Zagazig J. Pharm. Sci., June 2005
Vol. 14, No. 1, pp. 13-20

ISSN 1110-5089

AN ASPECT ON THE EFFECTS OF *CARICA PAPAYA* FRUITS AND LEAVES ON SOME BIOCHEMICAL AND PHYSIOLOGICAL CHANGES IN ALLOXAN INDUCED-DIABETIC RATS

Mohamed S. Mahmoud[1], Hany M. Helmy[2] and Emad S. Shaker[3]
[1]Nutrition and Food Science Dept., Faculty of Home Economics, Helwan University,
[2]Home Economics Dept., Faculty of Special Education, Zagazig University,
[3]Agric. Chemistry Dept., Faculty of Agriculture, Minia University. Egypt

ABSTRACT

This study was carried out to investigate the importance of *Carcia papaya* fruit and its leaves as an antidiabetic agent. The glucose and fructose contents of papaya fruit were determined using HPLC technique. The effect of fruit (10 & 20%) and leaves (5 & 10%) on food efficiency ratio, body weight gain, liver weight, kidney weight, blood glucose, cholesterol, triglycerides, uric acid and creatinine levels were determined in alloxan-induced diabetic rats. Fourteen days treatment with *Carica papaya* showed considerable lowering in blood glucose level, no significant changes in serum cholesterol and triglycerides, decreasing in uric acid and creatinine levels in the treated diabetic group under investigation. Fruit and leaves showed phenolic contents and potential reducing power as indicator for antioxidative activity. These results suggest that *Carica papaya* fruit and leaves possess antidiabetic effects in alloxan-induced diabetic rats, while no hypolipidemic effects were observed. The amelioration in the blood glucose level and other physiological organs may be due in part to the antioxidant activity of *Carcia papaya* fruits and leaves.

INTRODUCTION

Carica papaya is an endogenous plant in West India, Mexico and Central America, and widely cultivated in other tropical and subtropical areas. In Egypt[1], papaya has been planted in total fruitful area 65 fed, and the production was 437 ton with yield of 6.72 ton/fed. The fruit can be used to make drinks, salads, marmalade and candy. Papain, a protease enzyme, molecular weight 23 kDa, is obtained from the latex of the unripe but fully grown papaya fruit, leaves and trunk. It has many industrial and consumer uses including as a meat tenderiser, clearing agent in the production of beer, contact lens cleaner, and reagent in the biochemical and pharmaceutical industries. Its edible seeds have a spicy flavor somewhat reminiscent of black pepper. Unusually Papaya fruit contains butyric or butanoic acid (1.2 mg/kg), which is also found in butter and used in the manufacture of plastics[2]. Recently, papaya is used as food or medication[3] in folk medicine.

Papaya fruit is one of the best sources for provitamin A (ß-cryptoxanthin)[4] the predominant carotenoid. Moreover, papaya fruit is a rich source of soluble dietary fiber and showed health benefits[5]. Dry comminuted leaves of papaya were exhaustively extracted[6] with dichloroethane to produce a yellow-orange residue from which six carotenoids were separated.

Diabetes complications, especially late (chronic) ones, are the main reasons of invalidity and early mortality. The most threatening diabetes complications are vascular and metabolic complications (diabetic neuropathy, cataract, glaucoma, optic neuropathy, diabetic nephropathy). Good diabetes control is very important, because in early stages these changes are reversible. In order to decrease the number of diabetes complications and to postpone their development, the use of biologically active natural products is recommended. The most important biologically active substances for this purpose are vitamins, minerals, proteins, polysaccharides, saponins and flavonoids

Carica papaya is one of the naturally used products for treatment of symptoms related to venous and lymphatic vessel insufficiency, and for the prophylaxis[7]. It suggested also for liver damage caused by metabolic toxins, in chronic degenerative liver conditions, for the therapy of digestive disorders, and to stabilize membranes through antioxidant and free radical scavenging actions.

Free radicals have been related with aging and diseases such as cancer, diabetes and especially in neurological disorders, for example, Parkinson's disease or Alzheimer's disease[8]. Diet including variable antioxidant foods such as papaya or fermented papaya may therefore help to prevent these illnesses. The fermented papaya preparation also increased superoxide dismutase activity. These results suggested that the fermented papaya preparation has antioxidant actions. So that, it may be a prophylactic food against the age related and neurological diseases associated with free radicals.

