STUDY ON THE IMPORTANCE OF LUPINE IN TYPE 2 DIABETES

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RESEARCH ARTICLE

Abstract
Lupine is an extremely valuable source of protein, has a low content of digestible carbohydrates and a high content of dietary fiber. This helps reduce the absorption of glucose from the intestine making it a good dietary choice for people suffering from diabetes.
In human nutrition, lupine is most commonly consumed in the form of grains and in the form of flour, obtained by grinding the grains. The flour has a golden yellow color and can be used together with wheat flour to obtain preparations with improved nutritional value.
Diabetes mellitus is a metabolic disease with chronic evolution
Type 2 diabetes occurs most frequently in adults and is characterized by reduced sensitivity to insulin action.

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INTRODUCTION

Man has used natural resources since the beginning of his existence as sources of food, as well as solutions to remedy organic sufferings. Thus from traditional medicine to modern medicine, plants have been an important means of healing human suffering.

Lupine is a vegetable that originates in southeastern Europe and western Asia. The genus Lupinus includes about 200 species, three of which are of particular importance for human nutrition and animal feed: the white lupine (Lupinus albus L.), the blue lupine (Lupinus angustifolius L.) and the yellow lupine (Lupinus luteus L.).

Lupine is an extremely valuable source of protein, has a low content of digestible carbohydrates and a high content of dietary fiber. This helps reduce the absorption of glucose from the intestine making it a good dietary choice for people suffering from diabetes.

In human nutrition, lupine is the most commonly consumed in the form of grains and in the form of flour, obtained by grinding the grains. The flour has a golden yellow color and can be used together with wheat flour to obtain preparations with improved nutritional value.

Lupine is rich in vegetable protein (it contains up to 39% protein, four times more than wheat grains), is rich in fiber (32%), low in fat (7%), cholesterol-free, gluten-free and it has a low glycemic index, being recommended in the hypoglycemic diet.

The flour obtained from sweet lupine seeds does not contain substances with potential gastric irritants, is probiotic and also contains high amounts of essential amino acids.

If up to half of the wheat flour used in bread making is replaced with lupine flour, the glycemic index of the products drops by 50%, the fiber content increases by 200%, and the vegetable protein intake by 100%.

Diabetes mellitus is a metabolic disease with chronic evolution, and it has a complex etiopathogenesis, being characterized by disorders in carbohydrate metabolism materialized by basal hyperglycemia and decreased glucose tolerance, to which are added disorders of lipid, protein, hydroelectrolytic, acid-base metabolism , following insulin deficiency, which can be relative or absolute, and following the onset of insulin resistance.

In diabetes, the body either does not produce enough insulin or cannot use insulin effectively.

Insulin controls the amount of glucose in the blood and the percentage in which the glucose is absorbed into the cells.

Type 2 diabetes occurs most commonly in adults, is characterized by reduced sensitivity to insulin action, followed by progressive loss of pancreatic β-cell secretory function, and is treated primarily with diet and physical activity, or in combination with oral hypoglycemic

agents (oral antidiabetics), although sometimes insulin injections may be required.

Patients with type 2 diabetes are mostly overweight or obese. Their lifestyle involves eating habits and being sedentary, which contribute to diabetes.

Thus after diagnosis, lifestyle interventions are crucial. These interventions aim at weight loss and maintaining an optimal weight, lowering blood glucose and plasma lipid values, as well as maintaining blood pressure at optimal values.

MATERIAL AND METHOD

The study was carried out over a period of three months and included 20 patients diagnosed with type 2 diabetes. Diabetes was diagnosed based on the criteria of the American Diabetes Association, among which we mention:

- a fasting blood sugar (without eating) greater than or equal to 126 mg/dl (without caloric intake for at least 8 hours), or

- blood sugar greater than or equal to 200 mg/dl 2 hours after the oral glucose tolerance test with 75 g of anhydrous glucose dissolved in water, or

- Glycosylated hemoglobin (HbA1c) equal to or above 6.5%, or

- A blood glucose value greater than or equal to 200mg/dl in a patient with symptoms determined by hyperglycemia

The aim of the study was to highlight the beneficial effects that the consumption of flour obtained from lupine seeds has on the blood sugar level and on the body mass index in patients with type 2 diabetes.

The case report was provided by an internal medicine practice, with the 20 patients signing a consent to participate in the study.

Of the 20 patients, 10 were men and 10 were women, aged between 38 and 75 years. At the start of the study, all included patients were on oral antidiabetic medication, a treatment that was maintained throughout the study period.

Upon inclusion in the study, the patients were evaluated from the point of view of the glycemic profile by measuring the blood glucose and glycosylated hemoglobin from the serum obtained by venipuncture and based on the data of the clinical examination (measurement of the abdominal waist, body weight, blood pressure) and the calculation body mass index (BMI), to assess obesity.

The 20 patients participating in the study were divided into two groups of 10 patients each, a control group and a test group. The study was carried out over a period of three months in which there were three patient monitorings plus the initial monitoring, so a total of four monitorings.

