Antihyperglycemic activity of prickly pear (Opuntia ficus-indica) aqueous extract

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Abstract: We have studied the antihypoglycemic activity of a plant species commonly used by the ethno-doctors in diabetes treatment: the Opuntia ficus-indica cladodes. The experiment was performed on albino rabbits subject of a hyperglycemia test per os-induced (HPVO); they develop a glycemia of which the pick (200 mg/100 ml of blood). The plants extract are administrated to rabbits before the hyperglycemia test. The cladodes extract (2ml/kg) reduces the glucose rate of 21.67% starting from 30 min. The whole obtained results can to a certain extent, enable to explain the use of the Opuntia ficus-indica in diabetes traditional therapy.

Keywords: Opuntia ficus-indica; traditional medicine; hyperglycemia; glucose.

Introduction

Nowadays, most of the used medicines in the industrialized countries are extracts from vegetable substances or have been elaborated from these ones. These medicines are pulled from the traditional pharmacopoeia and from recovery methods used by different cultures in the world (Xiaorui, 1998).

Diabetes of type 2 is a frequent and serious disease; it sets a public health problem by its complications. It requires medicines, a diet and a medical follow-up. Today, in the therapeutic field, the man has, in addition to the conventional treatments (the insulin and the oral antidiabetic), resort to the use of medicinal plants as complementary treatment or treatment in the bit high glycemia. The phytotherapy constitutes, therefore, a serious alternative or at the least, a complimentary to the classical pharmacy (Rammal et al., 2009).

In the popular medicine, several plants among which, is the prickly pear (Opuntia ficus-indica) appear in a good place. The use of plants extracts to treat diabetes is current in the traditional middle. Prickly pear is an arboresect plant that can reach from 3 to 5 meters of height, native from Mexico, develops as well in the Mediterranean regions than several African countries. Characterized by stems in the shape of thick rackets, elliptical, crowned in spring by beautiful yellow vivid flowers to which succeeded ovoid green yellowish fruits, sometimes tinted of red (Griffit, 2004; DeFelice, 2004).

Our work is a contribution, starting from the Algerian sample, to show the antihyperglycemic activity of a fraction issued of the stems aqueous extract. The experiments had been performed among normoglycemic rabbits; on a hyperglycemia pattern per-os induced using the hyperglycemia applied technics by glucose.
excess. This technic leaves the cells B of the pancreas intact.

Materials and methods

Plant material

*Opuntia ficus-indica* cladodes, thorny varieties, were picked during the month of June, 2011, Constantine region (Algeria). They had been identified at the Pharmacology and Toxicology Laboratory of Natural Sciences of Mentouri University Faculty of Constantine.

The extract preparation

Picked cladodes had been washed, thorns took away and crushed with a grinder (Moulinex), the solution thus obtained had been filtered. It’s this solution that will be administrated to rabbits per-os only.

Experimental animals

Male rabbits, from 2 to 3 months old and weighing between 1.5 to 1.9 kg, had been used in this study. These animals had been supplied by a cattle farm of Constantine City. They had been kept at the University animal facility for at least a week before the experiment, in standard individual rabbit cages. Food and water were provided *ad libitum* and light-dark cycle was of 12 hours, with a temperature of 22 ± 2 °C and relative humidity to 60%. All the adopted experimental procedures were in accordance with the International Directives for Animal Protection.

The experimental procedures

Among normoglycaemia rabbits

The rabbits were fasted 16 hours. The aqueous extract of *Opuntia ficus-indica* cladodes was administered as a single dose per os to white rabbit in dose 2 ml/kg, of weight. Blood sampling had been done by puncture in the ear marginal vein, before force-feeding then at the first, second and third hour after the administration of the studied substance (Ndiaye, et al, 2008; Abdel-Barry et al, 1997).

Table 1: The *Opuntia ficus-indica* aqueous extract effect on the normoglycemic rabbits basic glycemia.

<table>
<thead>
<tr>
<th>Lots</th>
<th>H0</th>
<th>60 mn</th>
<th>120 mn</th>
<th>180 mn</th>
</tr>
</thead>
<tbody>
<tr>
<td>Witnesses</td>
<td>0.91 ± 0.01</td>
<td>0.88 ±</td>
<td>0.86 ±</td>
<td>0.85 ±</td>
</tr>
<tr>
<td>Aqueous extract</td>
<td>0.091 ±</td>
<td>0.03</td>
<td>0.85 ±</td>
<td>0.79 ±</td>
</tr>
<tr>
<td>Reduction</td>
<td>0 %</td>
<td>3.40 %</td>
<td>3.48 %</td>
<td>7.05 %</td>
</tr>
</tbody>
</table>

Among rabbits issued of an induced-hyperglycaemia

The induced hyperglycaemia was caused among normoglycaemia male rabbits after oral administration with a syringe provided with oesophageal probe 4 g of glucose/kg of the animal weight. The extract administration taken orally 60 minutes before administrate the glucose excess to match the time of maximum activity of hyperglycemic glucose overload with the maximum hypoglycemic activity of the extract. The glycaemia determination is done with a Blood Glucose Monitor Ref. Accu Check Performa. The punctured blood drop is put down on the active zone of a strip. The glycaemia reading is done automatically. The result is expressed in mg/100 ml of blood. (Ndiaye et al., 2008; Abdel-Barry et al., 1997; Lawson et al., 1997).