The effects of consumption of guava or papaya (400 g /day) on total antioxidant status and lipid profile. A significant change in plasma glucose level was found after four weeks of papaya consumption, and a significant increase of plasma total cholesterol and triglyceride level[9]. No significant increase in plasma HDL-cholesterol and LDL-cholesterol levels was observed. Significant increases in serum total antioxidant status, glutathione reductase level were stated but no significant increase in blood glutathione peroxidase level. The consumptions of guava and papaya reduce oxidative stress and alter lipid profile. Thus, it could reduce the risk of disease caused by free radical activities and high cholesterol in blood.

The effect of powdered drinks formulated on a basis papaya, green plantain and rice bran has been illustrated on glycemic index GI[10]. Papaya powder presented the best equilibrium in relation to insoluble/soluble fiber (1.4:1) when compared with green plantain and rice bran. The highest total dietary fiber (12.8-16.1 g/100g) caused the lowest increase in glycaemic response. The glycaemic index was smaller than that of a glucose solution, indicating that they could be used by people with special diets, such as diabetic patients.

This study shed light on the effect of papaya fruit and its leaves on some biochemical and physiological changes such as blood glucose, cholesterol, uric acid, creatinine, liver, kidney weight, fed intake and body weight gain. The chemical composition of monosaccharides, phenolic compounds and reducing power in papaya fruit and its leaves were also studied.

MATERIALS AND METHODS

Materials:

Papaya *(Carica papaya* L.): Papaya used in this research was collected from the local market of Sharkya governorate in May, 2004.

Alloxan: Alloxan used in this research was obtained from Hoffman La'Roch Company. Diabetes was induced in normal healthy rats by subcutaneous injection of alloxan (200 mg/kgm weight)[11].

Methods :

Preparation of papaya pulp and its leaves: Papaya (*Carica papaya*) fresh pulp was cut into small pieces, dried in an oven at 50°C for 3 days until fully dried and grounded by using a grinder. The fresh leaves were cut, washed with water and dried at room temperature for10-12 days until fully dried, then grounded by using a grinder.

HPLC assay of monosaccharides in papaya pulp: Soluble sugars in papaya pulp were extracted[12]. Ten grams blended pulp were homogenized with 200 ml deionized water at 60°C, 3 min. Lead acetate (10 ml, 10%) was added to precipitate non carbohydrate compounds, and centrifuged at 10.000 xg/15 min. The supernatant was filtered and kept for analysis using HPLC. HPLC-HEWLETT-PACKARD Liquid Chromatography series 1050, with detector HP 1047 A and Bio-Rad aminx HPX-87c column 300 mm X7.8 mm was used. Deionized degassed water (in degasser series 1050) was used as a mobile phase with flow rate 0.6 ml/min, temperature 70°C and injection volume 5 ul. Monosaccharide (MS) percentage in papaya pulp sample was calculated as equation;

Monosaccharide % =

(peak area of MS X standard Wt. X 100) /
(peak area of standard X sample Wt.)

Phenolic content measurement: The phenolic compounds concentration was measured[13], and calculated using tannic acid and catechin as standards. The dried samples in methanolic HCl (0.01 g) were added to 2 ml 2% Na_2CO_3. After 2 min, Folin-Ciocalteu reagent (0.1 ml) was added to the mixture, then it was left for 30 min. Absorbance at 750 nm was measured using a spectrophotometer. Results are the mean of three samples, were expressed as grams percentage of tannic acid or catechin equivalent to 100 g dry weight.

Reducing power assessment for papaya pulp and leaves: The reducing power activity for extracts - which relate to the antioxidant activity- was compared to that of vitamin C (0.01 g/ml) as a standard common antioxidant and reducing agent. Aqueous extracts (0.01 g) were mixed with phosphate buffer[14] and potassium ferricyanide. Then, these mixtures were incubated at 50°C for 20 min. A portion of trichloroacetic acid was added to the mixture, which was then centrifuged. The upper layer of solution was mixed with distilled water and $FeCl_3$. The absorbance of three replicates was measured at 700 nm. Increased absorbance of the reaction mixture indicated increased reducing power.

