

High Institute of Public Health
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Nutritional Quality of *Opuntia Ficus-Indica* and Effect of its Consumption on some Biochemical Parameters in Diabetic Rats

A Thesis Submitted In Partial Fulfillment of the requirements for the degree of Doctor of Philosophy

In

Public Health Sciences (Food Analysis)

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2020



SUMMARY

Diabetes mellitus (DM) is a major public health problem worldwide. Egypt was recorded by the International Diabetes Federation (IDF) as one of the world top 10 countries in the number of patients with diabetes. In addition it is alarming that diabetes prevalence in Egypt is increasing rapidly within a relatively short period, from around 4.4 million in 2007 to 8.9 million in 2019. It is anticipated that if this trend continued this number will increase to 16.9 million by 2045.

The management of diabetes is a global problem, there has been expanded scientific interest in medicinal plants that are traditionally used to control and treat diabetes with no or minimal side effects.

Opuntia ficus-indica, commonly called prickly pear or nopal cactus, belongs to the dicotyledonous angiosperm *Cactaceae* family. *Opuntia ficus-indica* is a tropical and subtropical plant, it can grow in arid and semi-arid climates with a geographical distribution encompassing Mexico, Latin America, South Africa and Mediterranean countries including Egypt. Two parts of the plant have been used for food: the fruits or the prickly pears and the nopal cactus pad or cladodes.

The *Opuntia ficus-indica* cladodes and fruit contain considerably high levels of macro- and micronutrients including fibers, minerals, amino acids; and fatty acids. In addition, they are rich in different bioactive compounds as vitamins, phenolic compounds as well as powerful antioxidant activities, they are widely used in traditional folk medicine for the treatment of diabetes, arteriosclerosis, gastritis, ulcers, wounds, and rheumatic pain.

The aim of the present study is to assess nutritional quality of *Opuntia ficus-indica* and effect of its consumption on some biochemical parameters in diabetic rats. Specific objectives were to assess the chemical composition of *Opuntia ficus-indica* cladode and fruit, and to investigate the effect of *Opuntia ficus-indica* cladode and fruit consumption on some biochemical parameters in diabetic rats.

Opuntia ficus-indica cladode solution, fruit juice were used to determine proximate composition (moisture, fat, total ash, crude protein, crude fiber, and carbohydrate content), total phenolic compounds, total antioxidant activity, fatty acid profile and vitamins (C, E, D and β -carotene)

Sixty healthy male adult albino rats of Wistar strain weighing around 120-150 g were randomly divided into six groups having ten rats in each group as follows:

Group I. Untreated normal control group (normal control), rats were received distilled water.

The other groups (groups 2-6) comprised rats with alloxan-induced diabetes using a single subcutaneous injection of freshly prepared alloxan (120 mg/Kg body weight).

Group II. Untreated diabetic rats, rats received distilled water.

Group III. (Diabetic + cladode solution) this group were daily orally injected with 5 mg/kg body weight (BW) of cladode solution.

Group IV. (Diabetic + fruit juice) this group were daily orally injected with 5 mg/kg BW of fruit juice.

Group V. (Diabetic + combination of cladode solution and fruit juice) this group were daily orally injected with 5 mg/kg BW of combination of cladode solution and fruit juice.

Group VI. (Diabetic + metformin) this group were daily orally injected with 300 mg/kg BW of crushed tablets of metformin dissolved in water.

Body weights were measured at the beginning of experiment and weekly till the end of experiment (8 weeks). At the end of the experimental period, rats were fasted overnight and blood samples were collected, the blood was allowed to clot and serum was separated by centrifugation at 3000 rpm for 10 min. Serum samples were separated and stored at -20°C for further biochemical tests. The following parameters were measured after 4 weeks and at the end of 8 weeks: fasting glucose level, lipid profile including: total cholesterol, triglyceride, high density lipoprotein, low density lipoprotein and very low density lipoprotein, renal functions including: urea, creatinine and liver functions including: aspartate aminotransferase (AST), alanine aminotransferase (ALT) and alkaline phosphatase (ALP) in different rats groups.

Data of the present study showed that the cactus cladode and fruit juice contained phenolic compounds as 119.66 and 123.56 mg/100gm respectively. The antioxidant activity was 40.38% and 39.18 % respectively. It also contained appreciable amounts of vitamin C as 15.94 and 26.76 mg/100 g, the amount of vitamin E were 1.37 and 96.80 µg/100gm, as regard vitamin D it was not detected in cladode while the fruit contain 1.40 µg/100gm, the amount of beta-carotene (β-carotene) were 57.51 and 28.01 µg/100gm, respectively. The major fatty acids of cladode and fruit were unsaturated fatty acids. The main unsaturated fatty acids were linoleic acid (omega-6), linolenic acid (omega-3) and oleic acid (omega-9) and the main identified saturated fatty acids include palmitic acid and stearic acid.

Treatment of diabetic rats with *Opuntia ficus-indica* cladode, fruit and combination revealed obvious improvement in bodyweight gain% after 4 and 8 weeks with mean body weight significantly higher compared to the untreated diabetic rats group. The highest improvement of the body weights gain in relation to untreated diabetic rats were seen in rats treated with combination as 81.95% then 113.75% respectively followed by metformin as 71.95% then 100.79% respectively afterward cladode as 52.86% then 74.23% respectively and the least elevation of the body weights gain were seen in rats group treated with fruit as 36.5% then 57.14% respectively. On the other hand these rats recorded minimal increase in body weight compared to those of the normal control group.

There were significant reduction of FBS level in all groups in relation to the untreated diabetic rats group after 4 and 8 weeks with the highest reduction (59.6% and 74.5%) was detected in rats treated with fruit juice, followed by those treated with combination (45.3% and 59.47%), then the rat group treated with cladode (42.3% and 54.43%) and the lowest reduction was observed in rats treated with metformin (30.9% and 44.62%).

Cholesterol and triglyceride levels were significantly reduced compared to the untreated diabetic rat groups. Urea concentration showed significant reductions in rats treated with fruit (38.16% and 60.06% respectively). There were significant reductions

in AST, ALT and ALP levels in all groups in relation to untreated diabetic rats after 8 weeks the highest mean reduction were reported in rat group treated with fruit (79.24%, 69.48% and 40.39% respectively).

Based on the present study results, it can be concluded that *Opuntia ficus-indica* cladode and fruit can serve as a good source of important nutrients, thus, the plant can be explored as a viable supplement in food and as a functional food.

Opuntia ficus-indica cladodes and fruits are a beneficial source of fibers, which may promote body weight reduction. In addition they have strong antioxidant properties and can be considered as natural source of antioxidants due to their beneficial source of polyphenols, vitamin C and beta carotene.

Opuntia ficus-indica cladode solution, fruit juice and combination improve the physiological changes induced by diabetes in the experimental animals as hyperglycemia, hypercholesterolemia, and hepato-renal function parameters. Orally consumed *Opuntia ficus-indica* cladode and fruit caused great reduction in blood glucose levels than the conventional oral antidiabetic drug used for DM management (metformin)

Further investigations are recommended with different doses and for more prolonged periods to fulfill the profile of the plant in order to introduce it as a natural antidiabetic agent and to identify its therapeutic potential in different diseases.