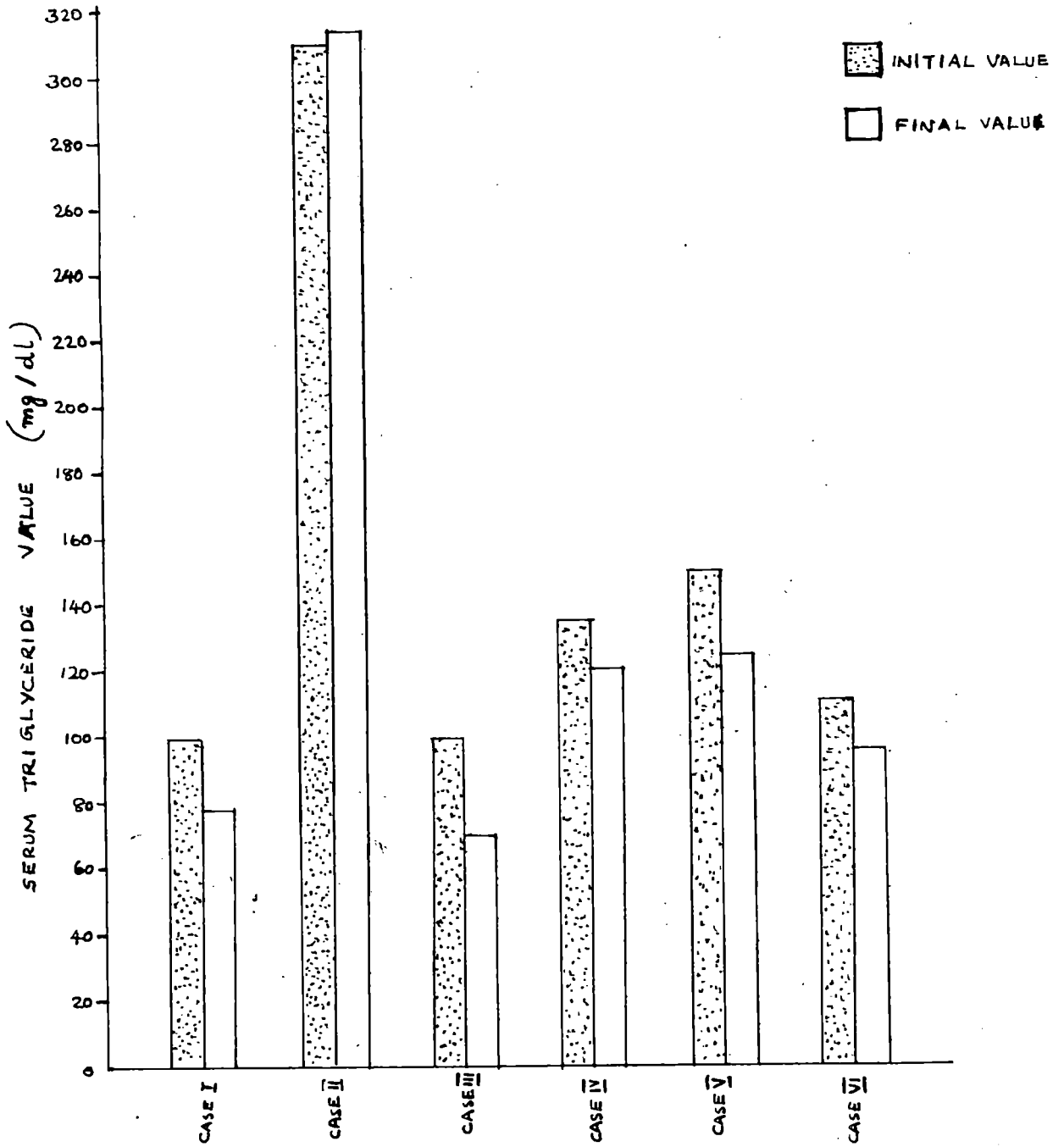


Table 52 indicates that the body weight of the patient was maintained after six months of followup. Initially the blood glucose level was very high when compared to the normal value. After following the modified diet continuously for a period of 6 months blood glucose level was reduced significantly. Similarly there was significant decrease in the cholesterol and triglyceride levels also.

CASE STUDY - II

Adult male	— Height 5'8"
Body weight	— 62 kg
Ideal body weight	— 69.5 kg
Type of activity	— Sedentary
Sleeping pattern	— 8 h/day
Exercise	— Occasionally
Age at the onset of the disease	— 47

Dietary pattern

He used to take three major meals per day consisting of breakfast, lunch and supper. Breakfast and lunch were based on rice preparations and supper was made from wheat. Evening time he used to eat fried foods and other confectionaries. The main initial symptom he experienced was easy fatigue.

The average actual intake and proportion of major nutrients like carbohydrate, fats and proportion of major nutrients like carbohydrate, fats and proteins of case study-II was studied in detail and was compared with the calculated recommended values. The results are given in table 53 and fig.5.

Table 53

ACTUAL INTAKE OF MAJOR NUTRIENTS COMPARED TO CALCULATED RECOMMENDED VALUES OF CASE STUDY-II

	Calculated recommended	Average actual intake/day
Total energy (K cal)	1980	2041
Energy (K cal) from:		
Carbohydrate	1188-1287	1000
Protein	297-396	240
Fat	297-495	801
Amount of:		
Carbohydrate (g)	297-322	250
Protein (g)	74-99	60
Fat (g)	33-55	89

The actual calorie intake was high when compared to the recommended value of the total calories. About 39 per cent was supplied from fat, whereas from carbohydrate it was only

49 per cent. Calories supplied from protein was also found to be less. With regard to the quantities of these nutrients, fat consumption was too high whereas carbohydrates and proteins were difficient in the diet.

Table 54

INITIAL AND FINAL METABOLIC STATE OF CASE STUDY-II

Parameters	Normal value	Initial value	Final value	t value
Body weight (kg)	69.5	62	62	--
Blood glucose (fasting) mg/dl	60-100	160±4.8	164±4.1	0.633
Urinary glucose	Nil	Traces	Traces	--
Cholesterol(mg/dl)	150-280	425±12.75	435±10.87	0.5961
Triglyceride(mg/dl)	10-150	310±9.61	314±6.59	0.343

Table 54 shows the initial and final metabolic state of case study-II. It was found that there was no change in body weight. With regard to the blood glucose, cholesterol and triglyceride values there was a slight increase which was not significant. There was no change in the urinary glucose pattern also.

CASE STUDY--III

Adult male	— Height 5'7"
Body weight	— 69 kg
Ideal body weight	— 66.8 kg
Type of activity	— Sedentary
Sleeping pattern	— 8 h/day

Regular exercise -- 1 h/day
Age at the onset of the disease -- 42

Dietary pattern

Usually he had three meals per day and these three meals were mainly based on rice preparations. During evening tea time he used to take fried foods. The main symptom which helped to recognise the disease was easy fatigue.

The average actual intake and proportion of major nutrients like carbohydrate, fats and protein of case study-III was studied in detail and was compared with the calculated recommended values. The results are given in table 55, and fig.5.

Table 55

ACTUAL INTAKE OF MAJOR NUTRIENTS COMPARED TO CALCULATED RECOMMENDED VALUES OF CASE STUDY—III

	Calculated recommended value	Average actual intake/day
Total energy (K.cal)	2070	2110
Energy (K.cal) from:		
Carbohydrate	1242-1346	1112
Protein	311-414	216
Fat	311-518	783
Amount of:		
Carbohydrate(g)	311-337	278
Protein(g)	78-104	54
Fat(g)	35-58	87

Regarding the caloric intake of case study-III, it was higher than the calculated recommended value. The distribution of energy supplied from the major nutrients showed that the calories from carbohydrate and protein was less and that of fat was too high than the calculated recommended values.

The initial metabolic state of case study-III was analysed including body weight and after following the diabetic regime for six months, the impact of modified diet was observed and is given in table 56, fig-6, 7 and 8.

Table 56

INITIAL AND FINAL METABOLIC STATE OF CASE STUDY-III

Parameters	Normal value	Initial value	Final value	t value
Body weight (kg)	66.8	69±2.07	67±2.01	0.693
Fasting blood glucose (mg/dl)	60-100	175±3.5	87±2.4	20.736*
Urinary glucose	Nil	Nil	Nil	--
Cholesterol (mg/dl)	150-280	225±9.5	207±8.28	3.183**
Triglycerde (mg/dl)	10-150	100±3	70±2.8	7.310*

* Significant at 1 per cent level

** Significant at 5 per cent level

Table 56 indicates that slight reduction in body weight was observed. The initial fasting blood glucose level was very high i.e., 175 mg/dl, which was significantly reduced to 87 mg/dl and was maintained within normal range. There was no glycosuria. Blood cholesterol and Triglyceride levels also decreased significantly.

CASTE STUDY--IV

Adult male	-- Height 5'6"
Body weight	-- 66 kg
Ideal body weight	-- 64 kg
Type of activity	-- Sedentary
Sleeping pattern	-- 7 h/day
Regular exercise	-- walking
Age at the onset of diabetes	-- 61

Dietary pattern

Meal pattern included three main meals per day and mainly consisted of rice preparations. During evening time he used to take steamed banana or fried foods. The disease was diagnosed by a delayed wound healing.

The average actual intake and proportion of major nutrients like carbohydrate, fats and proteins of case study-IV was studied in detail and was compared with the calculated recommended values. The results are given in table 57 and fig.5.

Table 57

ACTUAL INTAKE OF MAJOR NUTRIENTS COMPARED TO CALCULATED RECOMMENDED VALUES OF CASE STUDY-IV

	Calculated recommended value	Average actual intake/day
Total energy (K. cal)	1980	2218
Energy (K. cal) from:		
Carbohydrate	1188-1287	1180
Protein	297-396	304
Fat	297-495	734
Amount of:		
Carbohydrate (g)	297-322	295
Protein (g)	74-99	76
Fat (g)	33-55	81.5

It shows that the calories intake of case study-IV was higher than the calculated recommended value. Regarding the distribution among major nutrients, calories supplied by carbohydrate and protein was found to be satisfactory but that of fat was too high.

The metabolic state of case study IV was analysed before and after the six months follow study. The details are given in table 58, fig. 6, 7 and 8.