Experimental animal design: A total of 36 male healthy rats (weigh between 140-150 g) were divided into 6 groups. The first group was used as negative control, and groups (2-6) were subcutaneous injected by alloxan (200 mg/kg body weight) to induce hyperglycemia as follows:

1- Fed on basal diet as a "negative control"
2- Fed on basal diet as diabetic rats without treated "positive control"
3- Fed on basal diet (diabetic rats) containing 10% dried papaya pulp.
4- Fed on basal diet (diabetic rats) containing 20% dried papaya pulp.
5- Fed on basal diet (diabetic rats) containing 5% dried papaya leaves.
6- Fed on basal diet (diabetic rats) containing 10% dried papaya leaves.

Preparation of diet: The basal diet contains proteins (13%), fat (4%), salt mixture (3.5%), vitamin mixture (1%), choline (0.2%), cellulose (5%)[15] and starch.

Blood sampling: After 40 days treatment with papaya, rats were starved for 12 hr., and sacrificed under ether anesthesia. Blood samples were collected from the aortic vein into clean dry centrifuge tubes and stored at room temperature for 15 minutes. They were cooled at 4°C for 2 hour, and then centrifuged for 10 minutes at 3000 rpm to separate serum. Serum was carefully aspirated and transferred into dry clean Wasser –man tubes- by using a Pasteur pipette and kept frozen at (-20°C) for analysis.

Analytical methods of blood serum:

1- **Determination of serum glucose:** Serum glucose was colorimetrical determined[16].
2- **Determination of total cholesterol:** Serum cholesterol was determined using the enzymatic method[17].
3- **Determination of triglycerides:** The triglycerides in serum were colorimetrical determined[18].
4- **Determination of uric acid:** Serum uric acid was colorimetrical determined[19].
5- **Determination of creatinine:** Serum creatinine was measured in alkaline solution and reacted with picrate to form a colored complex[20].

Statistical analysis: The obtained data were statistically analyzed[21].

Zagazig J. Pharm. Sci., June 2005
Vol. 14, No. 1, pp. 13-20

RESULTS AND DISCUSSION

HPLC assay of monosaccharides in papaya fruit pulp:

HPLC analysis (Table 1 and figure 3) indicated the presence of glucose and fructose in papaya fruit pulp in concentrations 5.196 and 2.379 %, respectively. The monosaccharide concentrations of *C. papaya* have been calculated by comparison with standard glucose and fructose peak area (figures 1 and 2), at retention times 7.480 and 8.68 min., respectively. Results were in agreement with that found[22] fructose (3%), which may be correlated with the low glycaemic index GI.

During the early papaya fruit development, glucose was the major sugar[23]. Cell wall invertase [β-fructofuranosidase] activity, which was very low in the young papaya fruit, began to increase 90 day after flowering and that paralleled sugar accumulation. Enzyme invertase is hydrolyzing sucrose into glucose and fructose in nature. Invertase isolated from *Carica papaya* fruits is inhibited by fructose[24], and not by glucose. Fructose appears to be an important effector of this enzyme, and inhibition by fructose is not suppressed by proteins as occurs with other plant invertases.

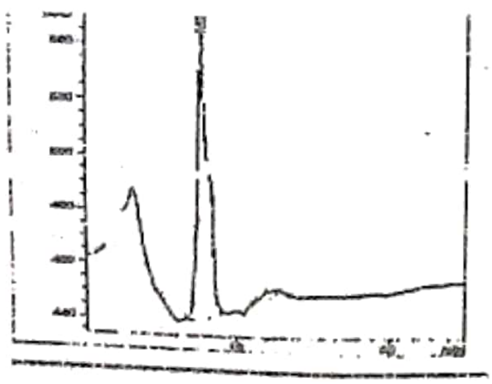


Figure (1): HPLC chromatogram for standard glucose.