Patients in the test group introduced lupine flour bread into their diet, while patients in the control group consumed the same amount of other types of bread of their choice.

Patients in the test group consumed 250 g of lupine flour bread per day. The bread was obtained by each patient individually in his own household, replacing half of the necessary flour with lupine flour in the bread recipe. The bread was obtained according to the following recipe: 250 g lupine flour, 250 g white wheat flour type 650, 300 ml water, 12 g fresh yeast, 5 g salt. The ingredients are mixed, the obtained dough is left to rise for an hour and a half, then it is baked at 200 ºC for 40-50 minutes.

The first monitoring was carried out at the beginning of the study and the next 3 monthly until the end of the three months. The patients had their blood glucose and glycosylated hemoglobin dosed from the serum obtained by venipuncture and their BMI was calculated at each of the four monitorings.

The obtained data were centralized for each individual patient.

RESULTS AND DISCUSSIONS

Regarding the blood glucose level during the three months of the study, the number of patients from both the test group and the control group in which decreases in the blood glucose level were found was recorded. (table 1, figure 1)

Thus: - At the first monitoring (done at the beginning of the study), of the 10 patients of the test group and the 10 of the control group, all patients had a slightly increased level of blood glucose.

- At the second follow-up (after 1 month), the following results were obtained: out of the 10 patients in the test group, 3 had normal blood sugar, while out of the 10 patients in the control group, only 1 patient had normal blood sugar values.

- At the third follow-up (after 2 months) - out of the 10 patients in the test group, 6 had normal blood sugar, while out of the 10 patients in the control group, only 3 patients had normal values.

- At the fourth follow-up (after 3 months) - out of the 10 patients in the test group, 9 had normal blood glucose values, while out of the 10

patients in the control group, only 6 patients had normal values.

Table 1

Evaluation of plasma glucose levels in patients with type 2 diabetes throughout the study period

Number of monitorings	Number of participating patients/group	Control group Number of patients with ↓ blood glucose values	Test group Number of patients with ↓ blood glucose values
First monitoring	10	0	0
Second monitoring	10	1	3
Third monitoring	10	3	6
Fourth monitoring	10	6	9

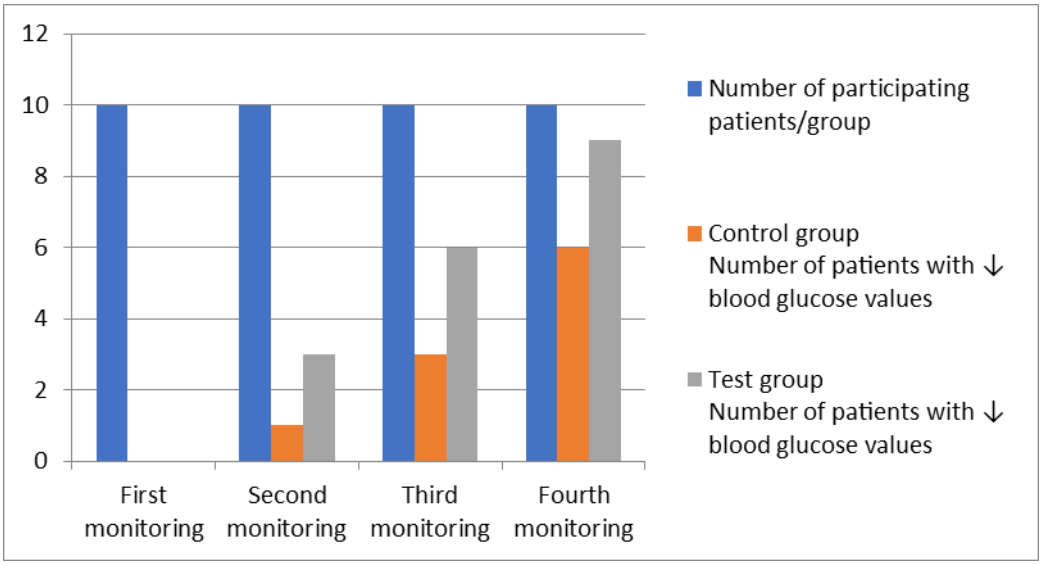

Figure 1 **Evaluation of plasma glucose levels in patients with type 2 diabetes, throughout the study period**

Following the monitoring, it was found that in the group of patients who consumed lupine flour bread, a better control of glycemic values was obtained, than in patients who consumed other types of bread, during the three months of the study. Thus the consumption of lupine has a beneficial influence on the blood sugar level in patients with type 2 diabetes.

Regarding body mass index (BMI) and abdominal waist, at each follow-up for each patient in the study, the body mass index was calculated and the abdominal circumference (AC) was measured, recording the number of patients who had found their decreases. (table 2, figure 2)

BMI was calculated according to the formula: weight measured in kilograms over height in meters squared. A BMI between 18.5 and 24.9 means normal weight, a BMI between 25 and 29.9 means overweight and a BMI over 30 obesity. For abdominal waist, abdominal circumference was measured in centimeter, approximately halfway between the iliac crest of the coxal bone and the ribs, in the navel area. For abdominal circumference, values below 80 cm for women and values below 94 cm for men are considered normal.