Table 58

INITIAL AND FINAL METABOLIC STATE OF CASE STUDY-IV

Parameters	Normal value	Initial value	Final value	t value
Body weight (kg)	64	66±1.98	64±1.92	0.725
Blood glucose (mg/dl)	60-100	80	80	--
Urinary glucose	Nil	--	--	--
Cholesterol (mg/dl)	150-250	240	224±4.48	2.136
Triglyceride (mg/dl)	10-150	135±4.05	120±4.8	2.384

Table 58 shows that there was a slight decrease in the body weight, but it was not significant. There was no change in the blood glucose level. The cholesterol and triglyceride values were decreased but not significantly.

CASE STUDY—V

Adult female	-- Height 5'
Body weight	-- 54 kg
Ideal body weight	-- 45.5 kg
Type of activity	-- Sedentary
Sleeping pattern	-- 7 h/day
Regular exercise	-- Waling
Age at the onset of the disease	-- 54

Dietary pattern

She used to take three major meals per day based on rice preparations. During evening tea time she was in the habit of taking steamed banana or some confectioneries. She experienced easy fatigue, increased thirst and hunger.

The average actual intake and proportion of major nutrients like carbohydrate, fat and protein of case study-V was studied in detail and was compared with the calculated recommended values. The results are given in table 59 and fig. 5.

Table 59

ACTUAL INTAKE OF MAJOR NUTRIENTS COMPARED TO CALCULATED RECOMMENDED VALUES OF CASE STUDY-V

	Calculate recommended value	Average actual intake/day
Total calories (K. cal)	1290	1709
Energy (M. cal) from:		
Carbohydrate	774-839	948
Protein	194-258	212
Fat	194-323	549
Amount of:		
Carbohydrate (g)	194-210	237
Protein (g)	49-65	53
Fat (g)	22-36	61

The total calorie intake was higher when compared to the recommended value. Regarding the distribution of calories, only the proportion of protein was found to be adequate while the calories supplied from carbohydrate and fat was found to be higher than the recommended values.

The metabolic state of case study-V was analysed before and after the six months follow up study. The details are given in table 60, fig.6, 7 and 8.

Table 60

INITIAL AND FINAL METABOLIC STATE OF CASE STUDY-V

Parameters	Normal value	Initial value	Final value	t value
Body weight (kg)	45.5	54±1.62	50±1.25	1.954
Fasting Blood flucose (mg/dl)	60-100	130±3.9	88±3.08	8.451*
Urinary glucose	Nil	—	—	—
Cholesterol (mg/dl)	150-280	290±8.7	250±8.75	3.241**
Triglycerides (mg/dl)	10-150	150±5.75	124±3.72	4.922*

* Significant at 1 per cent level
** Significant at 1 per cent level

It was found that the decrease in body weight after six months was not significant. But much decrease in blood glucose and triglyceride was observed and the reduction is significant at 1 per cent level. In the case of cholesterol the reduction is significant at 5 per cent level.

CASE STUDY--VI

Adult female	-- Height 5'2"
Body weight	-- 50 kg
Ideal body weight	-- 50 kg
Type of activity	-- Sedentary
Sleeping pattern	-- 8 h/day
Regular exercise	-- 20 minutes walking/day
Age at the onset of the disease	-- 47

Dietary pattern

She had three rice based major meals per day and during evening tea time she usually had uppuma.

The main discomfort she experienced at the time of onset was easy fatigue.

The average actual intake and proportion of major nutrients like carbohydrate, fats and proteins of case study-VI was studied in detail and was compared with the calculated recommended value. The results are given in Table 61 and fig.5.

Table 61

ACTUAL INTAKE OF MAJOR NUTRIENTS COMPARED TO CALCULATED RECOMMENDED VALUES OF CASE STUDY-VI

	Calculated recommended value	Average actual intake/day
Total energy (K. cal)	1500	1933
Energy (K. cal) from:		
Carbohydrate	900-975	989
Protein	225-300	293
Fat	225-375	651
Amount of:		
Carbohydrate (g)	225-244	247
Protein (g)	56-75	73
Fat (g)	25-42	72

It shows that calorie intake of case study-VI was found to be higher than the calculated recommended intake. Only the proportion of calories supplied from protein was adequate.

The metabolic state of case study-VI was analysed before and after the six months of follow up study the details are presented in table 62, fig. 6, 7 and 8.

Table 62

INITIAL AND FINAL METABOLIC STATE OF CASE STUDY-VI

Parameters	Normal value	Initial value	Final value	t value
Body weight (kg)	45.5	50±1.25	48.5±1.45	0.783
Fasting blood sugar (mg/dl)	60-100	180±5.4	129±4.51	7.248*
Urinary glucose	Nil	--	--	--
Cholesterol (mg/dl)	150-280	190±4.75	175±5.25	2.118
Triglyceride (mg/dl)	10-150	110±3.3	96±3.36	2.972**

* Significant at 1 per cent level
** Significant at 1 per cent level

There was a slight decrease in the body weight of the case study-VI, but it was not significant. The blood glucose level was decreased significantly 1 per cent level. The cholesterol value was also, decreased but it was not a significant reduction. There was a reduction observed in the triglyceride value at 5 per cent level of significance.

DISCUSSION

DISCUSSION

The present study was carried out to assess the socio-economic and food consumption pattern of the families of diabetic patients, personal characteristics and dietary pattern of the patients and the impact of diet counselling and a modified diabetic dietary regime on the metabolic state of the diabetic patients.

Socio economic and food consumption pattern of the families of the diabetic patients.

Socio-economic and food consumption pattern of the families of the diabetic patients were assessed by conducting a survey among 150 families. The prevalence of diabetes was found to be more common in the urban community than in the rural community. As reported by ICMR (1972) the average incidence of diabetes was 2 per cent in the cities and 1.5 per cent in the villages. This implies not only changes in demographic and socio-economic facets of life of people but also in their pattern of living, working, food consumption and health seeking behaviour. In the present study the ratio between the patients from the urban and rural community was 2.1:1. Nearly sixty per cent of the patients were Hindus.

The economic status of the families of the diabetic patients revealed that most of them were having permanent Government jobs while some were pensioners. Most of the families of the diabetic patients had a monthly income more than Rs.3000/- and only 4 per cent of the families had a monthly income less than Rs.500/- but more than Rs.400/- Ramachandran (1988) reported that urban Indians being more susceptible to diabetes the implication seems to be that with increasing urbanization and increase in per capita income could be a cause for the corresponding increase in the prevalence of diabetes. The present study also indicated that as the socio-economic status increased the incidence of diabetes also increases. Srivastava (1987) reported that the prevalence rates of diabetes were significantly higher in subjects belonging to higher socio-economic group. The striking increase in the incidence of diabetes in the affluent communities may be due to a change in the dietary pattern, particularly to an increased consumption of refined carbohydrate (Seshiah et al., 1986 b).

Majority of the families were found to belong to the higher economic status and so their education level also was found to be higher. Around half of the population were college educated, and 1/3 of the population were high school educated.

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From table 6 it is clear that most of the patients were from families where there were 3 to 5 members. This might be due to the higher educational status of the families.

In table 9, monthly expenditure pattern of the families are given. It was seen that, in the study on expenditure pattern of the families, there were families who spent upto 80 per cent of their monthly income on food and no family spent more than 25 per cent of its income on other items, like clothing, shelter, education, entertainment and health.

Since majority of the families resided in the urban area, and the cost of housing and shelter being higher when compared to the rural areas, more than 80 per cent of the families spent about 10 per cent of their monthly income on shelter. Regarding the expenditure on education, around 35 per cent of the families did not spent money for education. This may be due to the reason that in the present study, about 75 per cent of family members were adults, who had completed, their education. Of the remaining, more than 50 per cent of the families spent upto 15 per cent of their monthly income on education. Diabetes is a disease requiring some type of treatment and so the expenditure of the family on health was also considered and it was found that more than 80 per cent of the families spent upto 10 per cent of their monthly income for maintaining better health.

Most of the families surveyed belonged to higher income group and were in the habit of saving money. Around 5 per cent of the families were found to save 25 to 35 per cent of their monthly income.

The expenditure on food was greatly influenced by the income of the family. From the present study it was clear that as the income increased, there was a relative decrease in the percentage of income spent on food and vice versa. Families with a monthly income less than Rs.500/- were found to spend 65 to 80 per cent of their monthly income on food, while those families with a monthly income more than Rs.3000/- spent less than 45 per cent of their monthly income on food. Food habits of the families revealed that more than 90 per cent of the families were non vegetarians.

Regarding the purchase of various food items, most of the families made a monthly purchase of cereals and pulses. Almost all the families made a weekly purchase of vegetables, green leafy vegetables and roots and tubers. All the families purchased milk daily. Eight per cent of the families were basically vegetarians and so they did not purchase flesh foods and egg. Almost all the nonvegetarian families purchased

fish daily. Occasional purchase of bakery items was observed in most of the families studied, however 32 per cent of the families were found to make weekly purchase and 10 per cent of the families made daily purchase of bakery items. This shows that the use of processed and refined foods, may be higher in these families.

The frequency of use of various food items by the families of the diabetic patients was analysed. The cereals, especially rice was used daily by all the families. But millets like ragi, which contain more fiber and is therefore suitable for diabetic patients was consumed by only a very few per cent of the families. A majority of the families did not use ragi. The consumption of refined processed cereal products like maida was found to be considerably high. Seshiah et al. (1986 b) reported that among the dietary habits the consumption of refined carbohydrates and the reduced intake of fiber are some contributing factors of type II diabetes. Roots and tubers, especially tapioca was consumed by some families. The consumption of leafy vegetables by the families was found to be fairly good. Other vegetables were also consumed by most of the families. Milk and milk products were used daily by almost all the families. Regarding the frequency of consumption of flesh

foods, beef is found to be the item most frequently consumed. Other flesh food items were included only occasionally in the diet by almost all the families, where as fish was included in the faily diet of almost all the families. Comparing the frequency of consumption of hen's egg and duck's egg, hen's egg was consumed more by majority of the families.

Sugar, fats and oils, coconut etc. were included in the daily diet by all the families. The present survey revealed that the consumption of processed and bakery foods by these families were found to be considerably high, indicating that as a community becomes more affluent the consumption of such items also increases.