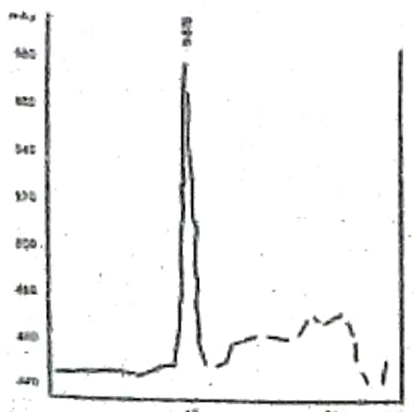
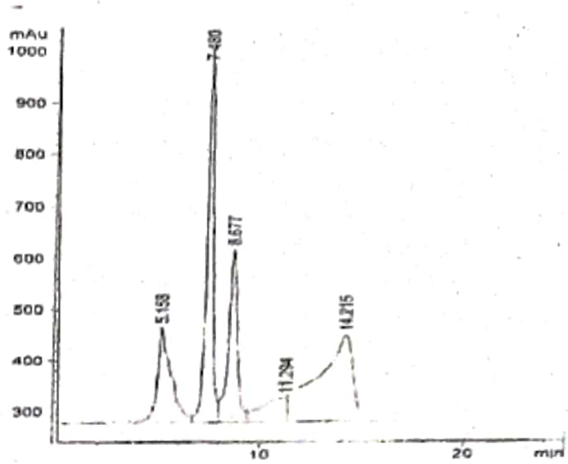


Figure (2): HPLC chromatogram for standard fructose.



Figure(3): HPLC chromatogram for papaya peels sacharides (g/100g) measured as glucose and fructose

Table (1): HPLC assay of monosaccharides for papaya fruit pulp (%).

	Glucose %	Glucose R_t	Fructose %	Fructose R_t
Papaya fruit pulp	5.196 ± 0.112	7.48	2.379 ± 0.093	8.68

Glucose, fructose and sucrose in papaya juice were found in total concentrations of 0.5-0.7 molar[25]. Heat treatment of the fruit before juice preparation inactivates the enzyme and lower amount of the simple sugars. On the other side, sucrose was found in the predominant sugar (75%) in papaya seeds[26], in addition to few free monosaccharides. Carbohydrate content as well [27] was mentioned to be 10%, which constitute mainly arabinose (48%) and fructose (23%) in papaya fruit pulp.

Assay of phenolic content:

The phenolic content in papaya pulp and leaves (figure 4) was measured as tannic acid and catechin. Papaya pulp has phenolic content 0.64% and 0.28%, respectively. On the other hand, Papaya leaves have lower phenolic content 0.58% and 0.21% as tannic acid and catechin, respectively. Phenols as rutin, and variety of carotenoids have been also detected in papaya leaves[6]. These compounds might be responsible for the high antioxidant activity, and the hypoglycemic effect of papaya. Phenolics and flavonoids are reported to be responsible for hypoglycemic activity[28].

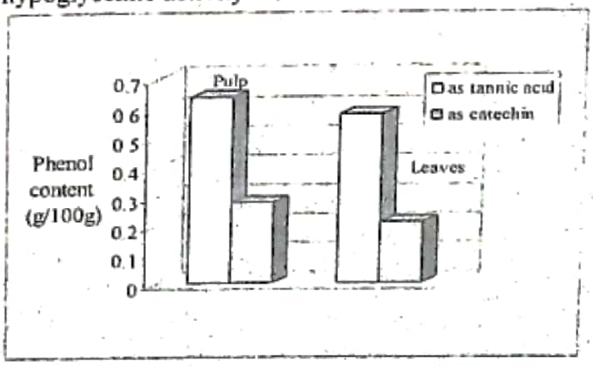


Fig (4): Total phenols for papaya peels and leaves (g/100 g) measured as tannic acid and catechin.

Super-oxide value and 1-diphenyl-2-picrylhydrazyl radical scavenging activity in guava, mango, banana and papaya are generally linked with total phenolic and ascorbic acid content[29].

Reducing power assessment *in vitro* for papaya pulp and leaves:

Reducing power as indicator for anti-oxidative activity was measured at 700 nm for the pulp and leaves aqueous extracts and compared with the reducing power for the standard antioxidant vitamin C (Figure 5). The reducing power may be due to the electron donor activity for the compounds. Reducing power is due to the ability to react with the free radicals[30] to convert them to more stable products and terminate radical chain reaction.

