survive longer while undergoing dialysis it may become a greater problem, raising the question of whether it is justified to screen patients undergoing dialysis with a view to prophylactic nephrectomy. Computed tomography will show both cystic change and tumour formation and is probably the method of choice,[22 23] though the changes can also be shown well by ultrasonography. In our patient the primary was clinically silent and a screening programme of asymptomatic patients undergoing dialysis would have been required to make the diagnosis before metastatic spread. As tumours may be bilateral and bilateral nephrectomy will seriously exacerbate anaemia assessment of malignant potential before nephrectomy is necessary. Size may be helpful and as this tumour is the largest we have seen in acquired cystic disease it might be argued that malignant spread was likely and death preventable by nephrectomy; screening of the older patients undergoing dialysis may therefore be justified.

We thank Dr S Golding, consultant radiologist who obtained the computed tomographic images in case 5.

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(*Accepted 14 September 1983*)

Influence of imaginative teaching of diet on compliance and metabolic control in insulin dependent diabetes

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Abstract

Dietary non-compliance is an important cause of poor metabolic control in insulin dependent diabetes. Patients are often blamed, but teaching methods may be at fault, so a prospective study was set up to compare the effect of three different teaching methods. After a three month run in, 40 adults with longstanding poorly controlled insulin dependent diabetes (mean haemoglobin A_1 13·0%) were allocated at random to three teaching methods: conventional diet sheet instruction (group 1); practical lunchtime demonstrations (group 2); videotape education (group 3). Knowledge was assessed by questionnaires, compliance by seven day food records, and glycaemic control by serial glycosylated haemoglobin measurements. During six months of follow up there was no improvement in knowledge, compliance, or HbA_1 in group 1, but in groups 2 and 3 both knowledge and compliance improved. In group 2 HbA_1 fell to 10·6 (SD 2·1)% and in group 3 to 9·6 (2·3)%. The change in HbA_1 showed an appreciable correlation with dietary compliance as judged by day to day consistency in carbohydrate intake.

These findings show that new and interesting educational methods can have a major influence on knowledge, compliance, and metabolic control in insulin dependent diabetes.

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Introduction

For patients treated with insulin to achieve and maintain good diabetic control they need to pay attention simultaneously and continuously to many variables including insulin dose, correct site of injection, and the effects of exercise and diet.[1] Rollo in 1798 was the first to point out that patients find it very difficult to adhere to prescribed dietary restrictions.[2] Yet, however many advances have been made in the treatment of

diabetes over the past two centuries, the problem of dietary non-compliance has been rediscovered every time it has been looked for.[3-13] The extent to which the actual eating habits of patients deviate from their theoretical dietary prescription is surprisingly large and has prompted some authors to suggest that dietary policies should be simplified and made more flexible to suit the patient's lifestyle.[3 13-15]

The aims of this study were to compare the effects of three teaching methods on the knowledge, compliance, and glycaemic control among adults with longstanding poorly controlled insulin dependent diabetes.

Patients and methods

To be included in the study patients had to be between 16 and 65 years and to have been taking insulin for at least four years. Their current insulin regimen had to be at least two injections daily of short and intermediate acting insulin and they had to have had at least two estimations of haemoglobin A_1 (HbA_1) in the previous 12 months greater than 12·0% (the upper limit of the normal range in our laboratory being 8·5%).

We wrote to 143 patients who fulfilled the above criteria explaining the purpose of the study and what their participation would entail. Eighty three replied, of whom 52 wished to take part. Eight patients dropped out during the run in period and a further four during the intervention period. The latter comprised one patient from group 1, one from group 2, and two from group 3 (see below). They did not differ from those who completed the study in terms of age, duration of diabetes, or HbA_1. Three dropped out because of intercurrent illness (exacerbation of epilepsy, vitreous haemorrhage, and a road traffic accident) and one because of pressure of work. Thus 40 patients (23 men, 17 women) completed all aspects of the study. Their mean age was 35 (range 17 to 64) years and mean duration of diabetes 12 (range 4 to 26) years. Twenty nine were of normal weight (body mass index between 19·1 kg/m² and 24·9 kg/m²), one was underweight (body mass index less than 19·1 kg/m²), and 10 were overweight (body mass index greater than 24·9 kg/m²).

