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Research Article

Determination of the Glycemic Index of a Dish based on Oyster Mushrooms and the Influence of its Consumption on some Biochemical Parameters of Diabetic Peoples

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ABSTRACT

The glycemic index (GI) is the ability of a food to vary postprandial blood sugar. Frequent consumption of high GI foods is believed to cause chronic hyperglycemia which worsens the complications due to diabetes. The search for low GI foods would be of great interest in the prevention of postprandial hyperglycemia. Our work therefore has focused on determining the GI of a dish based on *Pleurotus pulmonarius* and the influence of its consumption. The dish studied was sautéed *Pleurotus* mushrooms (*P. pulmonarius*) with unripe plantains. We included for this study after obtaining ethical clearance, thirty (30) male volunteers (15 diabetic subjects and 15 non-diabetic subjects) aged between 20 and 70 years old. We determined the influence of consumption on some biochemical parameters of the participants. To do this, we took blood samples at the beginning of the experiment (preprandial) and at the end of the experiment (postprandial). After obtaining the serum, we performed for each participant the lipid profile (total cholesterol, HDL cholesterol, LDL cholesterol and triglyceride) we determined cretinemia, transaminase and total protein increased in concentration at the end of the test experimentation.

This work brings added value concerning the use of edible mushrooms in the management of type 2 diabetes. From this study, we can highlight the ability of the test dish to minimize excessively marked variations in postprandial glycemia in diabetics.

Keywords

Glycemic Index (GI), Diabetes, Oyster mushrooms, Food, Clinical nutrition.

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Introduction

The concept of glycemic index (GI) was developed by Jenkins and his collaborators in 1981 to characterize the rate of carbohydrate absorption after a meal. The concept being improved, the GI has therefore become a criterion for classifying foods according to their power to make vary blood sugar within two hours of absorption [1]. Indeed, studies have shown that regular consumption of high GI foods (≥ 70%) contributes to worsening diabetes-related complications by causing too marked spikes in postprandial blood sugar; on the other hand, regular consumption of foods with a low GI (≤ 55%) will help to minimize postprandial blood sugar spikes through low insulin secretions of insulin [2,3], adopting a hygiene-dietary lifestyle including low GI foods could be an approach for the management and control of type II diabetes [4]. Talking about food, several studies have shown that edible mushrooms belonging to the oyster mushroom genus in particular Pleurotus pulmonarius have a large reservoir of biomolecules (phenolics) compounds, flavonoids, alkaloids, polypeptides, terpenes, steroids, Saponins, etc.) responsible for their antihyperglycemic properties [5]. The search for foods with low or medium GI would therefore help in the dietary management of diabetics and also help non-diabetics to control their diet. However, given the importance of GI in food choice in people with type 2 diabetes and knowing the levels of bioactive compounds in oyster mushrooms, we proposed to determine the GI of a dish based on oyster mushroom mushroom (species P pulmonarius) with plantains as an accompaniment and to measure the influence of its consumption on some biochemical parameters in people with type 2 diabetes.

Methods and Results

Methods

Subjects

Our study involved thirty (30) volunteer subjects, or 15 diabetics recruited at Bonassama District Hospital and 15 non-diabetics recruited from the University's Faculty of Science of Douala / Cameroon. They were selected on the basis of a number of inclusion criteria such as age range (between 20 and 70 years), pathology (type 2 diabetic) and acceptance materialized by the signature of informed consent. However, exclusion criteria were mainly based on non-age, presence of another medical condition and non-consent. The study was effective after obtaining ethical clearance indicating the agreement of the ethics committee for scientific research of the University of Douala. The participants, after giving them extensive explanations of the methodology, gave their opinion by signing the informed consent. For each participant, anthropometric parameters such as weight, height, waist circumference to hip circumference ratio, blood pressure and BMI were determined using successively as equipment: scale, toise, meter, and blood pressure monitor. Preprandial and postprandial blood glucose levels. Pre-prandial and postprandial glucose levels were also collected from each participant using the glucometer (sd-codefree).

Test Food

Preparation of the test food

Indeed, the dish to test was the mushroom sauté pleurotus pulmonarius with vegetables accompanied by plantain. It has been prepared in a traditional kitchen respecting all hygiene measures. The mushroom species used and the plantain were purchased respectively in a mushroom farm located in Logbessou (Douala / Cameroon), and at the pk8 market (Douala / Cameroon).

Analysis of some constituent macronutrients of the dish

We have analysed some macronutrients in the soil analysis and environmental chemistry research unit of the University of Dschang (Cameroon). We were talking about evaluating the protein content [6], fat [7] and ash content [6]. Carbohydrate content was calculated by difference.

