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Lasting Improvement of Hyperglycaemia and Bodyweight: Low-carbohydrate Diet in Type 2 Diabetes. – A Brief Report

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ABSTRACT

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In two groups of obese patients with type 2 diabetes the effects of 2 different diet compositions were tested with regard to glycaemic control and bodyweight. A group of 16 obese patients with type 2 diabetes was advised on a low-carbohydrate diet, 1800 kcal for men and 1600 kcal for women, distributed as 20 % carbohydrates, 30 % protein and 50 % fat. Fifteen obese diabetes patients on a high-carbohydrate diet were control group. Their diet, 1600–1800 kcal for men and 1400–1600 kcal for women, consisted of approximately 60 % carbohydrates, 15 % protein and 25 % fat.

Positive effects on the glucose levels were seen very soon. After 6 months a marked reduction in bodyweight of patients in the low-carbohydrate diet group was observed, and this remained one year later. After 6 months the mean changes in the low-carbohydrate group and the control group respectively were (±SD): fasting blood glucose (f-BG): –3.4 ± 2.9 and –0.6 ± 2.9 mmol/l; HBA1c: –1.4 ± 1.1 % and –0.6 ± 1.4 %; Body Weight: –11.4 ± 4 kg and –1.8 ± 3.8 kg; BMI: –4.1 ± 1.3 kg/m_ and –0.7 ± 1.3 kg/m_. Large changes in blood glucose levels were seen immediately.

Conclusion: A low-carbohydrate diet is an effective tool in the treatment of obese patients with type 2 diabetes.

INTRODUCTION.

Diets with low carbohydrate, high protein and fat content have by several authors been shown to give a marked weight reduction together with an improved lipid profile. No harmful effects have been reported (1–7). Most of the weight loss has been explained by a lowered caloric intake (3–7). Furthermore, in type 2 diabetes,

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favourable short-term effects have been seen on glycaemic control (8, 9). It therefore seemed worthwhile to test the beneficial effects of a low carbohydrate diet over a longer period in obese patients with type 2 diabetes.

The purpose of the present observational study was to observe over 6 months fasting blood glucose(f-BG), long-term glycaemic control (HBA1c), bodyweight (BW) and body mass index (BMI) in a group of obese patients with type 2 diabetes on a low-carbohydrate diet (LCD), and to compare the results with a control group (CG) on high-carbohydrate diet. Both groups were advised on a diet limited in calories but with different carbohydrate, protein and fat distribution.

MATERIALS AND METHODS

Patients

All LCD (16) and CG (15) patients were originally referred from primary care because of failure to achieve control of BG and weight. BMI for all patients was ≥30 kg/m_. They fulfilled the criteria for diabetes in the form of a fasting BG > 6 mmol/l and HBA1c > 5.6 %, or they used glucose lowering medication. No patient had manifest heart disease or untreated thyroid illness.

LCD group

At an information meeting for diabetes patients and relatives, the reported short-time effects of a changed caloric composition of the diet was discussed. Sixteen patients, all regularly visiting the clinic, later contacted us, all wanting our help to attempt another diet. We decided to supervise the patients as a group and offer them the same follow-up frequency as other patient groups attending our six months educational program. For this pilot project the patients received written information and gave informed consent. The project was approved by the local Medical Research Committee. The LCD test group thus consisted of 16 patients, all having failed to achieve control of glucose and weight. Eleven were insulin-treated, 15 received metformin and 5 sulfonylurea (SU). Average age and diabetes duration was 57.1 ± 6.2 and 13 ± 5.5 years respectively. Average BW was 100.6 ± 14.7 kg.

Controls

The 15 patients in the control group (CG) undertook their ordinary educational program. They were informed that another group shortly would test another diet. They all gave permission to use data from the group in the final comparison. Six were insulin-treated, 10 received metformin, and 5 SU. Average age and duration of diabetes was 58.6 ± 10.1 and 8.5 ± 5.4 years respectively. Mean BW was 101.5 ± 14.5 kg.