The study began with a run in period of three months during which an attempt was made to improve overall diabetic treatment as much as possible without mentioning diet. Patients were told about the value of long term normal glycaemia and how this could be assessed by regular blood glucose recordings at home and HbA_1 estimations. They were taught to measure blood glucose before each meal and before bedtime on two days a week using BM 20-800 strips, and to adjust their own insulin regimens on the basis of the results. They were given the target of achieving and maintaining glucose values at these times of 4-8 mmol/l (72-144 mg/100 ml) if this was possible without provoking unacceptably frequent hypoglycaemia. Each patient was also told what his HbA_1 concentration was at each visit and that our aim should be to keep this below 10%.

Patients were then allocated into one of three groups for dietary education. Group 1 (14 patients) were given conventional dietary teaching, group 2 (13 patients) were given a lunchtime demonstration, and group 3 (13 patients) were given a videotape demonstration. Dietary policy was the same for all patients and was kept as simple as possible to encourage compliance. An appropriate total daily intake of carbohydrate was determined jointly by the patient and dietitian taking into account previous eating habits, age, weight, and lifestyle. This was then broken down into 10 g carbohydrate exchanges. Patients were asked to keep to an agreed distribution of carbohydrate exchanges in the form of three main meals and three snacks. Variety in the actual carbohydrate containing foods to be eaten each day was achieved by giving each patient lists of common food stuffs (expressed in grams/ounces and household measures) containing 10 g carbohydrate. No emphasis was placed on reducing fat or increasing fibre intake. Restriction of energy was advised, however, in the overweight. The overriding concept we tried to impart to the patient was that they should eat the same amount of carbohydrate at the same times each day and adjust their insulin regimen around this "consistent carbohydrate profile" to achieve the blood glucose and HbA_1 targets described above. Three different methods of dietary education were used.

Group 1—These patients were assessed by a dietitian and received individual tuition about what carbohydrate distribution would be appropriate for them. In addition to a pamphlet containing 10 g exchange lists they were given simple menus to emphasise the carbohydrate profile they should stick to from day to day.

Group 2—In addition to the individual assessment and dietary pamphlet described for group 2, these patients were asked to come to the hospital canteen in groups of four or five (with accompanying spouse and children if possible) where they had lunch with both dietitian and doctor. These sessions were in two parts. Firstly, patients were asked to help themselves to a variety of hot and cold dishes and to make up their carbohydrate allowance to what had been prescribed for them previously. Any mistakes were corrected by the dietitian and problems of guessing or measuring were discussed. After lunch they were shown a display of other items of food (including breakfast food, snacks, etc) so that they could see and feel exactly how much of each item *did* in fact contain 10 g carbohydrate. Scales were provided to verify the weight of slices of bread etc. Specimen meals were also laid out and each patient asked to guess the carbohydrate content. Over the course of their three lunchtime visits they were exposed to a wide variety of foods which they might encounter at various times of the day in their own lives.

Group 3—In addition to the individual assessment and dietary pamphlet as described for group 1 these patients were shown a 24 minute videotape—"Healthy eating and diabetes" prepared by the audio visual department, University Hospital. This was viewed on three separate occasions while sitting in an arm chair in a quiet room, and without dietitian or doctor being present. The videotape began with an explanation of the importance of eating a balanced diet and maintaining a consistent carbohydrate profile. It then took the viewer through a day in the life of two insulin treated patients with very different dietary requirements and lifestyles. The tape showed what food each patient ate at each meal and snack, building up a different "carbohydrate profile" for each. It ended by suggesting that the viewer should try to work out his or her own carbohydrate profile with the dietitian's help. Patients in all three groups were seen for dietary instruction three times during the six month intervention period.

Dietary knowledge was tested by two questionnaires, one at the end of the run in and the other at the end of the intervention period. The questions were similar, but not identical, on both occasions and tested the patient's understanding of his or her own diet. They were asked to say how many 10 g exchanges of carbohydrate they ate each day and what steps they took to make sure these were measured accurately. Finally, they were asked specific questions about the number of 10 g carbohydrate exchanges contained in several common foods, including items in their carbohydrate exchange list. The maximum possible score on each questionnaire was 20 points.

Dietary compliance was assessed from detailed seven day food records at the end of the run in and intervention periods. Since the aim of the education was to encourage day to day consistency in the amount of carbohydrate eaten at each meal and snack, the data derived from the seven day food records were handled as follows for each patient. The amount of carbohydrate taken at each of the seven breakfasts was calculated. The coefficient of variation was then derived by (standard deviation/mean) $\times$ 100. This calculation was repeated for all seven morning snacks, lunches, mid-afternoon snacks, evening meals, and bedtime snacks. In this way, six coefficients of variation were derived for each patient. An average of these was then calculated to give one single figure, the overall coefficient of variation for each food record, which therefore gives a measure of the day to day consistency in eating habits for that patient.