Experimentation on Participants

The study initially consisted of determining the GI and observing any modification of the biochemical parameters. We used Wolever's protocol [8], to determine the GI of the dish. To do this, we subjected non-diabetics to fasting for 10 to 12 hours the day before the test, to administer to them on the first day of the test, the reference food, namely glucose water (0.71 g / kg of body weight of glucose dissolved in 250 ml of water), then the following day to give them the food to be tested. During the two appointments, we collected capillary blood glucose levels at 0, 30, 60, 90 and 120 minutes.

Measurement of the Glycemic Index (GI)

The GI value was calculated through the incremental areas under the blood glucose curves of each food consumed (test and reference food). As for the incremental areas, they were determined by the trapezoid method [9] while using GraphPad version 7.3 software. The obtained GI value was classified as follows: high (≥ 70), medium (55-69), low (≤ 55%).

Assays of some pre and postprandial biochemical parameters

In order to assess the effect of consumption of the test dish on some biochemical parameters of volunteers, in particular people with diabetes, venous samples were taken in pre and postprandial situations. Indeed, the various parameters studied were among others: lipid profile (total cholesterol [9], HDL [10], LDL [10] and triglycerides [11]), creatinine [12], total proteins [13] and transaminases [14].

Statistical Analysis

The data were introduced into a Microsoft Excel sheet and subsequently analyzed using Statgraphics Centurion XV version 17.1.12 software for Windows. Qualitative and quantitative variables were presented as percentage and mean ± standard deviation (SD), respectively. The Mann-Whitney nonparametric test was used to compare the means between two unpaired groups while the Wilcoxon non-parametric test was used to make comparisons between matched groups. The significance level was set at p-value <0.05.

Results

Anthropometric parameters

Thirty male volunteers, namely 15 diabetics and 15 non-diabetics, were recruited. Their mean age was 57.30 ± 10.34 and 27.57 ± 1.99 respectively in diabetics (D) and non-diabetics (ND). Their mean body mass index (BMI) was 27.30 ± 4.35 and 23.87 ± 3.65 in D and ND. No significant difference was found between the characteristics of each group (p <0.05).

Change in blood sugar over time and glycemic index

Figure 1 shows the change in blood sugar levels over time in diabetics and non-diabetics after consuming 150 g of the test food. It appears that the consumption of the dish did not led to abnormal variations in blood sugar within the two study group [15]. In addition, using the GraphPad version 7.3 software version, we obtained a glycemic index value equal to 43.51, which we qualify as low given Wolever's classification [16].

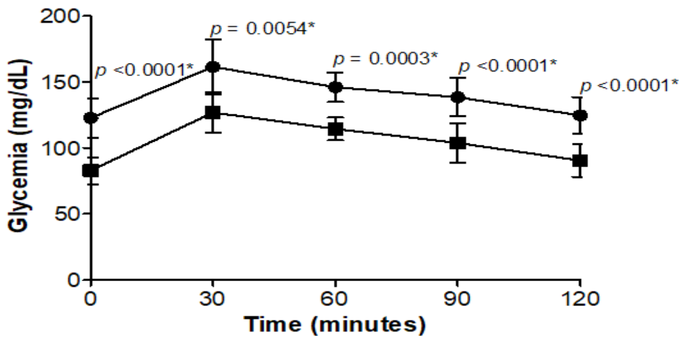

Figure 1: Change in blood sugar (mg / dl) in the two study groups.

Macronutrient content of the test dish and IG

Table 1 below shows the macronutrient content of the dish. To determine the approximate capacity of the dish studied, a dissociation was made between the sautéed oyster mushroom and the unripe plantain after cooking.

Table 1: Macronutrients content in 100 g of food

Macronutrients	Sautéed mushrooms	Plantain
Carbohydrates (%)	38,12 ± 0,68	64,19 ± 0,38
Fat (%)	41,82 ± 0,06	19,16 ± 0,00
Protein (%)	19,8 ± 0,37	16,53 ± 0,95

Variation of Some Pre and Postprandial Biochemical Parameters

Assays were performed using different assay kits. For each assay, the figures below were obtained.'

Creatinine

The figure 2 below shows the variations in serum creatinine concentrations.