Due to high total phenolic content of papaya pulp (fig 4), it showed higher reducing power activity (0.775±0.118) than that for the leaves (0.394±0.298). The activity for pulp was much higher than the activity for vitamin C (0.478±0.212). Another study showed that glucose, fructose and sucrose presented in papaya juice are responsible for HO· quenching activity[25]. An imbalance between oxidative stress and antioxidative defense mechanisms in diabetics can result in cell and damage the tissue, and accelerate diabetic complications. It was mentioned that diet including variable antioxidant foods may help to prevent illnesses related to free radicals. Connection between *Lycium barbarum* extracts which is rich in antioxidant components and its hypoglycemic effect has been detected[31].

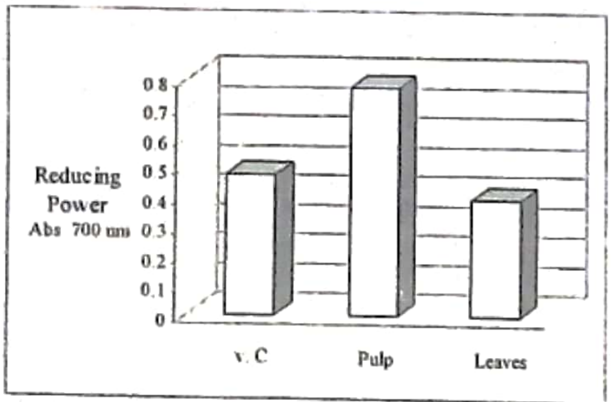


Fig (5): Reducing power activity for papaya pulp and its leaves comparing to vitamin C activity.

Antioxidative capacity of fruit pulps showed that papaya pulp in the 11th order based on scavenging 2,2-azino-bis-3-ethylbenzthiazoline-6-sulfonic acid (ABTS) free radical[32] and ascorbic acid equivalent antioxidant capacity.

Biological parameters:

Effect of papaya pulp and its leaves on biological parameters in diabetic rats was studied. The parameters included food consumption, food efficiency ratio (FER), weight gain and organs to body weight ratios (Table 2 and figure 6). It was observed that, significant decrease in food intake and food efficiency ratio (FER) for diabetic rats fed on basal diet. While, a slight increase in food intake and significant increase in (FER) for diabetic rats fed on basal diet with different levels of papaya and it's leaves comparing with control group. The significant increase in (FER) may be due to effect of some important substances in papaya such as papain enzyme that enhance digestibility and absorption.

Table (2): Effect of papaya pulp and its leaves on daily food intake (g/day) and food efficiency ratio (%) (mean + SE)

Groups / Parameters	Negative Control	Positive Control	Papaya fruits 10%	Papaya fruits 20%	Papaya leaves 5%	Papaya leave 10%	F-value
Daily food intake (g/day)	12 ±0.29 a	11.03 ±0.33 b	12.03 ±0.30 a	12.18 ±0.29 a	12.39 ±0.37 a	12.67 ±0.31 a	3.082*
Food Efficiency Ratio (%)	7.52 ±0.82 a	1.9 ±0.47 c	3.64 ±0.42 b	3.79 ±0.24 b	4.93 ±0.53 b	4.97 ±0.45 b	13.123*

Values with same letters indicate non significant difference (P<0.05) and vice versa.
*Significant (P<0.05), NS=non significant

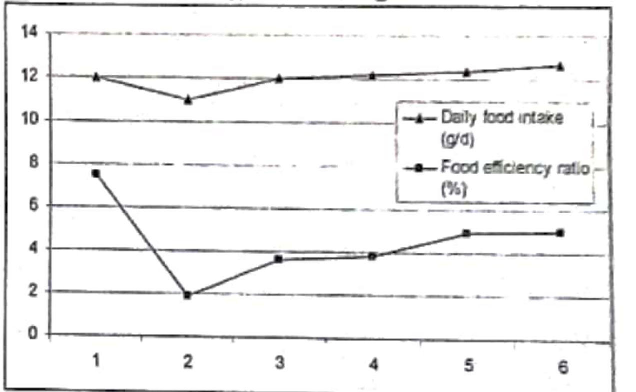


Figure (6): Effect of Papaya fruits and leaves on daily food intake (g/day) and food efficiency ratio (%). (1: negative control, 2: positive control, 3: fruits 10%, 4: fruits 20%, 5: leaves 5% and 6: leaves 10%).