Metabolic control was assessed by the serial HbA_1 measurements using an electrophoretic method on cellulose acetate membrane.[16] The coefficient of variation for this method is less than 6% where HbA_1 is less than 10% of total HbA and is less than 4% where HbA_1 is greater than 14% of total HbA. Patient samples were measured in duplicate, and HbA_1 control (Glycophore control product No 51262, Gelman Sciences Ltd) run on each membrane. Where duplicate samples differed by more than 1%, the analysis was repeated.

Paired non-parametric statistical tests were used. Changes in questionnaire score, overall coefficient of variation for carbohydrate consistency, and HbA_1 between groups 1, 2, and 3 were tested using the Mann-Whitney method while the relation between change in HbA_1 and change in overall coefficient of variation for carbohydrate consistency (figure 1) were determined with the Kendall-Rank method.

Results

Table I shows the characteristics of patients in groups 1, 2, and 3. There were no significant differences between the groups with

respect to age/sex distribution, duration of diabetes, insulin dose, HbA_1, or body mass index at the start of the study.

Table II shows the changes within each group during the six month intervention period. There were no significant changes in insulin dose or body mass index. Dietary knowledge was equally poor in all three groups at the time of the first questionnaire. When asked how many carbohydrate exchanges they ate each day, only 21 (52%) of the patients gave an answer, and less than one third of these answers was correct when compared with their seven day food records. There was widespread ignorance about the difference between energy and carbohydrate. Over one third thought that *fried* bacon counted as a carbohydrate exchange whereas *grilled* fish did not.

TABLE I—*Characteristics of patients allocated to three methods of dietary education. Figures are mean (SD)*

	Group 1 (n = 14)	Group 2 (n = 13)	Group 3 (n = 13)
Men	8	8	7
Women	6	5	6
Age (years)	35·6 (10·4)	31·6 (8·3)	36·5 (15·3)
Duration of diabetes (years)	10·9 (6·1)	11·8 (5·1)	13·4 (6·0)
Insulin dose (U/kg per day)	0·68 (0·25)	0·79 (0·30)	0·78 (0·17)
Initial HbA_1 (%)	12·9 (1·6)	13·0 (2·9)	12·9 (1·3)
Body mass index (kg/m²)	24·0 (3·0)	23·3 (2·0)	23·8 (2·9)

None of the differences between groups 1, 2, and 3 are statistically significant.

TABLE II—*Effect of three methods of dietary education on insulin dose, body mass index, knowledge, and compliance at the end of the run in period (initial) and at end of six month intervention period (final). Figures are mean (SD)*

	Group 1 (n = 14)	Group 2 (n = 13)	Group 3 (n = 13)
Insulin dose (U/kg per day):			
Initial	0·68 (0·25)	0·79 (0·30)	0·78 (0·17)
Final*	0·68 (0·24)	0·76 (0·23)	0·78 (0·18)
Body mass index (kg/m²):			
Initial	24·0 (3·0)	23·3 (2·0)	23·8 (2·9)
Final*	23·9 (2·3)	23·7 (1·7)	23·8 (2·0)
Questionnaire score (maximum possible = 20):			
First	10·5 (3·6)	11·1 (3·2)	10·6 (3·5)
Second*	8·0 (4·3)	15·9 (2·8)§	17·4 (2·1)§
Food record:			
First†	52·8 (19·6)	64·1 (23·2)	52·4 (31·1)
Second*	53·5 (27·6)	47·4 (20·5)	23·6 (14·7)‡
OCV (%)			

*At nine months.
†See text for explanation.
‡$p < 0·01$ } compared with group 1 (Mann-Whitney U test).
§$p < 0·001$ }
OCV = Overall coefficient of variation.