Diet

All patients received information about a caloric restricted diet. In the LCD group it consisted of 1800 kcal for men and 1600 for women. In the CG it was individualised, consisting of 1600–1800 for men and 1400–1600 for women. In the LCD

group the caloric composition of carbohydrates, protein and fat was 20 %, 30 % and 50 %; in the CG it was approximately 60 %, 15 % and 25 % respectively.

In the LCD group the recommended carbohydrate consumption was limited to vegetables and salad. Instead of ordinary bread, crisp/ hard bread was recommended, crunchy slices about the size of a slice of bread, each containing 3.5 to 7 g carbohydrates. All processed carbohydrates – such as bread and pasta – and rice and potatoes were excluded.

Follow-up

The f-BG and BW were measured in the clinic at the start of the observation period and after 2, 4, 6, 8, 10, 12, 16, 20 and 24 weeks; HBA1c at start and after 8, 16, and 24 weeks. (HBA1c: normal value <5.6 % in non diabetics)

All patients were instructed to measure pre-meal and evening BG, to exercise 30 minutes a day, and to take a daily multivitamin supplement containing extra calcium.

RESULTS

The attendance was good in both groups. In the LCD group a considerable reduction in the insulin requirements was noted very soon. The mean requirement among the 11 insulin-treated patients decreased from 60 ± 33 to 39 ± 21 IU/day the first week, and the mean f-BG decreased from 11 ± 2.8 to 6.9 ± 1.2 mmol/l. Three patients were able to discontinue insulin within the 24 weeks. The average insulin requirement among the last 8 patients was 18 ± 11 IU/day after 24 weeks observation time.

The 6 insulin-treated patients in the CG displayed lowering of the mean f-BG during the first week from 12.3 ± 1.8 mmol/l to 11.1 ± 4 mmol/l. A slight increase in mean insulin requirement was seen amongst these patients during the 24 weeks observation time.

Two persons in the LCD group discontinued SU; the other 3 reduced the doses because of episodes of hypoglycaemia.

The only change in medication in the CG group was that one person discontinued SU treatment.

Fasting blood glucose, HBA1c, Bodyweight and BMI. The figure shows that all parameters measures in the LCD group decreased during the 24 weeks as compared to the CG. In week 24 HBAc1 in the LCD group increased, it was likely due to increased fruit consumption in the autumn.

One year later. Six months after the conclusion of the study period, i.e. one year after start, all but one of the patients from the LCD group has been seen again as part of the regular follow-up routine at the clinic. Mean BW is unchanged 89.5 ± 14.6 kg. Mean HBA1c has increased to 7.0 ± 1.4 %. Nine of the 15 patients, however, still display an HBA1c below 6.5 %, which is the target for glycaemic control in Sweden. One year earlier 2 patients did so.

DISCUSSION

The present observations show that a simple change of the caloric proportion of carbohydrates, protein and fat in the diet is an effective tool in the management of type 2 diabetes.

Recently published results from short-term studies have shown similar positive effects on glycaemic control and BW in obese patients with type 2 diabetes (10, 11).

As the results of an LCD are noticeable after a short period, patients are motivated to continue the program. One example was the case of a bus driver, who had been referred to the clinic. A poor diabetes control had necessitated commencement of insulin therapy, and, according to Swedish laws, this disqualified him from holding a passenger service vehicle license. The patient was offered to test the LCD which he accepted. Two weeks later he was able to discontinue the insulin treatment and resume his profession.

The present observations show that it is possible to motivate a majority of patients to continue a LCD and that the effects both on glucose metabolism and the reduction of bodyweight are retained for a long period.

Possible explanations for the recorded beneficial effect of a changed caloric composition have been given (12–14), but further studies are needed to clarify the pathophysiological mechanisms behind the effects.

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