Aqueous extracts of papaya seeds (5 & 20 mg/kg body/day oral doses) for 60 days are safe and could serve as an effective male contraceptive in rodents[33] It did not manifest any estrogenic effects in male mice, and LD50 studies indicated its nontoxic nature. The body weight or the weights of reproductive organs, kidney and adrenal were not affected. The serum SGOT, SGPT, proteins and cholesterol levels were within the normal range in the extract treated mice.

Table (3): Effect of papaya pulp and its leaves on body weight, body weight gain ratio and daily body weight gain (g) (mean + SE)

Groups / Parameters	Negative Control	Positive Control	Papaya fruits 10%	Papaya fruits 20%	Papaya leaves 5%	Papaya leave 10%	F-value
Initial weight (g)	146.33 ±2.42 a	145.33 ±2.1 a	149.17 ±2.39 a	147.5 ±2.14 a	145 ±1.83 a	145.83 ±2.39 a	0.501NS
Final weight (g)	180.83 ±2.39 a	153.33 ±1.67 c	166.67 ±2.11 b	166.66 ±1.67 b	169.17 ±3.01 b	171.67 ±1.67 b	17.374*
Body weight gain ratio(g)	34.50 ±3.11 a	8 ±1.83 e	17.5 ±2.14 d	18.33 ±1.05 cd	24.14 ±2.39 bc	25.83 ±2.01 b	18.947*
Daily body weight gain (g)	0.91 ±0.08 a	0.2 ±0.05 e	0.44 ±0.05 d	0.46 ±0.03 cd	0.61 ±0.06 bc	0.65 ±0.05 b	19.33*

Values with same letters indicate non significant difference (P<0.05) and vice versa.
*Significant (P<0.05), NS=non significant

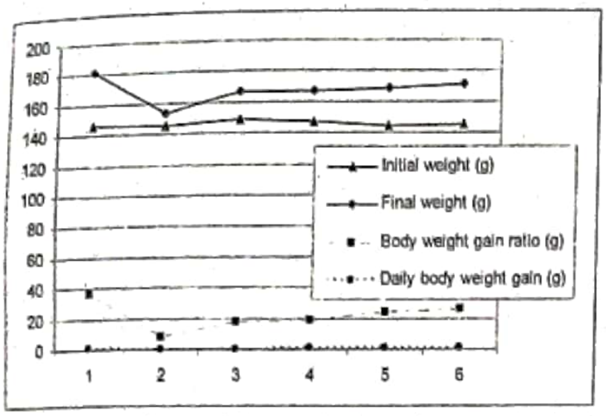


Figure (7): Effect of Papaya fruits and leaves on body weight (g), body weight gain ratio (%) and daily body weight gain (%). (1: negative control, 2: positive control, 3: fruits 10%, 4: fruits 20%, 5: leaves 5% and 6: leaves 10%).

From data tabulated in table (3) and figure (7), it could be demonstrated that no significant deference between all groups in initial weight. Regarding to final weight and body weight gain, the lowest value was recorded by diabetic rats fed on basal diet (positive control) (153.33 g and 8 g), respectively. Then it was increased significantly up heave to diabetic rats fed on basal diet with different levels of papaya and it's leaves comparing with negative control that recorded the highest value of final weight and body weight gain (180.83 g and 34.50 g), respectively. The treatment resulted in an improvement in body weight for diabetic rats, and that might due to its antidiabetic activity.

Table (4): Effect of papaya pulp and its leaves on liver and kidney to body weight ratio (%) (mean + SE)

Groups / Parameters	Negative Control	Positive Control	Papaya fruits 10%	Papaya fruits 20%	Papaya leaves 5%	Papaya leave 10%	F-value
Liver/Body weight ratio (%)	2.71 ±0.20 a	3.06 ±0.10 a	3.13 ±0.28 a	3.09 ±0.17 a	2.92 ±0.11 a	2.91 ±0.13 a	0.816 NS
Kidney/ Body weight ratio (%)	0.756 ±0.04 a	0.715 ±0.014 a	0.83 ±0.01 8 a	0.94 ±0.02 7 a	0.895 ±0.02 1 a	0.865 ±0.21 b	0 636 NS

Values with same letters indicate non significant difference (P<0.05) and vice versa.
*Significant (P<0.05), NS=non significant