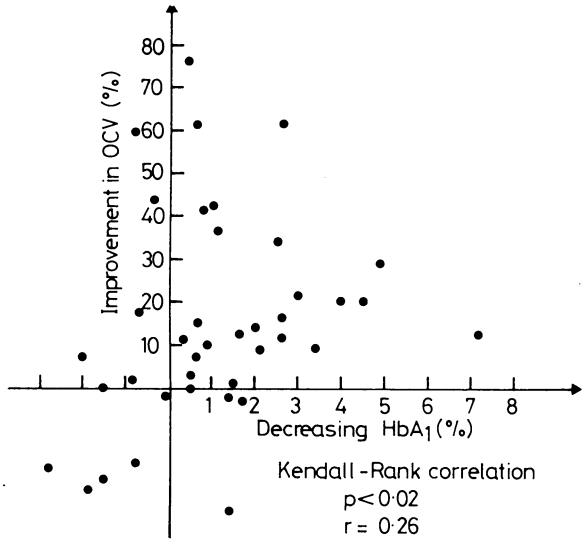

FIG 1—Correlation between change in HbA_1 and change in day to day dietary consistency among 40 insulin dependent adults. OCV = overall coefficient of variation.

In the second questionnaire, however, there was no improvement in knowledge in group 1, but patients in both other groups scored very much higher ($p < 0·001$). Day to day dietary consistency was equally poor in all three groups during the run in. The mean overall coefficient of variation for carbohydrate profiles in the first seven day food records was over 50% in all three groups. Again, there was no significant improvement in group 1, but patients in both the other two groups showed significant reductions in day to day carbohydrate variation in the second food record ($p < 0·01$).

Changes in mean HbA_1 throughout the study are shown in fig 2.

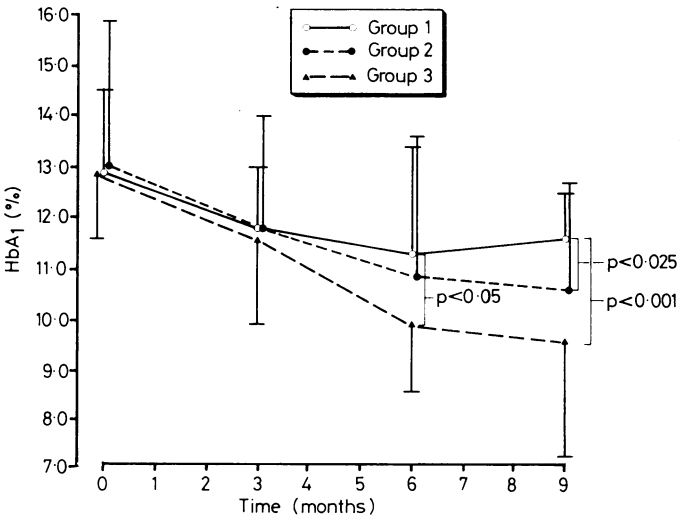

FIG 2—Change in HbA_1 over nine months in patients receiving conventional dietary instruction (group 1), lunchtime demonstrations (group 2), or videotape education (group 3).

By the end of the run in, HbA_1 in groups 1, 2, and 3 had fallen by a similar amount to 11·8 (1·2%), 11·8 (2·2%), and 11·6 (1·7%), respectively. Three months later there was no further improvement in group 1 where HbA_1 was 11·3 (2·1%). HbA_1 in group 2, however, had fallen to $10·9 \pm 2·7\%$ while the videotape group 2 showed even more improvement at $9·9 \pm 1·3\%$, significantly better than group 1 ($p < 0·05$). By the end of the six month intervention period haemoglobin A_1 in group 1 remained much the same at 11·6 (0·9)%. Both groups 2 and 3 were significantly better than group 1 at this stage being 10·6 (2·1)% ($p < 0·025$) and 9·6 (2·3)% ($p < 0·001$), respectively.

To assess whether the improvement in haemoglobin A_1 was directly related to improved dietary compliance, the change in overall coefficient of variation for carbohydrate consistency between first and second food records was correlated with the change in HbA_1 between the end of the run in and the end of the intervention period in each patient (fig 1). Though the points are widely scattered, there is significant correlation between the two (Kendall-Rank $r = 0·26$, $p < 0·02$). Thus by and large where individual patients showed a substantial reduction in HbA_1 during the intervention period, this was associated with a substantial improvement in their day to day carbohydrate consistency, as measured by a reduction in the overall coefficient of variation.