Total protein

The variations in total protein concentrations of the subjects are shown in Figure 3 below:

Transaminases

The variations in the concentrations of transaminases (ASAT and ALAT) of the subjects are presented in Figure 4 below:

Conclusions

According to the official classification of the glycemic index [17] The data obtained showed that the dish, had a glycemic index of 43.51% considered low. This low glycemic index value is believed to be the cause of the small variations in postprandial blood sugar level measured in both diabetics and non-diabetics. In fact, food intake did not significantly influence the variations in postprandial glucose levels in the two study groups. These results are in agreement with the work of Dickinson and al., who showed that foods with a low GI lead to less marked variations

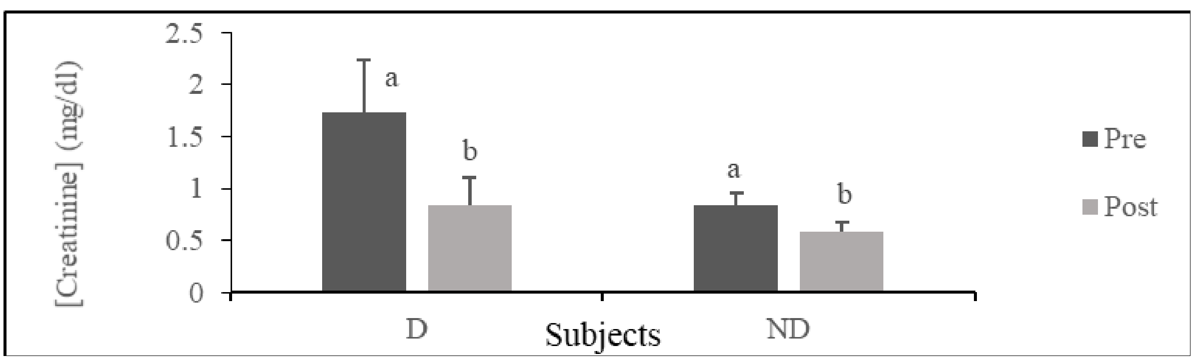

Figure 2: Variation in creatinine concentration as a function of subjects.

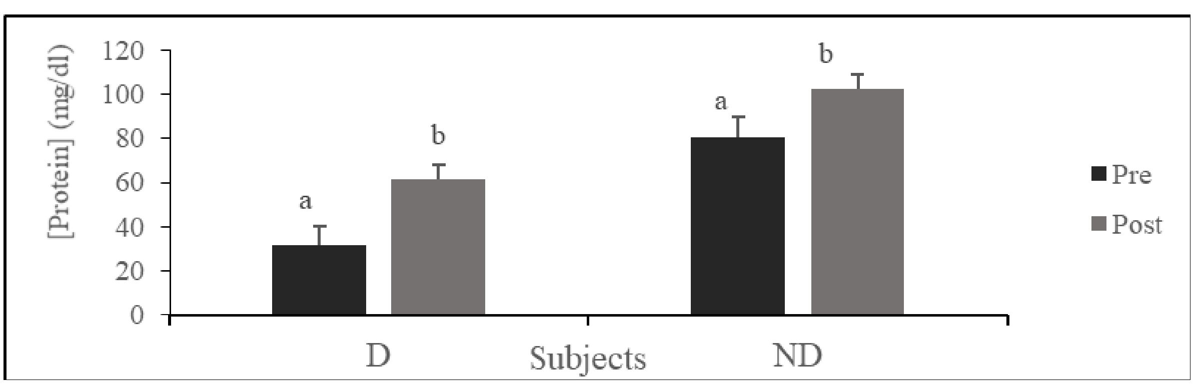

Figure 3: Variation in total proteins as a function of subjects.

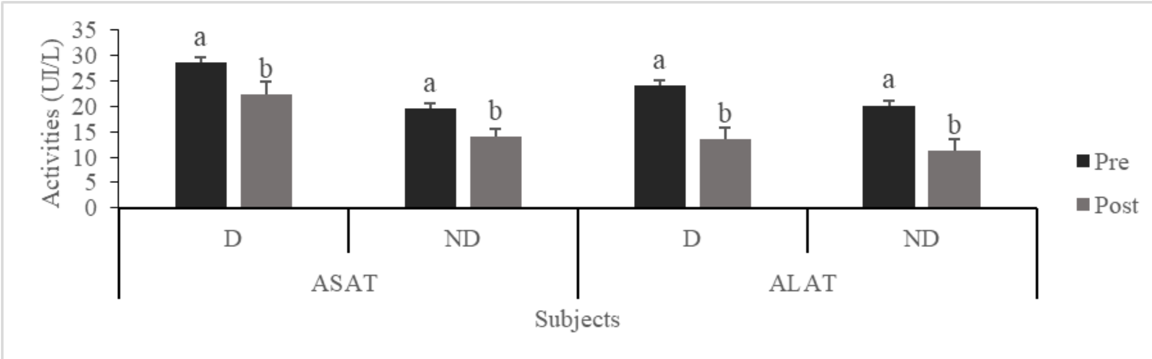

Figure 4: Variations in transaminases depending on the subject.