Of the total patients participating in the study, 4 patients were normal weight, and 16 were overweight or obese with a BMI over 25 and an abdominal circumference over 80 cm in women and over 94 cm in men. Of the 4 normal-weight patients, 2 were placed in the test group and 2 in the control group, so that at the first follow-up both in the control group and in the test group there were 2 patients each with normal values of BMI and AC and 8 patients each with increased BMI and AC values.

At the second follow-up of the 10 patients in the test group, 4 patients had a decrease in BMI and 3 patients had a decrease in AC. In the control group at the second follow-up, there was no change compared to the first.

At the third follow-up of the 10 patients in the test group, 7 patients had a decrease in BMI and 6 patients had a decrease in AC. Of the 10 patients in the control group, 4 patients had lower BMI values and 3 patients had lower AC values.

At the fourth follow-up of the 10 patients in the test group, 9 patients had a decrease in BMI and 8 patients had a decrease in AC. Of the 10 patients in the control group, 6 patients had lower BMI values and 4 patients had lower AC values.

Table 2

Assessment of BMI and AC in patients with type 2 diabetes over the study period

Number of monitorings	Number of participating patients/group	Control group		Test group	
		No. of patients with ↓ BMI	No. of patients with ↓ AC	No. of patients with ↓ BMI	No. of patients with ↓ AC
First monitoring	10	2	2	2	2
Second monitoring	10	2	2	4	3
Third monitoring	10	4	3	7	6
Fourth monitoring	10	6	4	9	8

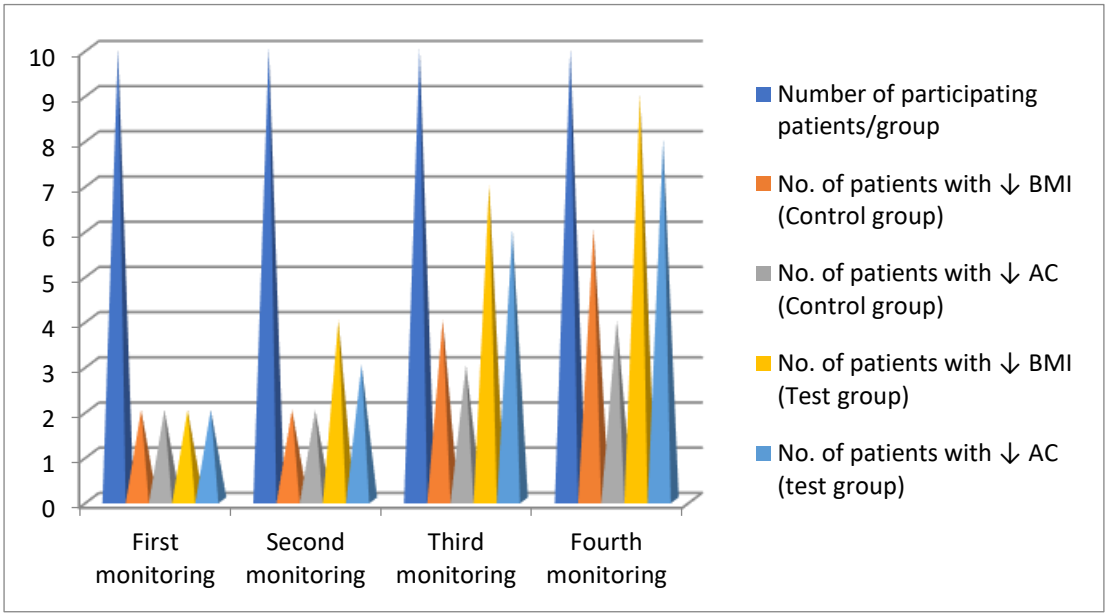

Figure 2 Assessment of BMI and AC in patients with type 2 diabetes over the study period

At the end of the study period, it was found that in the test group, the number of patients in whom body mass index and abdominal circumference decreased was higher than the number of patients in the control group. In the patients of the test group, the abdominal circumference registered an average decrease of 3 cm, following the decrease in weight and the improvement of the body mass index values.

CONCLUSIONS

Lupine is an undervalued vegetable despite its high protein and dietary fiber content and its health benefits.

The fibers of lupine seeds slow down the absorption of sugar in the blood, being a vegetable primarily indicated for those suffering from diabetes.

In addition to the important fiber content, lupine is rich in vegetable proteins, vitamins from the B complex, but also in essential minerals (zinc and manganese).

It is effective in combating obesity and metabolic syndrome, it also helps to lower cholesterol values (lowers total cholesterol and LDL-cholesterol, without affecting HDL-cholesterol) and blood pressure.

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