The inclusion of verious food items in the menu, by these families, through a 24 h. recall method showed that almost all the families took a cereal based breakfast supplemented with some pulses, fruits, eggs and milk. For lunch rice was supplemented with almost all food groups. Pickles were used by all the families but most of the families did not take fruit after lunch. Evening tea consisted of milk with sugar in the preparation of Coffee or Tea and bakery items such as cakes, biscuits and other fried items. Dinner pattern was some as that of lunch. However, the inclusion of

pulses, roots and tubers and leafy vegetables were low compared to lunch. During bed time milk was consumed by all the family members.

The cooking oils used by majority of the families were found to be palm oil and coconut oil. A good number of families consumed coconut oil alone or coconut oil along with other cooking oils. In general the consumption of fats, oils and sugar were considerably higher among these families, especially saturated and hydrogenated fats.

Various methods of cooking adopted in the families depended on the type of food. However, fried items were preferred due to its taste. Fried foods have a higher fat content, which leads to excess energy consumption, resulting in cardiovascular and other related complications. All these faulty dietary habits may act indirectly, leading to an increased incidence of diabetes.

Majority of the families belonged to higher socio-economic classes and they were in the habit of celebrating occasions like birth days, marriage, religious festivals etc. Since the families' socio-economic and educational back ground was high, the diet given to the family members during special physiological conditions was according to their needs and requirements.

Actual food intake of the family members assessed through food weighment survey.

From the food weighment survey results, it was clear that the consumption of various food groups like cereals, pulses and egg by the male members of the families was almost equal to that of the recommendations. The consumption of leafy vegetables, fats and sugar were found to be in excess when compared to the recommended values. The consumption of excess leafy vegetables is not harmful, but the excess consumption of oils and sugar add to the total calories and is known to lead to other complications. The consumption of fruits, mainly banana, which contributes more calories was high where as, other fruits which could provide more minerals and vitamins were not consumed. The consumption of roots and tubers and other vegetables were found to be less when compared to the recommended values.

The quantities of milk and milk products, meat and fish consumed were much greater than the recommended levels. This indicates that the inclusion of the various food groups were not in a balanced proportion. From this it can be concluded that this pattern of diet could have predisposed the individual to diabtes.

The quantity of foods consumed by the female family members of the patients, indicated a rather high consumption of milk and milk products and fruits, mainly banana, was found to increase carbohydrate and there by the calorie intake. The consumption of leafy vegetables was found to be very low. From this it can be concluded that the intake of fiber also was low. The intake of flesh foods and sugar was found to be moderately high. The excess intake of sugar provides only empty calories.

It was found that the energy consumption of the male members of the families' of the diabetic patients, along with intake of vitamin A, thiamin, riboflavin and niacin was nearly the same as the recommended allowances. But protein, calcium, iron and vitamin C were found to be in excess of the recommended levels.

The average consumption of nutrients by the female family members of the diabetic patients show that the consumption of proteins, calcium, riboflavin and vitamin C were high. The intake of energy, iron, vitamin A and thiamin were found to be about the same as the recommended level but nicotinic acid intake was rather low.

A comparison of the consumption pattern with regard to the various food groups and the nutrient intake among the male and female family members of the diabetic patients revealed that in both the cases most of the items were consumed in excess of the recommended level, especially milk and milk products and flesh foods. There was an excess intake of energy by the female members. Excess energy consumption is known to lead to obesity, increasing the chances for the occurance of diabetes.

It is a well known fact that the consumption of food in general increases with income. The data gathered here indicated that the diets are generally high in calories and proteins. This result is in line with the study conducted by Quiogue (1972) whose salient findings indicate the foods consumed in larger amount in urban areas than in rural areas are sugar, fruits and vegetables, meat, poultry, eggs, milk and fats. The study also indicates that increase in the household income and increase in the average years of schooling of the household members directly increases the calories and protein content of their diets. The author concluded that avoidance of over eating and obesity would prevent the appearance of adult onset diabetes.

Personal characteristics and dietary pattern of the diabetic patients.

Personal characteristics and dietary pattern of the diabetic patients were studied by conducting a survey among the patients visiting the diabetic clinic.

From the present study it was found that the incidence of diabetes is slightly higher among men (50.7 per cent) than women (49.3 per cent). Ahuja (1979) reported that in India, there is a greater incidence of diabetes in men than in women, the ratio being 2.6:1.8. A survey of 4660 Israeli adults aged 30 to 65 years; revaled that the prevalence of diabetes was slightly less among woman (3.5 per cent) than among men (4.3 per cent).

Occupational status appears to play a role in the occurrence of the disease, and was found to be greater in individuals doing full time sedentary work. In the present study the onset of diabetes was seen to occur more in the age group of 46 to 50. Dutta et al. (1967) reported that in the present population office personnel indicated a higher prevalence of (5.8 per cent).

The educational status of the diabetic patients was quite high. High school or College educated patients were around 70 per cent. This may probably be due to the high socio-economic back ground of the urban families.

The agewise distribution of the diabetic patients helped to reach the conclusion that majority of the patients came in the age group of 46 to 60 (60 per cent). Sankar (1965) conducted a study in Hubli and found that the incidence of diabetes was maximum at the age group of 40-59 years. Here also the same pattern was observed.

Another trend observed was that as age increased beyond 65 there was a corresponding decrease in the percentage of women patients when compared to men in the same age groups. The age of onset of diabetes was analysed and it was found that the incidence was higher in the age group 46 to 50 years, comprising about 27 per cent. Generally the onset was greater in the age group of 41 to 55 years comprising 63 per cent.

There is no evidence to indicate the type of blood group in which the incidence of diabetes was more common. In this study it was seen that the highest incidence was among individuals with blood group O, followed by blood group A.

The role of genetic factors in the aetiology of Non-Insulin Dependant Diabetes (NIDDM) has been appreciated ever since the recognition of the disease. The present study revealed that incidence of diabetes was high in those with a family history of the disease, i.e., around 49 per cent. Sathe (1973) reported that a positive family history was obtained in proportion ranging from 11.7 to 46.4 per cent. The results of the study indicated that the chances of inheriting diabetes from the paternal side was greater. In the present study the percentage of patients who had a history of diabetes on the father's side was 19.3 per cent, where as from the mother's side it was only 8.7 per cent. In a study of pedegree analysis of 1000 cases of NIDDM conducted in the Department of Diabetology, Madras Medical College, it was found that paternal influence was statistically more significant than the maternal influence (Seshiah et al., 1986 b). Regarding the other associated diseases of diabetes, female members of the family had a high rate of incidence of obesity and high blood pressure when compared to male members. Heart diseases were found to be more among male members.

Initial symptoms which were experienced by the patients before diagnosing the disease was found to be varying. The most common symptoms were easy fatigue, increased thirst

and hunger. Appearance of abcess and frequent urination were found to follow the above symptoms. The diabetic patients were found to suffer from various minor compliants like restlessness during sleep and at the time of waking.

Fatigue and pain in the body were the other most common complaints experienced early in the morning. Majority of the patients had disturbed sleep during night. Roy (1986) reported that fatigue may be the only symptom in some diabetic patients.

Diabetes is said to be a disease of multi faceted nature, increasing susceptibility to heart disease, hypertension etc. The incidence of other diseases in diabetes was surveyed and it was found that 22.7 per cent of the diabetic patients had hypertension. The prevalence of hypertension in diabetes varies from 20 to 41 per cent (Roy, 1986). This supports the study by Sprajka et al. (1988) about the higher incidence of hypertension among diabetics. Diabetes is a factor supposed to be responsible for higher incidence of cardiovascular complications. In the present study the incidence of heart disease was found to be 8.7 per cent. Roy (1986) reported that the incidence of heart disease and

stroke increased by 2 to 3 times in patients with diabetes. In a prospective study he found that 12.8 per cent of type II diabetes had heart disease.

Obesity and diabetes are found to have a direct relationship. 29.3 per cent of the diabetic patients studied were over weight. Thashev (1986) in his study revealed that 70 per cent of the diabetics were over weight. Among the over weight patients, the percentage of over weight women was higher than men. Similarly Ramachandran (1988) reported that obesity is related to diabetes in Indian women. Gall et al. (1988) demonstrated an association between excess abdominal fat, obesity, atherogenesis and a worse diabetic metabolic control. In the present study, 10.7 per cent of the patients were found to have greater waist measurements indicating excess abdominal fat.

Alcohol consumption, smoking, lack of physical exercise etc. are some of the risk factors of diabetes and in the present study it was found that only 2 per cent of the patients were in the habit of consuming alcohol, while 18 per cent abstained from consumption. Mc culloch et al. (1980) reported that in 541 white diabetic men 7 per cent had frank alcoholism and 15 per cent drank heavily.

Roy (1986) reported that cigarette smoking contributes to atherogenesis by several mechanisms and this leads to microangiopathy in diabetes. The present study showed that 17.3 per cent of the patients were smokers, while 14 per cent abstained from smoking. 7.3 per cent of the patients were in the habit of chewing tobacco while 12 per cent abstained from this habit after the onset of diabetes. Majority of the patients were in the habit of taking coffee or tea without sugar thrice a day. A study of Samantha et al. (1987) revealed that a lot of patients drank 'Indian tea' on several occasions through out the day and as the recipe indicates this contained half milk and half water and so the amount of milk consumed per day through this beverage was high.

Reduced physical activity is a risk factor in diabetes. Exercise has a beneficial effect on other associated risk factors like hypertension, obesity, hyperlipedimia and glucose intolerance. The present study showed that about 50 per cent of the diabetic patients did not take any regular exercise.

Monitoring control of diabetes, through glycemic control and tailoring are the various components in the management of diabetes. In most of the patients the disease was diagrosed

by both urine and blood test. All the patients were in the habit of attending the speciality clinic, or visiting private medical practitioners, general diabetic clinics and also trying Ayurvedic medicines. Majority (79.3 per cent) of the patients controlled the disease through diet and oral hypoglycemic drugs, while only 7.3 per cent of the patients controlled the disease through dietary management alone.

The present study showed that the severity of the disease can be reduced through education, and through the influence of social contacts. It was found that after the onset of the disease, some patients changed their habits because they knew about it through their education and majority of the patients were influenced by friends, neighbours, relatives and other diabetic patients. Alleyene et al. (1979) reported that the control of the severity of diabetes has some relation to social variables such as facilities at home, education attained, employment status, informal education and understanding of the illness.