Discussion

This study has shown that even patients with long standing poorly controlled insulin dependent diabetes can show a big improvement in dietary knowledge and compliance when imaginative educational techniques are used, and that these changes are reflected in improved metabolic control. Not all the improvement in control is the result of the intervention; the mean HbA_1 in all three groups dropped by 1·1% during the run in period and this beneficial effect of "being in a study" is probably related to the increased attention patients receive rather than to the specific techniques that are taught.[17,18] Worth *et al* showed that HbA_1 in a similar group of patients tended to fall steadily over the first six months of the study

but then rose to "prestudy levels" by nine months.[17] This pattern was certainly seen in our patients in group 1 and was disappointing. After all, repeated individual tuition supplemented by dietary pamphlets and sample menus is the method used in most diabetic clinics throughout the country. It may work in newly diagnosed patients but perhaps with a group of patients with longstanding poorly controlled diabetes, such as those in this study, it is too uninteresting to stimulate their interest in the long term.

The improvement in the other two groups cannot simply be ascribed to the increased attention of being in a study. Apart from improved glycaemic control, the patients in these groups showed better understanding in all aspects of dietary management. One can only speculate what particular aspects of the educational methods used for groups 2 and 3 were particularly beneficial; certainly patients commented that they enjoyed being taught in small groups, particularly when members of their own family could be present. Weinsier *et al*[19] in a study of older patients with non-insulin dependent diabetes found that long term cooperation was improved by small group orientated teaching, frequent follow up, feedback to patients of laboratory data, individualisation of diet prescriptions, and family involvement. Our study endorses these findings. Several patients also said they found it much easier to understand the concept of carbohydrate exchanges when shown real food containing 10 g carbohydrate, rather than simply being given a printed diet sheet.

The extent of the improvement shown in this study is surprising as the dietary advice given was very simple. No attempt was made to change the type of food which patients enjoyed eating. Each patient played a major part in determining a carbohydrate distribution that suited him or her, a policy suggested by West[12] and Nuttall.[15] The only point emphasised was that, once established, this pattern of eating should be repeated consistently from day to day. The importance of this simple aspect of diet therapy in insulin dependent diabetes has been suggested by others[14 16] but it is often forgotten by the proponents of more complex dietary strategies. Unfortunately, though lip service has been paid to these practical considerations in the new recommendations by both the American and British Diabetic Associations, in reality dietary prescriptions have become more confusing and more complicated in recent years. Dietary policies on the North American continent are even more complex, entailing up to six different exchange lists requiring understanding of protein, fat, and calories as well as carbohydrate. In addition, the new recommendations proposed by the diabetic associations in the United States, Canada, and Britain will mean major changes in the structure of the diets that patients are prescribed. The results of this study indicate that substantial improvement in understanding and compliance can be achieved by much simpler diet recommendations and that the main reason why diet usually fails[12] is not that the diet is wrong but that methods of teaching it and maintaining interest are ineffective.

The videotapes as used in our study should not replace the work of dietitians since the two complement one another. A videotape has the advantage that it can convey basic information in a form that is appealing and easy to understand. It can also be repeated as often as necessary which will allow dietitians to spend more time on individual counselling and practical food demonstrations. These methods could easily be applied in most diabetic clinics and should be more effective than the traditional printed diet sheet and lecture from the dietitians.

This study was supported by a British Diabetic Association development project grant. DKMcC is a research fellow funded by the British Diabetic Association. Copies of the videotape "Healthy eating and diabetes" (25 minutes) can be obtained in any format from Mrs M Cumpstey, Audiovisual Department, Queens Medical Centre, Nottingham, at a cost of £50.

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(*Accepted 16 September 1983*)

A fit, active woman of 55 has had a persistently low blood pressure of 80/50 for many years. This was discovered at a routine examination and she was refused life assurance because of this. The patient has never complained of any symptoms and is not anaemic. Should anything be done for her?

There is a regrettable tendency to associate low blood pressure with symptoms and, as this history illustrates, with a poor prognosis. The distribution of blood pressure in the population is such that a small percentage of people will have blood pressures well below the mean of the general population. With the exception of those few patients with an underlying disease leading to postural hypotension, or with Addison's disease, the evidence from the Framingham Study among others suggests that the lower the blood pressure the better the prognosis.[1] Shapiro has questioned the association of hypotension with symptoms—in short the acceptance of the entity as a disease—in the public's mind and among doctors, and he comments on the potential for iatrogenic illness.[2] We can do no better than quote Robinson who as long ago as 1940 wrote: "There are no symptoms peculiar to or due to low blood pressure. . . . Hypotension is not a disease; it is an ideal blood pressure level."[3]—VINCENT BRADY, medical registrar, and EOIN O'BRIEN, consultant physician (cardiology), Dublin.

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