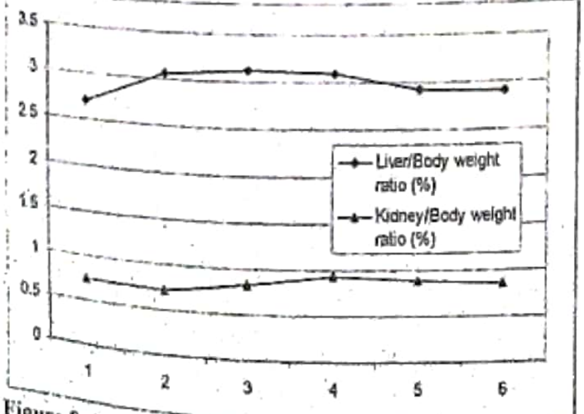


Figure 8: Effect of Papaya fruits and leaves on liver and kidney to body weight ratio (%). (1: negative control, 2: positive control, 3: fruits 10%, 4: fruits 20%, 5: leaves 5% and 6; leaves 10%).

From data in table (4) and figure (8), it could be observed slight increasing for liver/body weight and slight decreasing for kidney / body weight. No significant difference in liver or kidney / body weight ratios for all treated diabetic rats with papaya and its leaves comparing with control group.

Biochemical analysis:

Table (5) and figure (9) indicated the glucose level, cholesterol and triglycerides levels in controls and diabetic rats fed with papaya fruits and leaves. The glucose level showed dramatically increase (317.95 mg/dl) with injected alloxan rats, and this value significantly decreased with papaya leaves than that with fruits. High blood glucose for diabetic rats might result from insufficient release of insulin for the oxidative damage by the generation of reactive oxygen species[34]. Reduction of serum glucose level may be due to high level of fiber, phenols and saponins[35]. In spit of serum glucose levels were decreased by papaya leaves or fruits, levels did not reach the normal glucose level.

Table (5): Effect of papaya pulp and its leaves on serum glucose, cholesterol and triglycerides levels (mg/dl) (mean + SE)

Groups / Parameters	Negative Control	Positive Control	Papaya fruits 10%	Papaya fruits 20%	Papaya leaves 5%	Papaya leave 10%	F-value
Glucose	82.69 ±5.69 d	317 95 ±14 28 a	266.24 ±20 01 b	252 65 ±16.89 b	197 81 ±8 79 c	170 02 ±8.85 c	38 366*
Cholesterol	54 04 ±1 60 c	62 62 ±2.28 a	59 9 ±1.49 ab	60 28 ±2 11 ab	59.45 ±1.56 ab	56 13 ±1 38 bc	2 907*
Triglycerides	66 44 ±2.25 ab	69 89 ±2.26 ab	71.09 ±3 00 ab	74 01 ±3.29 a	67.55 ±2.18 ab	65.16 ±1 37 b	1.755NS

Values with same letters indicate non significant difference (P<0.05) and vice versa.
*Significant (P<0.05), NS=non significant

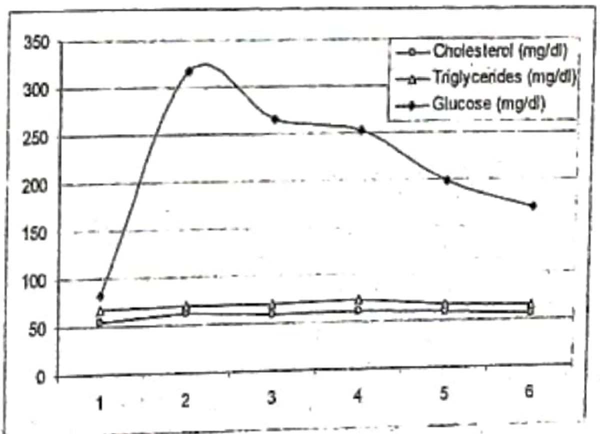


Figure (9): Effect of papaya fruits and leaves on serum glucose, triglycerides and cholesterol levels (mg/dl). (1: negative control, 2: positive control, 3: fruits 10%, 4: fruits 20%, 5: leaves 5% and 6: leaves 10%).