The patients knowledge regarding the food to be avoided and the foods to be included in the diet of diabetics revealed that according to many, sugar roots and tubers were to be completely avoided. A few said that rice, wheat, meat

and fish also were to be avoided. Many patients were of the opinion that food groups like vegetables, leafy vegetables, cereals, milk and curds, pulses fish and meat should be included in larger quantities in their diet. These results support the study reported by Sherad (1984).

In the diabetic diet it is advisable to take required quantities of food by increasing the number of meals per day instead of limiting the number of meals by increasing the quantity in each meal. But here the patients studied were found to take three major meals in a day especially the office personnel for whom the suggested method was not practical. The patients had the habit of eating in between meals. Most of them took coffee or tea and snacks at the work place.

The percentage of patients taking meals outside the home was 12 per cent without any restriction in the quantity and quality. Majority of the patients had a liking for sweets and fried food items and they were in the habit of taking these items when they had the desire to eat. This shows that the dietary restrictions were not strictly adhered to, by the patients.

A number of foods are believed to act as hypoglycemic agents. The patients studied were found to be in the habit of taking some of these foods regularly. Nearly half of the patients (54 per cent) studied took bitter gourd juice while others took fenugreek. Fenugreek was found to be a hypoglycemic agent by sharma (1987).

The saturated and unsaturated fats in the diet have been shown to have some effect on the metabolism. Here a majority of the patients were in the habit of using palm oil and coconut oil as a medium for cooking.

It was found that the patients restricted the use of sugar in their diet. Very few families were in the habit of preparing special foods for the diabetic patients, and these special foods prepared were usually wheat preparations or green leafy vegetable preparations. Frequency of use of various food item by the diabetic patients showed that cereals, milk coconut oils etc. were consumed daily by all the patients. Vegetables, fish etc., were also consumed by almost all the patients. Processed foods like pickles, confectioneries etc., were consumed frequently by almost all the patients.

Impact of Diabetic clinic on the existing dietary pattern of the patients.

A well designed meal plan is an important cornerstone in the management of diabetes. The ideal treatment for diabetes would allow the patients to remain not only symptom free but in good health with a normal metabolic state and to escape the long term complications.

Results of the observation and interview of the personnel as well as patients carried out in the clinic shows that diet counselling in the clinic was done without the help of a dietitian. The British medical Association (1987) similarly reported that 20 per cent of all hospital diabetic clinics are being run without a dietitian and general practitioners have no access to dietitians.

National Institute of Health (1987) suggested that, the meal plan, education and counselling programmes should be individualized for the person with diabetes. But in this clinic there was only a general diet sheet for all the patients. According to West (1976) diabetics rarely understand and follow their diet prescription and the standards of

medical practice in relation to diet therapy for diabetic patients are generally low. The present study shows that not all the patients were regular in following the diet prescription from the clinic.

The knowledge of the patients regarding the diet was analysed. It was found that the patients did have some knowledge about the diabetic diet like the restriction of sugar, inclusion of more vegetables etc. But they were not aware of the importance of fiber, the effect of excess fat in the diet etc., Similar results are reported by Sherad(1984) about the knowledge of the diabetic patients, regarding diabetic diets.

The impact of diet counselling and a modified diabetic diet on blood and urine profile.

Dietary pattern of the case studies revealed that for all the patients the total calorie intake was far exceeding the calculated recommended value based on each patients' body weight and height. Findings further indicate that an excessive calorie intake resulted in weight gain and obesity. Seshiah et al. (1986 a) had noted that with moderate obesity there is four fold increase in diabetes and with

severe obesity a ten fold increase. Regarding the proportion of total calories from energy yielding nutrients viz. carbohydrate, protein and fat, it was found that in all cases calories supplied from carbohydrate were less and the calories from fat was very high when compared to the calculated recommended values for each patient. Daily meal plan of diabetic patients should be consistent in terms of total calories and the distribution of energy yielding nutrients (Seshiah et al., 1986 a). The present study shows that the calories supplied from protein in the diabetic diet was adequate. The results of this study is in line with the study conducted by Hackett et al. (1987) who revealed that the dietary intakes of diabetic patients were deficient in carbohydrate but more sufficient in fat than recommended.

The metabolic state of the patients before following a diabetic diet was observed with regard to the presence of glucose in urine. Only case I and II had tracess of glucose where as other patients were negative to this test. Davidson et al. (1975) had suggested that urine testing is wasteful since upto 3 per cent of the people may have renal glycosuria and have to be recalled for blood test. This was also supported by Sainani (1986) who suggested that urineglucose monitoring is unreliable in assessing diabetes control due to the wide variations between blood glucose level and urine reduction.

Of the six case studies, case II had abnormally high levels of cholesterol and case V had slightly above the normal level. They were not maintaining ideal body weight also. Case II was seen to have high levels of triglycerides and in this case the calories from fat in the existing diet was about 39 per cent. As reported by Anderson and Chen (1979), serum cholesterol and triglycerides are major risk factors for Ichaemic Heart Disease in diabetic patients and one goal of nutrition management of diabetic individuals is to minimise the risk of atherosderosis by maintaining healthy or safe serum cholesterol and triglyceride concentration.

All patients had high levels of blood glucose except case IV who maintained the blood glucose level with in the normal range. For this patient all other biochemical parameters were also normal.

After the followup study, among the six case studies, case I was found to have maintained the ideal body weight with the modified diet, where as case II, a low body weight patient, did not increase the weight to his ideal body weight. All other patients managed their body weight at the ideal during the six months followup. Urine analysis for glucose was negative for all patients except case II. There was a

significant decrease in the levels of serum cholesterol and Triglycerides. This implies that a well balanced diet with correct proportions of carbohydrate, protein and fats according to the patients ideal body weight will bring about a normal metabolic state in diabetic patients. Anderson and Sieling (1985) also suggests that in general a high carbohydrate, low fat diet usually improves glucose metabolism in diabetic patients. Normalising blood lipid, is an important goal in nutrition management. Viswanathan et al. (1984) reported that diabetic patients have been treated with high carbohydrate high fiber diet without other meducation over a three year period; fasting blood glucose value decreased by an average of 18 per cent; corresponding reduction in serum cholesterol and triglyceride values were observed.

In general the dietary pattern of the diabetic patients revealed that their total calorie consumption was high and the percentage of calories derived from carbohydrate was between 45 and 55 per cent, as that of protein between 10 and 15 per cent and that of fat between 30 and 40 per cent.

In the present study a modified diet with 60 to 65 per cent calories from carbohydrate, 15 to 20 per cent calories from protein and 15 to 25 per cent calories from fat of the total calorie intake helped to improve the diabetic patients metabolic state.

Diabetes is a disease of the prosperous and in wealthy countries it is one of the major health problems. The importance of sufficient exercise and of avoiding dietary excess for health has been stated repeatedly. Diabetes, like obesity and atherosclerosis is likely to arise iin predisposed persons who eat too much and exercise too little.

SUMMARY

SUMMARY

Non Insulin Dependent Diabetes Mellitus (also known as NIDDM) was so designated in 1979. Its features and causation were well known to ancient Hindu Physicians in India three thousand years ago. They attributed it to heredity and over indulgence in unwhole some food.

Epidemiological studies have established the significant contribution by other factors, such as physical indolence, dietary habits (independent of obesity), viz., consumption of refined carbohydrates and a reduced intake of fiber, urbanization with associated affluence and the stress of life, in the aetiology of type II diabetes mellitus.

The present study deals with the influence of traditional family diets as a predisposing factor and the role of dietary management in controlling diabetes. This study on dietary factors and diabetes was conducted in the city of Trivandrum and its subrbs, mainly in the families of patients attending the diabetic clinic at Medical College.

Data required under the study was collected through surveys on the socio-economic and food consumption pattern of the families and on the personal characteristics and dietary pattern of the diabetic patients. Also the diet counselling being imparted in the clinic was observed. The diet counselling which was imparted to six diabetic patients selected as case studies and their biochemical profile, before and after the diet counselling, was assessed.

The survey on socio-economic and food consumption pattern of the families of the diabetic patients imparted information on religion, area of residence, family size, education, occupation, income and expenditure pattern of the families. Frequency of purchase and use of foods, cooking practices, use of foods during special occasions, were the other information derived from the above survey. The survey on personal characteristics and dietary pattern of the diabetic patients provided information regarding the age at onset of diabetes, disease history of relatives of the patients, health conditions, alcohol and tobacco consumption, smoking habits, sleeping pattern and exercise pattern of the diabetic patients. Also the special foods prepared and consumed, type of oils used and the frequency of use of various food items were the other information obtained.

The survey revealed that 67.3 per cent of the patients were from the urban areas. 59.3 per cent of the families were Hindus. 62 per cent of the families had 3-5 family members and 78 per cent of the families had below 5 members. 74.8 per cent of the family members were above 18 years. The major source of income for the families was from permanent jobs followed by the income from pension. The educational status of the family members was considerably high and around three fourth of the population had obtained high school education and above. Majority of the families surveyed were of the higher economic group and no family was found to be under the poverty line. The economic dependency ratio of the families was found to be 1.76:1. No family spent more than 80 per cent of their monthly income on food, while one fourth of the families spent above 60 per cent of their monthly income for food. Most of the families (92 per cent) were basically non-vegetarians. Regarding the purchase of foods by the families, it was found that various food items like cereals, pulses, fats and oils, sugar, spices and condiments etc., were purchased monthly. Cereals, especially rice and wheat were found to be the staple foods in these families, where as millets like ragi was consumed only by a very few families. The consumption of refined cereals

almost all the families. The daily consumption of processes foods was comparatively high among these families. Confectioneries also were consumed daily by a good number of the families. The consumption of sugar, salt and oil per day by the family members was found to be high. Palm oil and coconut oil were used by majority of the families. The straining method was commonly adopted for the cooking of cereals. Frying of some foods like fish, egg, pulses etc. was common among these families. The families were in the habit of celebrating various family occasions like birth days, marriage, religious festivals etc., by preparing special food.

The food weighment survey indicated that the various food groups like milk, milk products, fats and oils, flesh foods and sugar exceeded the recommended, while roots and tubers and other vegetables were less than the recommended, in the case of male members of the families of diabetic patients. In female members a similar trend in the consumption of various food groups was observed, except that in this case the consumption of leafy vegetables was less than the recommended.