Statistical analysis

The result analysis is realized by the comparison of the studied lots using the student ‘t’ test. The glycaemia values are expressed on the average ± standard error to the average. The significance limit is fixed to P < 0.05 (Ndiaye et al., 2008; Lawson et al., 1997).

Result

The extract effect among the normoglycemic rabbits

The extract administration of *Opuntia ficus-indica* to the dose of (2ml/kg, par os), among the normoglycemic rabbits causes a significant reduction of the basic glycemia among the rabbits after an hour of observation. (0.091 ± 0.03 to 0.85 ± 0.04) (p < 0.05; n = 6) (Table 1 and Figure 1).
Antihyperglycemic activity of *Opuntia ficus-indica*

**Figure 1**: The *Opuntia ficus-indica* aqueous extract effect on the normoglycemic rabbits basic glycaemia.

The *Opuntia ficus-indica* aqueous extract effect on the hyperglycaemia per os-induced

Among a rabbits-control group, the glucose administration to the dose of 4g/kg per os causes a significant hyperglycaemia with a pick that appears after 30 mn. The glycaemia varies, indeed, between 1.02 ± 0.07 to 2.03 ± 0.04 g/l (p < 0.05, n = 6). Among rabbits first treated with the aqueous extract (2ml/kg, per os), the glycaemia variation obtained after the glucose administration is less important than the one of the group control (1.01 ± 0.03 to 1.59 ± 0.05 g/l) (p < 0.05, n = 6) (Table 2 and Figure 2).

**Table 2**: The *Opuntia ficus-indica* extract effect on the HPVO

<table>
<thead>
<tr>
<th>Lots</th>
<th>Glycaemia (g/l of blood)</th>
<th>-90 mn</th>
<th>30 mn</th>
<th>60 mn</th>
<th>120 mn</th>
<th>180 mn</th>
</tr>
</thead>
<tbody>
<tr>
<td>Witnesses</td>
<td></td>
<td>1.02 ±</td>
<td>2.03 ±</td>
<td>1.75 ±</td>
<td>1.40 ±</td>
<td>1.19 ±</td>
</tr>
<tr>
<td>2ml/kg Aqueous</td>
<td></td>
<td>1.01 ±</td>
<td>1.59 ±</td>
<td>1.37 ±</td>
<td>1.24 ±</td>
<td>0.93 ±</td>
</tr>
</tbody>
</table>

Table 2: The Opuntia ficus-indica extract effect on the HPVO

**Figure 2**: The *Opuntia ficus-indica* extract effect on the HPVO.

**Discussion**

This study aimed to assess the hypoglycemic and anti-diabetic activity of the *Opuntia ficus-indica* cladodes extract. The results of this study show a hypoglycemic effect on the basic glycaemia of the aqueous extract normoglycemic rabbits, an hour after the administration, to a dose of 2 ml/kg.

These results suggest that the compounds responsible of this hypoglycemic effect of the *Opuntia ficus-indica* and which are extracting in the water will rather be substances to polar groupings. Indeed, the glycaemia reduction variation is of 0.85 ± 0.04 g/l. this observation led us to test the anti-diabetic activity of the aqueous extract on the hyperglycaemia per os – induced. On this pattern, the extract (2ml/kg, per os) causes a significant glycaemia decrease (0.93 ± 0.03 g/l).

The plant extract activity contains polyphenols in the glycaemia regulation on the diabetic animals patterns had been described by Ragunathan et al. (1994).

Earlier studies had shown the presence of polyphenols in the cladodes extracts of the *Opuntia ficus-indica* (José-Alberto et al., 2009). These components are extracting in water, which suggests the presence of polyphenols in the cladodes aqueous extract. This can explain at least a part of the pharmacological basis of the hypoglycemic and anti-diabetic activity of the aqueous extract of the *Opuntia ficus-indica* cladodes.

However, the results of the present study are in accordance with the works of Cunha et al. (2008), Dhanabal et al. (2007), Adeneye et al. (2007) and Puri (2001) on the flavonoids respectively of the plant *Leandra Lacunosa, Nymphaea Stellataqui, Musanga Cecropioide* and *Biophytum Sensitivum*, where it had been proved the antihyperglycemic activity of these extracts among rats.

Other authors (Esmaeili and Yazdanparas, 2004; Sharma et al. 2006; Shipra et al. 2009) had demonstrated that the flavonoid extracts of the plants *Eugenia jambolana, Cassia auriculata* L. and *Teucrium polium* stimulate and regenerate the cells β of the pancreas.
Conclusion

In this study we have shown the hypoglycemic activity of *Opuntia ficus-indica* cladodes among the normoglycemic rabbits and in state of hyperglycemia. The extract that we have tested is issued from the aqueous extract exhaustion, traditional form of the plant usage.

Therefore, we propose a purification of the aqueous extract in order to get the active molecule. But, an ameliorated form can already be prepared from this extract.

References