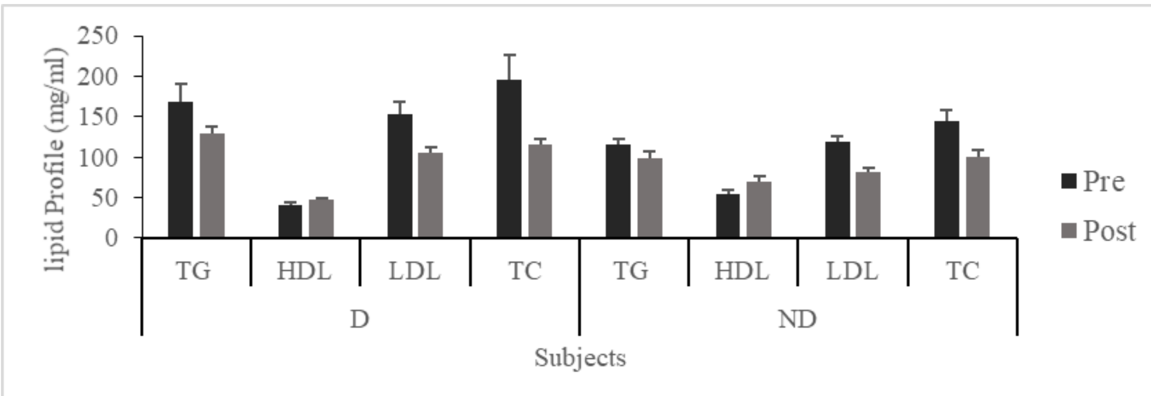

Figure 5: Variations in lipid profile as a function of subjects.

Diabetic Non-diabetic

D: diabetics, **ND**: non-diabetics, **Pre:** pre-prandial**, Post:** postprandial, **a b c**: significance of the values for creatinine, $p < 0,05$.

D: diabetics, **ND**: non-diabetics, **Pre**: pre-prandial, **Post**: postprandial, **a b c**: significance of the values for total protein, $p < 0,05$.

D: diabetics, **ND**: non-diabetics, **Pr:** pre-prandial, **Post:** postprandial, **a b c**: significance of the values for transaminases, $p < 0,05$. **ASAT**: Aspartate Amino Transferase, **ALAT**: Alanine Amino Transferase

D: diabetics, ND: non-diabetics, **Pre:** pre-prandial, **Post:** postprandial, a b c and d significance of the values for lipid profile, $p < 0,05$. **LDL**: cholesterol LDL, **HDL**: cholesterol HDL, **TC**: total cholesterol and **TG**: triglycerides.

in postprandial blood sugar level compared to those with a high GI which rather cause highly marked spikes in postprandial blood sugar level [3]. These observed results are also in agreement with the work of Demmak and al., who showed that low GI drinks led to non-insignificant increase in blood sugar in type 2 diabetics [18]. Furthermore, the non-significant variations in postprandial blood glucose levels obtained could also be direct the consequence of the action of the phenolic compounds that make up oyster mushrooms. This could be better explained by the work of Gnagne et al., who showed that secondary metabolites such as phenolic compounds would have an inhibitory effect on the activity of α-amylase, which would result in the reduction of the occurrence of spikes of high postprandial blood sugar levels [19]. Analysis of macronutrients such as: proteins, carbohydrates and lipids contained in unripe plantains and sautéed mushrooms dissociated from each other, revealed that, the unripe plantains had a statistically high and significant carbohydrate content compared to that of the sautéed mushrooms. The low glycemic index obtained and the non-significant variations postprandial blood sugar levels would be the result of the presence of other macronutrients in the dish namely: proteins and lipids. Likewise, the works of Latge and Karamanlis who have shown that, the higher the protein and lipid contents would be, the lower would be the GI [20,21]. The values of the various pre and postprandial biochemical parameters obtained both in diabetics and in non-diabetics showed that in both groups, the values of parameters such as creatinine, transaminases (ASAT and ALAT), triglycerides, LDL-cholesterol and total cholesterol decreased significantly at the end of experimentation. In contrast, total protein and HDL-cholesterol levels increased significantly at the end of the experiment in both groups of subjects.

To conclude, the objective of this study was to determinate the glycemic index of a dish based on *pleurotus pulmonarius* mushrooms and the influence of its consumption on some biochemical parameters of people with diabetes. The dish studied was "sautéed oyster mushrooms with unripe plantains". It appears that the dish studied had a GI equal to 43.51%, therefore low. Consumption of the dish did not significantly elevate blood sugar in diabetics and non-diabetics subjects. We also observed changes in postprandial glucose levels that did not deviate significantly from normal values. In addition, consumption of the dish had significantly improved some biochemical parameters ($p \leq 0.05$) studied for each group.

As perspectives, we propose: to evaluate the impact of regular consumption of the studied met on the long-term biochemical parameters formulate other dishes based on oyster mushrooms, and redo the same improved studies, evaluated the long-term contribution of these dishes in the management of type diabetes

Acknowledgements

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