The average nutrient consumption in the case of male members of the families indicated that all nutrients other than calories, vitamin A and Niacin were in excess of the recommended. In the case of female members of the families, there was a deficiency of Niacin, while other nutrients were in excess of the RDA except for iron and vitamin A.

The survey on personal characteristics and dietary pattern of the diabetic patients showed that, among the diabetic patients studied the number of male patients (50.7 per cent) was slightly higher than female patients (49.3 per cent). Among the female patients, most of them (37.3 per cent) were unemployed house wives. The number of pensioners was considerably high i.e., 32 per cent. None of the patients were illiterate and a majority had college education. Majority (59.3 per cent) of the patients were in the age between 46 and 60 years and no case below 30 years and above 75 years was observed. The age at onset in most of the patients (27.3 per cent) was between 46 to 50 years. The initial symptoms of the disease as experienced by most of the patients were fatigue, thirst and hunger. Positive family history of diabetes was seen among the patients. Paternal history of diabetes was found

to be higher than maternal, where as obesity and hypertension were higher among the female members of the families studied. Heart disease was found to be higher among father's of these patients. Hypertension and heart disease were two diseases which were common among the diabetic patients surveyed. Around half of the patients were of normal weight, while around 29.3 per cent of the patients were over weight. The incidence of obesity and hypertension was higher among the female patients. Smoking and tobacco chewing were habitually used by some of the patients, but the consumption of alcohol was very low. Majority of the patients consumed coffee or tea frequently through out the day. Only about 45.3 per cent of the patients had the habit of taking excercise and the average sleeping hours of the patients was found to be 7 to 8 hours.

79.3 per cent of the patients controlled the disease by resorting to diet control and oral drugs. Most of the patients were of the opinion that their education, conversation with friends, neighbours, relatives, other diabetic patients etc., did have an influence on the control of the disease through diet. It was found a few of the patients had some knowledge about the foods to be restricted and foods to be included in their diet without being aware of the underlying reasons.

Majority (68.7 per cent) of the patients were in the habit of taking three major meals a day. The nibbling habits of the patients showed that snacks were consumed twice a day by 47 per cent of the patients. A good number (56 per cent) of the patients had the desire to eat sweets and fried items, while only 38.7 per cent ate such foods when they had a desire for it. 54 per cent of the patients were in the habit of taking bitter gourd juice, as a hypoglycemic agent and some used fenu greek seeds. Palm oil and coconut oil were the medium for cooking used by majority of the diabetic patients. Only a very few patients used sugar daily. Some food items that were specially prepared in the family for the patients included, wheat dosai, broken wheat kanji, leafy vegetable preparations etc.

Regarding the diabetic clinic attended by the patients, the diet counselling was carried out without the help of a dietitian. The diet planning in the clinic was not individualized. Though the patients had a fairly good knowledge about the diet, most of them were still unaware of some aspects of the diabetic diet like food exchange lists, importance of dietary fiber etc.

The food weighment survey carried out in selected diabetic patients indicated that the calorie consumption by the diabetic patients was significantly higher. The carbohydrate intake was lower than the recommended and the fat intake was found to be higher than the recommended. The protein intake was almost adequate in these patients. The calories from fat was found to be very high in all patients as well as in the family diets.

The impact of diet counselling was found to be effective through the analysis of the biochemical profile of the diabetic patients selected as case studies. Though there was individual variation, significant reduction was found in blood glucose level, cholesterol and triglyceride levels etc. Education of the patients was thus found to have a significant effect in the control of the disease through diet.

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APPENDICES

APPENDIX I

KERALA AGRICULTURAL UNIVERSITY

Questionnaire to elicit information regarding the socio-economic and food consumption pattern of the families of diabetic patients

1.	Name of the patient	:	
2.	Age	:	
3.	Sex	:	Male/Female
4.	Religion	:	Hindu ( ) Christian ( ) Muslim ( ) Any other ( ) (Please tick ( ) for the answer.
5.	Residential area	:	Rural ( ) Urban ( )
6.	Monthly income of the Family	:	
7.	Sources of income of family	:	Permanent job ( ) Temporary job ( ) Agriculture ( ) Business/Rent/ Interest from Bank ( )

8. Family size and composition

Sl. No.	Relationship with the patient	Sex	Age	Education	Occupation	Monthly income	Health condition

9. Monthly expenditure pattern of the family

Sl. No.	Items	Monthly expenditure in rupees
1.	Food	
2.	Clothing	

4. Travelling
5. Education
6. Entertainment
7. Health
8. Saving
9. Miscellaneous
10. Food habit of the family: Vegetarian/Non vegetarian
11. Frequency of purchase of various food items by the family

	Frequency of purchase			
	Daily	Weekly	Monthly	Occasionally
1. Cereals				
2. Pulses				
3. Leafy Vegetables				
4. Roots & Tubers				
5. Other vegetables				
6. Fruits				
7. Milk & Milk Products				
8. Fish				
9. Meat				
10. Egg				
11. Oil seeds				
12. Fats and Oils				
13. Sugar/Jaggery				
14. Spices & condements				
15. Bakery items.				

12. Frequency of use of various food items

Food items	Frequency of use					
	Daily	Weekly			Occa-sionally	Never
		Once	Less than 3	More than 3		
1. Cereals						
Rice						
Wheat						
Rave						
Ragi						

2. Pulses

   Bengal gram
   Black gram
   Cow pea
   Red gram

3. Roots and tubers

   Potato
   Tapioca
   Yam
   Colocasia
   Carrot
   Beetroot

4. Leafy vegetables

5. Other vegetables

6. Fruits

7. Milk & milk products

   Milk
   Curd
   Butter milk
   Butter
   Cheese

8. Flesh foods

   Chicken
   Mutton
   Duck
   Beef

9. Fish

10. Egg

    Hens
    Duck's

11. Nuts and Oil seeds

    Ground nut
    Gingelly seeds
    Coconut

12. Fats/Oil

13. Sugar/Jaggery

14. Processed foods

15. Bakery items

13. One day meal pattern of the family

Food items	Meals	time
1. Cereals		
2. Pulses		
3. Roots & tubers		
4. Leafy vegetables		
5. Other vegetables		
6. Fruits		
7. Milk & milk products		
8. Meat		
9. Fish		
10. Egg		
11. Fats/Oils		
12. Sugar/Jaggery		
13. Processed foods		
14. Bakery items		

14. The use of following items in a day by the family members.

weith in gm

a. Sugar
b. Jaggery
c. Honey
d. Satt
e. Fats/Oils

15. Which oil is used for cooking in your family. Tick ( ) for the correct answer.

1. Gingelly Oil ( )
2. Ground nut Oil ( ))
3. Sanola ( )
4. Coconut Oil ( )
5. Vanaspathi ( )
6. Palm Oil ( )
7. Any other ( )

APPENDIX I (Contd.)

16. Methods of cooking of different food items

Food items	Boiling		Steaming	Frying	Any other
	Absorption	Straining			
1. Cereals					
2. Pulses					
3. Roots & tubers					
4. Leafy vegetables					
5. Other vegetables					
6. Fruits					
7. Meat & fish					
8. Egg					
9. Milk & milk products					
10. Oil seeds					

17. Diet during different physiological conditions

1. Infancy	
2. 3-6 years	
3. School going children	
4. Adolescents	
5. Pregnancy	
6. Lactation	
7. Old age	

18. Diet during special occasion

Occasion	items
Birth day	
Marriage	
Death	
Religious festivals	

APPENDIX II

KERALA AGRICULTURAL UNIVERSITY

Questionnaire to elicit information regarding the personal characteristics and dietary pattern of the diabetic patients

1. Name of the patient :
2. Age :
3. Sex : Male/Female
4. Food habit : Vegetarian/Non vegetarian
5. Blood group :
6. Type of diabetes : Type I / Type II
7. Occupation of the patient :
8. Age at onset of diabetes :
9. History of incidence of the disease in the relatives of the patients (Please tick ( ) in the appropriate column)

Diseases	Father	Mother	Father and mother	Sister	Brother	Father's Brother Sister	Mother's Brother/ Sister	No history

9a. Does the patient have heart disease, hypertension Kidney disease etc. Yes ( ) No ( )

b. If so, please specify the diseases

(a)
(b)
(c)

10. In which of the following group are you included ?

1. Over weight
2. Under weight
3. Normal

APPENDIX II (Contd.)

11. Please give the following:
    1. Height
    2. Weight
    3. Waist circumference.

12. a) Are you in the habit of drinking alcohol?
    Yes ( ) No ( )
    b) If you have stopped, indicate reasons
    i)
    ii)

13. a) Are you in the habit of smoking?
    Yes ( ) No ( )
    b) If you have stopped indicate reasons.
    i)
    ii)

14. a) Are you in the habit of chewing betal leaves?
    Yes ( ) No ( )
    b) If you have stopped, indicate reasons.
    i)
    ii)

15. a) Do you take coffee/tea daily?
    Yes ( ) No ( )
    b) If yes, how many times in a day
    c) Do you have it with sugar and milk
    d) After the onset of the disease have you decreased the number of times in a day of drinking these beverages.
    Yes ( ) No ( )
    e) If so give reason

16. How did you first diagnose the onset of the disease?
    1. Fatigue
    2. Thirst and hunger
    3. Frequent urination

17. How did you diagnose the onset of the disease
    1. Urine test
    2. Blood test
    3. Urine and Blood test

18. If it was through blood test please indicate the type.

1. Fasting
2. Post Prandial
3. G.T.T.
4. 1+2
5. 1+3
6. 1+2+3

19. Indicate which type of medical treatment you have been getting.

1. Nothing
2. Medical Practitioner
3. Hospital general clinic
4. Hospital speciality clinic
5. Ayurvedic treatments
6. Homoeopathic
7. Natural therapy

20. Treatment after diagnosis

1. No treatment
2. Diet control
3. Oral drugs
4. Injection
5. Diet control and oral drugs
6. Diet control and Injection
7. Oral drugs and Injection
8. Diet control, Injection and Oral drugs
9. Ayurvedic medicine
10. Homoeopathic medicine
11. Natural therapy

21. In connection with this disease, how often do you visit the hospital.

22. Do you get any instruction regarding diet control from the clinic?

23. Do you obey these instructions? Yes ( ) No ( )

24. If no, please give reason.
i)
ii)

25. Did the following have any influence in changing your dietary habit (Please tick ( )

1. Your education	Yes/No
2. Medical class attended	Yes/No
3. Articles in papers and magazine	Yes/No
4. Radio/TV programmes	Yes/No
5. Advertisements	Yes/No
6. Conversations with relatives, friends neighbours etc.	Yes/No
7. Other diabetic patients	Yes/No

26. Do you know what type of foods must be avoided on restricted in the diet of diabetic patients?

    Yes ( ) No ( )

27. If Yes, specify the items
    i)
    ii)

28. Do you know what type of foods are to be included in larger quantities in the diabetic diet.

    Yes ( ) No ( )

29. If yes, list out the items
    i)
    ii)

30. Have you heard about the food exchange list?

    Yes ( ) No ( )

31. If yes, what is its importance, from where did you obtain the information?

32. a) Are you in the habit of taking exercise?
    Yes ( ) No ( )

    b) If yes, how much time in a day do you spend for it.

    c) Which type of exercise do you follow?

33. a) At what time do you go to bed?
    b) At what time do you wake up?

34. a) Do you woke up frequently at night?

    Yes ( ) No ( )

    b) If yes how many time
    c) Please give reason

35. a) Do you feel energetic when you wake up in the morning?

    Yes ( ) No ( )

    b) If no, please specify the type of discomfort experienced.

36. Medium of transport to the place of work please tick ( ) for the correct answer.

1. Waling	( )	4. Scooter by self driving	( )
2. Bus	( )	5. Car by self driving	( )
3. Cycling	( )	6. Train	( )
		7. Any other	( )

37. How many major meals do you have in a day?

1. ( )	3. ( )
2. ( )	4. ( )
	5. ( )

38. a) Are you in the habit of taking in between meals?

Yes ( ) No ( )

b) If yes, at which time do you take it.

c) What type of food stuffs do you taking

1. 2. 3.

39. a) Do you have the habit of eating meals with the family members?

Yes ( ) No ( )

b) Are you in the habit of eating meals from out side the home?

Yes ( ) No ( )

c) If so, please indicate whether

1. Daily ( )
2. Once in a week ( )
3. Two or three times in a week ( )
4. Fortnightly ( )
5. Monthly ( ))
6. Occasionally ( )

40. Do you take the packed lunch to your place of work?

Yes ( ) No ( )

41. If yes, specify the items

i)

ii)

42. Do you take saccharine instead of sugar?

Yes ( ) No ( )

43. a) Do you have the desire to eat sweet and fried food items?

Yes ( ) No ( )

b) If yes, do you eat such items.

44. According to changes in your dietary pattern is there any change in the family dietary pattern.

Yes ( ) No ( )

45. a) Are you in the habit of taking any natural foods, which are known to have a beneficial effect on diabetes.

Yes ( ) No ( )

b) If yes, please tick for the correct and how they prepare.

1. Fenu greek
2. Bitter gourd
3.
4.

46. The quantity consumed per day of the following items.

1. Jaggery 2. Sugar 3. Honey 4. Salt

47. What type of oil is used for cooking your food (Please tick ( ) right one).

1. Gingelly oil	( )	4. Coconut oil	( )
2. Ground nut oil	( )	5. Palm oil	( )
3. Sanola	( )	6. Vanaspathi	( )
		7. Any other	( )

48. a) Are there any items which are prepared specially for you

Yes ( ) No ( )

b) If yes, give the details.

Items	Boiling				
	Strai-ring	Absor-ption	Stea-ming	Fry-ing	Any other

49. Frequency of use of various food items please tick ( ) the suitable column.

Food items	Frequency of use of food items					
	Daily	Weekly			Occa-sion-ally	Never
		Once	twice	3 or more times		
1	2	3	4	5	6	7
1. Cereals						
Rice						
Wheat						
Maida						
Broken wheat						
Ragi						
2. Pulses						
Green gram						
Bengal gram						
Red gram						
Black gram						

APPENDIX II (Contd.)

1	2	3	4	5	6	7
3. Roots and tubers						
Potato						
Carrot						
Beet root						
Tapioca						
Yam						
Colocacia						
Colease						
4. Leafy Vegetables						
Amaranthus						
Cabbage						
Drumstick leaves						
Any other						
5. Other vegetables						
Bitter gourd						
Ladies finger						
Snake gourd						
Beans						
Any other						
6. Fruits						
7. Milk & milk products						
Milk						
Curd						
Butter milk						
Cheese						
8. Flesh foods						
Mutton						
Chicken						
Beef						
Duck						
9. Fish						
10. Egg - Hen's						
Duck's						
11. Fats and oils						
12. Sugar						
Jaggery						
13. Processed foods						
Squash						
Jam						
Jelly						
Noodles						
Pickles						
14. Bakery Items						

APPENDIX III

KERALA AGRICULTURAL UNIVERSITY

SCHEDULE FOR THREE DAY WEIGHMENT SURVEY

FAMILY DIET SURVEY

1. Name of the head of the family:
2. Name of the patient or patients
3. Age and Sex composition of those who have taken the meal.

Age	Adult	12-21	9-12	7-9	5-7	3-5	1-3	Below 1	Gue-sts	Age
M										
F										

4.

Food Stuff	Weight in gm.	Food Stuff	Weight in gm.
CEREALS		ROOTS AND TUBERS	
1. Broken wheat		22. Beet root	
2. Maida		23. Carrot	
3. Rava		24. Potato	
4. Ragi		25. Tapioca	
5. Rice		26. Raddish	
6. Wheat flour		27. Onion big	
7. Others		28. Others	
PULSES		NUTS AND OIL SEEDS	
8. Bengal gram		29. Cashew nuts	
9. Black gram		30. Coconut dry	
10. Green gram		31. Coconut fresh	
11. Kesari dal		32. Ground nut	
12. Lentil		33. Others	
13. Red gram		MILK & MILK PRODUCTS	
14. Soybean		34. Milk	
15. Cowpea		35. Cruds	
16. Others		36. Butter milk	
LEAFY VEGETABLES		37. Skimmed milk	
17. Amaranthus		38. Cheese	
18. Chekkurmanis			
19. Drumstick leaves		FATS AND OILS	
20. Others		39. Butter	
21. Other vegetables			

40. Ghee
41. Hydrogenated oil
42. Cooking oil

OTHER FOOD STUFFS

43. Betal leaves
44. Biscuits, Salt
45. Biscuits, Sweet
46. Bread

FRUITS

47. Amla
48. Apple
49. Banana ripe
50. Lime and Orange
51. Mango ripe
52. Melon - water
53. Papaya ripe
54. Plantain ripe
55. Tomato ripe
56. Others

FISH

57. Fish fresh
58. Fish dry
59. Prawns

OTHER FLESH FOODS

60. Meat, beep
61. Chicken
62. Mutton
63. Any other
64. Liver
65. Egg
66. Sugar
67. Jaggery
68. Papad
69. Sago
70. Akoholic beveages
71. Deserts
72. Sweets
73. Horlicks
74. Maltova
75. Any other

Dietary information

Meal pattern	Type of preparation	Ingredients used	Raw amount (g/ml)	Total cooked amount (g / ml)
a	b	c	d	e
Early morning				
Break fast				
Mid morning				
Lunch				
Evening tea & snacks				
Dinner				
Others				

APPENDIX IV

CALCULATION OF IDEAL BODY WEIGHTS

Adult men : 5' = 105 lbs.
Add 6 lbs for every 1"

Adult Women : 5' = 100 lbs.
Add 5 lbs for every 1"

*Seshiah et al. (1986 a)

CASE STUDY - II

Adult male , Height - 5' 6"
Body weight - 63.5 kg.
Ideal body weight - 64 kg.
Normal body weight patient.

CASE STUDY - II

Adult male - Height 5' 8"
Body weight - 62 kg.
Ideal body weight - 69.5 kg.
Under weight patient

CASE STUDY - III

Adult male, - Height 5' 7"
Body weight - 69 kg.
Ideal body weight - 66.8 kg.
Normal body weight.

CASE STUDY - IV

Adult male, - Height 5' 6"
Body weight - 66 kg.
Ideal body weight - 64 kg.

CASE STUDY - V

Adult Female - Height 5'
Body weight - 54 kg.
Ideal body weight 45.5 kg.
Over weight patient.

CASE STUDY - VI

Adult Female - Height 5'2"
Body weight - 50 kg
Ideal body weight 50 kg.
Normal weight patient.

APPENDIX V

PROCEDURE FOR THE ESTIMATION OF BLOOD AND URINARY GLUCOSE

Blood and urinary glucose was analysed by the procedure of Asatoor and King (1954) with the modification that low alkaline copper reagent was used. Details of the procedure are given below:

Reagents

1. Isotonic sodium sulphate - copper sulphate solution
2. Sodium tungstate - 10 per cent
3. Low alkaline copper reagent (modified Harding solution B)
4. Arsenomolybdate reagent

0.05 ml of the sample was pipetted in to 3.9 ml of isotonic sodium sulphate - copper sulphate solution contained in a centrifuge tube. The protein was pipetted by adding 0.5 ml of sodium tungstate. The precipitated protein and copper tungstate were spun down and 1 ml of supernatant was used for glucose estimation.

An aliquot of the supernatant along with 1 ml of isotonic solution and a standard of 25 ug glucose made up to 1 ml with isotonic solution. To all the tubes were added 1 ml of low alkaline copper reagent and heated over a boiling water bath for ten minutes cooled immediately in an ice bath and added 1 ml of Arsenomolybdate reagent. All the tubes were made up to 5 ml for fifteen minutes and the absorbance was read at 520 mm.

APPENDIX VI

PROCEDURE FOR THE ESTIMATION OF CHOLESTEROL

Total cholesterol was estimated by the method of Abell (1952).

Reagents

1. 33 per cent KOH
2. Absolute ethanol
3. Ethanolic KOH - 6 ml of 33 per cent KOH in water was added to 94 ml of absolute ethanol.
4. Petroleum other (60 to 80°C) (AR)
5. Color reagent - 20 ml of acetic anhydride was cooled in ice. 1 ml of concentrated H_2SO_4 was added to this with shaking. It was again cooled for 10 minutes and 10 ml of glacial aceticacid was added and allowed to attain room temperature.

An aliquot from the lipid extract was pipetted out in to a glass stoppered centrifuge tube and evapourated to dryness. 5 ml of ethanolic KOH was added, stoppered and was shaken well. It was then warmed in a water bath at 37 to 40°C for 55 minutes. After cooling to room temperature, 10 ml of petroleum ether (60 to 80°C) was added and mixed. 5 ml of water was added to this and shaken vigorously for one minute. It was centrifuged at a low speed for 5 minutes. 4 ml of the petroleum ether layer was pipetted out in to a test tubeand evapourated to dryness at 60°C. A standard (2mg Cholesterol/ml) was also treated in the same manner. 6 ml of colour reagent was added to each tube and kept at 25°C after thorough shaking. 6 ml of colour reagent was taken as the blank. After 30 to 35 minutes, the optical density was read at 620nm.

APPENDIX VII

PROCEDURE FOR THE ESTIMATION OF TRIGLYCERIDES

Triglycerides were estimated by the method of Van Handel and Zilver smit (1957) with the modification that florisil was used to remove phospholipids.

Reagents

a) Chloroform - AR

b) Florisil

c) Ethanolic KOH - 0.4 %

d) 2g of KOH was dissolved in 100 ml of ethanol this was then diluted 5 times with ethanol.

d) H_2SO_4 - 0.2 N

e) Sodium metaperiodate - 0.05 M

f) Sodium arsenite 0.5 M

g) Chromotropic acid

2 g of chromotropic acid (or 2.24 g sodiumsalt) was diesolved in 200 ml distilled water. 600 ml of concentrated sulphuric acid was added slowly to 300 ml of distilled water which was chilled in ice. This chilled and diluted acid was then added to the chromotropic acid solution (0.25 mg/ml).

2 g of florisil was taken in a glass stoppered tube and 3 ml of chloroform was added. An aliquot of the extract was layered on top of florisil and mixed. More chloroform was then added to this to a total volume of 100 ml. It was then stoppered, shaken intermitlently for about 10 minutes and then filtered through a fitter paper. 1 ml of the filtrate was pipetted out in to each of 3 tubes. 1 ml of working standard of glycerol (9 g / ml) was pipetted out into each of 3 tubes. The solvent was evapourated at 60 to 70°C, 0.5 ml of ethanolic KOH was then added to 2 out of the 3 tubes (saponified sample) and 0.5 ml of ethanol was added to the third tube (un saponified sample). The tubes were closed and kept at 60 to 70°C for 15 minutes. 0.5 ml of 0.2 n H_2SO_4 was added to each tube and the tubes were then placed in gently boiling water bath for 15 minutes to remove alcohol. They were then cooled to room temperature. 0.1 ml of sodium arsenite solution was then added. An yellow colour of iodine appeared and vanished with in a few minutes. 5 ml of chromotropic acid was added to each tube and mixed. The tubes were closed and then heated in a boiling water bath for 30 minutes. They were then cooled and the absorbance was read at 570 nm.

APPENDIX VIII

EXCHANGE LISTS

* Pasricha (1985)

VEGETABLE EXCHANGE A

These vegetables may be used a desired Carbohydrates and calories are negligible

Leafy vegetables	Other vegetables
Amaranth	Ash gourd
Bathua	Bitter gourd
Brussels sprout	Brinjal
Cabbage	Calabash cucumber
Celery	Cauliflower
Coriander leaves	Cho-Cho
Curry leaves	Cucumber
Fenu greek leaves	Drumstick
Lettuce	French beans
Mint	Khol - Khol
Rape leaves	Ladies finger
Spinach	Mango green
Soya leaves.	Onion Stalks
	Parwar
	Plantain flower
	Pumpkin
	Radish
	Rhubarb stalks
	Snake gourd
	Tinda
	Tomato green
	Turnip

VEGETABLE EXCHANGE B

Carbohydrate - 10g Calories 50

Root vegetables	Quantity
Beet root	75
Carrot	105
Colocasia	45
Onion, big	90
Onion, small	75
Potato	45
Sweet potato	30
Tapioca	30
Yam (elephant)	60
Yam	45

Other Vegetables

Artichoke	60
Broad beans	90
Cluster beans	90
Double beans	50
Jack tender	105
Jack fruit seeds	30
Leeks	60
Peas	45
Plantain, green	75
Singhara	45

FRUIT EXCHANGE

Carbohydrate - 10 g Calories - 50

Fruit	Quantity g	Approximate number or size
Amla	90	20 medium
Apple	75	1 small
Banana	30	½ medium
Cape goosebery	150	40 small
Cashew fruit	90	6 medium
Custard apple	15	2
Dates	45	1 small
Figs	60	½ small
Grapes	105	20
Grape fruit	150	½ big
Jack fruit	60	3 medium pieces
Jambu fruit	50	10 big
Lemon	90	1 medium
Loquat	105	6 big
Mango	90	1 small
Mango steen	75	2 medium
Melon	270	¼ medium
Orange	90	1 small
Papaya	120	⅓ medium
Peach	135	2 small
Pear	90	1 small
Pineapple	90	1½ slices(round)
Plum	120	4 medium
Pomegranate	75	1 small
Strawberey	105	40
Sweet lime	150	1 medium
Tomato	240	4 small
Water melon	175	¼ small

APPENDIX VIII (Contd.)

CEREAL EXCHANGE

30g provide calories : 100, Carbohydrates : 20 g Protein : 2g

Bajra	Rice flakes
Barley	Rice puffed
*Bread	**Sage
Cholam (Jowar)	Samai
Corn flakes	Semolina (Suji)
Maize, dry	Vexmicelli (savian)
Oatmeal	Wheat flour
Ragi	Wheat broken (dalia)
Rice	White flour

* To meat carbohydrates and calories and 5g Sugar, Requires.

** Supplementation with other high protein foods.

LEGUME AND PULSE EXCHANGE

30g provide calories : 100g, Carbohydrates : 15g, Protein : 6g

Bengal gram	Kabuli chonna (White gram)
Bengal gram, roasted	Lentils
Besan (Bengal gram flour)	Moth beans
Black gram	Peas, dried
Cow gram	Rajmah
Green gram	Rawan
Horse gram	Red gram

APPENDIX VIII (Contd.)

FLESH FOOD EXCHANGE

Calories: 70 Protein : 10 g

Food	Quantity (g)
Beef	60
Crab	120 nos.
Egg, duck*	2 nos.
Egg, Hen*	2 nos.
Fish, gib	60
Fish small	60
Fish, vajra	60
Fowl	60
Liver, sheep	60
Mutton muscle*	60
Pigeon	60
Pork	60
Prawn	60

*Provides 100 calories

MILK EXCHANGE

Calories - 100 Protein : 5g

Butter milk	750 ml
Cheese	30 g
Curd	210 g
Khoa	30 g
Milk, Buffaloe	90 ml
Milk, Cow	180 ml
Milk, skimmed*	260 ml
Milk skimmed, powder*	30 g

* Provides 10g protein

FAT EXCHANGE

Almonds	15
Cashew nuts	20
Butter	15
Coconut	30
Ghee	11
Groundnuts roasted	20
Hydrogenated fat (Vanaspati)	11
Oil (Coconut, mustard)	11
Pistachionut	15
Walnuts	15

APPENDIX VIII (Contd.)

FOOD EXCHANGES

Food exchange	Amount (g)	Protien	Fat	Carbol hydrate	Calorie
Cereals	30	2.5	0.3	21	97-100
Pulses	30	6	0.5	17	97-100
Flesh foods	30	5	2	---	38-40
Nuts and Oilseeds	30	2	12	4	132-135
Fruits	30	---	---	4	16
Leafy vegetables	100	4	0.5	6	45-50
Other vegetables	100	2	---	10	48-50
Milk and milk products	100	3	4	4	64-65

* Grills and Bosscher (1981)

* Pasricha (1985)

APPENDIX IX

Calculation of calorie requirement for maintaining the body weights

Occupation	Calories/kg/day	
	Tropics	Temperate zone
Sedentary	30	33
Moderate activity	40	44
Heavy manual work	50	55

Antia (1973)

The calorie requirements are:

1. In an obese diabetic the calories should be restricted to reduce the body weight and then maintain the weight at 5 per cent below the ideal body weight
2. In a diabetic of normal weight enough calories should be given to maintain the weight.
3. In an under weight diabetic calories should be given to increase at 5 per cent below the ideal body weight.

APPENDIX X

Percentage of calories supplied by carbohydrate, fats and protein

Distribution of nutrients in the diet

Carbohydrate	:	60 to 65 per cent of the total calories
Protein	:	15 to 20 per cent of the total calories
Fat	:	15 to 25 per cent of the total calories.

* Seshiah et al. (1986 a)

Calculation

CASE STUDY - I

Sedentary working normal body weight patient calories required to maintain the normal body weight is 1905.

Calories from carbohydrate	:	1143 - 1238
Calories from Protein	:	285 - 381
Calories from fat	:	286 - 476

Amount of carbohydrate, protein and fat to be included in the diet to provide the above distribution of calories.

Carbohydrate	:	285 - 310g
Protein	:	71-95g
Fat	:	32 - 53g

CASE STUDY - II

Sedentary working under weight patient calorie required to maintain 5 per cent below the ideal body weight : 1980.

Calories from carbohydrate	:	1188 - 1287
Calories from protein	:	297 - 396
Calories from fat	:	297 - 495

Amount of carbohydrate, protein and fat to be included in the diet to provide the above distribution of calories

Carbohydrate	:	297 - 322 g
Protein	:	74 - 99 g
Fat	:	33 - 55 g

CASE STUDY - III

Sedentary working normal weight patient calories required to maintain the body weight is 2070.

Calories from carbohydrate	: 1242 - 1346
Calories from Protein	: 310 - 414
Calories from Fat	: 311 - 518

Amount of carbohydrate, protein and fat to be included in the diet to provide the above distribution of Calories

Carbohydrate	: 311 - 337 g
Protein	: 78 - 104 g
Fat	: 35 - 58 g

CASE STY - IV

Sedentary working normal weight patient calories required to maintain the body weight is 1980 K cal.

Calories from carbohydrate	: 1188 - 1287
Calories from Protein	: 297 - 396
Calories from fat	: 297 - 495

Amount of carbohydrate, protein and fat to be included in the diet to provide the above distribution of calories

Carbohydrate	: 297 - 322 g
Protein	: 74 - 99 g
Fat	: 33 - 55 g

CASE STUDY - V

Sedentary working over weight patient calories required to maintain 5 per cent below ideal body weight is 1290 K cal.

Calories from carbohydrate	: 774 - 839
Calories from protein	: 194 - 258
Calories from fat	: 194 - 323

Amount of carbohydrate protein and fat to be included in the diet to provide the above distribution of calories

Carbohydrate	: 194 - 210 g
Protein	: 49 - 65 g
Fat	: 22 - 36 g

CASE STUDY - VI

Sedentary working normal weight patient calories required to maintain the body weight is 1500 K cal.

Calories from carbohydrate	:	900 - 975
Calories from protein	:	225 - 300
Calories from fat	:	225 - 375

Amount of carbohydrate, protein and fat to be included in the diet to provide the above distribution of calories

Carbohydrate	:	225 - 244 g
Protein	:	56 - 75 g
Fat	:	25 - 42 g

APPENDIX XI

ONE WEEK MENU

MEALS	I DAY	II DAY	III DAY
Early morning	Coffee or Tea	Cofee or Tea	Cofee or Tea
Break fast	Stuffed amaranth chappathi Plantain Coffee or Tea	Broken wheat uppuma with vegetables Boiled egg coffee or tea	Ragi Puttu Steamed green gram Plantain Coffee or tea
Lunch	Line rice Banana flower thoran, Fish curry, cucumber salad Butter milk	Rice, Baked fish cabbage thoran sprouted green gram salad Butter milk	Chekkurmanis thoran with dhal meat curry mixed vegetables salad
Snacks	Sprouted green gram steamed Coffee or tea	Bengal gram sundal Coffee or Tea	Egg sandwich or Coffee Tea
Dinner	Rice, Cabbage thoran, Dhal curry Tomato-cucumber salad.	Dry chappathy meat or vegetable curry plantain Coffee or Tea	Wheat Dosai Sambar, Tomato Salad Coffee or tea

MEALS	IV DAY	V DAY	VI DAY
Early morning	Coffe or Tea	Coffee or Tea	Coffee or Tea
Break fast	Rava Iddly Sambar Plantain Coffe/Tea	Vegetable uppuma Plantain Boiled egg Coffee/Tea	Dosai Sambar Plantain Coffe/Tea
Lunch	Curd rice Banana peelthoran Fish curry Onion lemon salad	Rice Drumstick leaves thoran Aviyal Dhal curry	Rice Amaranth with dhal, Fish fry Sambar, Amla curd salad Fish curry
Snaks	Ragi porridge Coffee or Tea	Aval uppuma Plantain Coffe or tea	Vadai Coffee or tea
Dinner	Chappathi Vegetable kuruma Plantain	Rice, Fish Aviyal Papaya with green gram thoran Butter milk	Dry chappathi Mixed vegetable curry Coffee or Tea

APPENDIX XII

DISTRIBUTION OF THE QUANTITY OF FOOD ITEMS IN ONE DAY'S MENU FOR THE CASE STUDIES

CASE STUDY I

Food items	Quantity (g)	No. of Exchange	Protein (g)	Fat (g)	Carbohydrate(g)
Cereals	240	8	20	2.4	168
Pulses	75	2.5	15	1.2	42.5
Leafy vegetables	150	1.5	6	0.75	9
Other vegetables	300	3	4	-	30
Fruits	150	5	-	-	20
Milk and curd	500	5	15	20	20
Fish or meat Egg	60 30	3	15	6	-
Nuts and oilseeds	10	0.3	0.6	4	1.3
Oil	15	-	-	15	-
Total			75.3	49.35	290.8
Recommended			75-95	32-53	286-310

Total calories recommended - 1905 K cal.

CASE STUDY II & IV

Cereals	270	9	22.5	2.7	1.89
Pulses	65	2.2	13.2	1.1	37.4
Leafy vegetables	150	1.5	6	0.75	9
Other vegetables	300	3	6	—	30
Fruits	150	5	—	—	20
Milk and curd	500	5	15	20	20
Egg Fish or meat	30 60	3	15	6	—
Nuts and oilseeds	10	0.3	0.6	4	1.2
Oil	15	—	—	15	—
Total			78.3	49.55	306.6
			74-99	39-55	297-322

CASE STUDY III

Food items	Quantity (g)	No. of exchange	Protein (g)	Fat (g)	Carbo-hydrate(g)
Cereals	270	9	22.5	2.7	189
Pulses	75	2.5	15	1.25	42.5
Leafy vegetables	200	2	8	1	12
Other vetetables	350	3.5	7	--	35
Fruits	150	5	--	--	20
Milk and curd	600	6	18	24	24
Egg Fish or meat	30 60	3	15	6	--
Nuts and oilseeds	10	0.3	0.6	4	1.3
Oil	10	--	--	10	--
Total			86.1	48.95	325.8
Recommended			78-104	35-58	311-337

Total calories recommended - 207[illegible] K cal.

CASE STUDY V

Cereals	150	5	12.5	1.5	105
Pulses	60	2	12	1.0	34
Leafy vegetables	100	1	4	0.5	6
Other vegetables	250	2.5	5	-	25
Fruits	90	3	--	--	12
Milk and curd	400	4	12	16	16
Egg, meat or fish	30	1	5	2	--
Nuts and oil seeds	5	0.15	0.3	1.8	0.6
Oil	10	--	--	10	--
Total			50.8	32.8	198.6
			49-65	22-36	194-210

Total calories recommended - 1290 K cal.

APPENDIX XII (Contd.)

CASTE STUDY - VI

Food items	Quantity (g)	No. of exchange	Protein (g)	Fat (g)	Carbo-hydrate(g)
Cereals	210	7	17.5	2.1	147
Pulses	60	2	12	1	34
Other vegetables	250	2.5	5	—	25
Leafy vegetables	100	1	4	0.5	6
Fruits	60	2	—	—	8
Milk and curd	350	3.5	10.5	14	14
Egg Meat or fish	30 30	2	10	4	—
Nuts and oil seeds	10	0.3	0.6	4	1.3
Oil					
Total			59.5	35.6	235.3
Recommended			56-75	25-42	225-244

Total calories recommended 1500 K cal.

DIETARY FACTORS AND DIABETES

BY

SARAMMA ABRAHAM

ABSTRACT OF THE THESIS
SUBMITTED IN PARTIAL FULFILMENT OF THE
REQUIREMENT FOR THE DEGREE OF
MASTER OF SCIENCE
IN FOOD SCIENCE AND NUTRITION
FACULTY OF AGRICULTURE
KERALA AGRICULTURAL UNIVERSITY

DEPARTMENT OF HOME SCIENCE
COLLEGE OF AGRICULTURE
VELLAYANI, TRIVANDRUM

1989

ABSTRACT

A study on the dietary factors and diabetes was conducted in the city and suburbs of Trivandrum to assess the socio-economic and food consumption pattern of the families of diabetic patients, personal characteristics as well as dietary pattern of the diabetic patients and the effect of diet counselling which was imparted to selected case studies.

The results of the socio-economic and dietary survey conducted in 150 families of the diabetic patients, attending the diabetic clinic at Trivandrum Medical College, revealed that, most of the patients resided in the urban area and majority of them belonged to the higher socio-economic group. Regarding the expenditure on food, around 52 per cent of the families spent less than 50 per cent of their monthly income on food. Only a very few families (2.7 per cent) spent more than 75 per cent of their monthly income on food. 92 per cent of the families studied were non vegetarians. The food purchasing habit of the families showed that cereals and pulses were purchased monthly, milk and fish daily,

vegetables roots and tubers were purchased on a weekly basis by majority of the families. The frequency of purchase of processed and bakery foods was considerably high. All the families used rice daily but majority of them did not include ragi in their daily dietaries. Frequent use of processed and refined foods was also observed by these families. Milk, fish, vegetables etc., were consumed daily by almost all the families. Oil, sugar, coconut, spices and condiments etc. were also included daily in the diet of these families. Palmoil and coconut oil were the most commonly used cooking oils in these families. Almost all the families celebrated special occasions like birth days, marriage, religious festivals etc. by preparing special food items.

The results of the food weighment survey with regard to the consumption pattern of various food groups and the nutrient intake showed that, most of the items were consumed in excess of the recommended, especially milk and milk products and flesh foods. The intake of almost all the nutrients were found to be either adequate or more than the recommended, except for nicotinic acid which was low in the case of female members of the families. The calorie intake was found to be higher among the female members of the families than in the male members.

The results of the survey on personal characteristics and dietary pattern conducted among the diabetic patients showed that the prevalence of the disease was slightly greater in men. The age at onset of diabetes in majority of the patients was between 46 to 50 years. Most of the patients (63 per cent) came in the age group of 41 to 55 years. Regarding the genetic pattern of the incidence of the disease, paternal inheritance was found to be greater. The occurance of hypertension among the diabetic patients was found to be high (22.7 per cent). Among the patients studied 29.3 per cent were found to be over weight. The incidence of obesity and hypertension was found to be more in the case female patients. The incidence of heart disease was found to be 8.7 per cent. Alcoholism smoking and tobacco chewing were regular habits of some of these patients.

The diabetic patients studied did not have much knowledge about the role of diet in controlling diabetes. A few patients knew about the foods to be included and the foods to be avoided in their diets. Majority of the patients studied, had a liking for sweets and fried food items and they were in the habit of eating such foods without any restriction. Most of the patients were in the habit of taking hypoglycemic agents like fenugreek, bitter gourd etc. Palm oil and

coconut oil were used as cooking medium by majority of these patients. Food items like cereals, milk and milk products, oils, coconut etc., were used daily by all the patients fish, vegetable etc., were also used daily by almost all the patients.

The diet counselling in the diabetic clinic was studied through observation and it was found that the diet counselling was given without the help of the dietitian. The diet planning was not according to individual needs of the patients. Most of the patients were not satisfied with the quantity of food as prescribed in the clinic.

The actual intake of major nutrients by the diabetic patients was assessed through food weighment survey and it was found that the calorie intake was higher in all the patients. The proportion of calories from fat was found to be high in almost all the patients and the proportion of calories from carbohydrate was considerably low in many patients.

The present study showed that educating the patients with regard to the diabetic diet is very important in the control of the disease. The diet counselling which was imparted by the investigator in selected case studied was found to be effective in achieving metabolic control of diabetes. This was evident from the biochemical studies conducted which showed a significant reduction in the blood and urine glucose, cholesterol and triglycerides. This implies that diet counselling and education of the patients regarding the significance of diet in diabetes is important in the control of the disease.