The result did not show obvious changes for cholesterol and triglycerides for alloxan-diabetic rats fed with papaya fruits and leaves. While, another experiment showed a significant change of plasma glucose level, significant increase of plasma total cholesterol and triglyceride level after four weeks of papaya consumption[9]. Fruit rich in vitamins, fiber and antioxidants may affect through exerting a lowering effect on plasma total homocysteine concentrations[36]. Papaya might enhance glucose utilization for the significant decrease of blood glucose level.

Table (6): Effect of papaya pulp and its leaves on serum uric acid and creatinine levels (mg/dl) (mean + SE)

Groups / Parameters	Negative Control	Positive Control	Papaya fruits 10%	Pappaya fruits 20%	Papaya leaves 5%	Papaya leave 10%	F-value
Uric acid	1.41 ±0.15 c	2.60 ±0.34 a	2.42 ±0.28 ab	2.18 ±0.24 ab	1.99 ±0.08 abc	1.83 ±0.16 bc	3.554*
Creatinine	0.76 ±0.034 b	1.28 ±0.17 a	0.93 ±0.089 b	0.98 ±0.09 b	0.94 ±0.03 b	0.91 ±0.035 b	3.566*

Values with same letters indicate non significant difference ($P<0.05$) and vice versa.
*Significant ($P<0.05$), NS=non significant

Serum uric acid results from uric acid production through endogenous and dietary sources, and is eliminated by the kidney and intestine[37]. Creatinine as well excreted from the healthy kidney into the urine, and with dysfunction of kidney, creatinine goes into blood[38]. For the metabolic disturbance in diabetes, high activities of xanthine oxidase, lipid peroxidation, increases of triglycerides, cholesterol and uric acid might be detected[39]. Elevation of the serum uric acid (2.60 mg/dl) and creatinine (1.28 mg/dl), as significant markers, are related to renal dysfunction in diabetic hyperglycemia (Table 6 and figure 10). Hyperglycemia in diabetes is considered a critical factor in the development of renal disease[40].

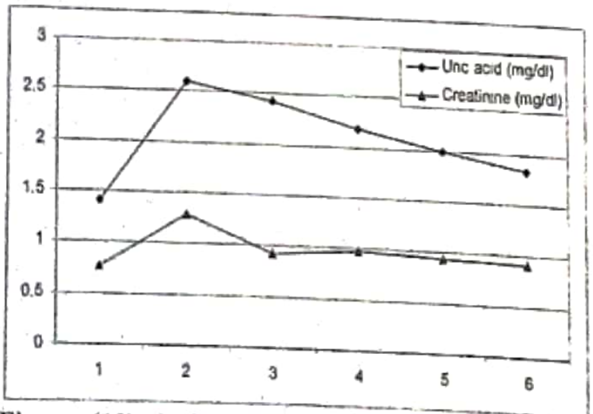


Figure (10): Effect of papaya fruits and leaves on serum uric acid and creatinine levels (mg/dl). (1: negative control, 2: positive control, 3: fruits 10%, 4: fruits 20%, 5: leaves 5% and 6: leaves 10%).

From the chemical and biological studies, it may be concluded that *Carica papaya* fruit and leaves have beneficial effects on blood glucose level against alloxan induced-diabetic rats. That might be related to their phenolic content and antioxidative effect. Further pharmacological and biochemical investigations need to elucidate the mechanism of the antidiabetic effect of *Carica papaya* fruits.

REFERENCES

1. The Statistics of the Egyptian Agricultural Ministry Land Reclamation, Economic Affairs Sector. Area, Yield and Production. 333-334. (2004)
2. Idstein, H.; Bauer, C. and Schreier, P. **Z Lebensm Unters Forsch**, 180, 394-397. (1985)
3. Mahmoud, A.; Sidik, K. and Salmah, I. **Internat. J. Molecular Med. Adv. Sci.**, 1, 398-401. (2005)
4. Bhaskarachary, K.; Rao, D.; Deosthale, Y. and Reddy, V. **Food Chem.**, 54, 189-193. (1995)
5. Ramuli, P. and Rao, P. **J. Food Composition Analysis**, 16, 677-685. (2003)
6. Topuriya, L. **Chemistry of Natural Compounds**, 26, 98-99. (1990)
7. Savickiene, N.; Dagilyte, A.; Lukosius, A. and Zitkevicius, V. **Medicina**, 38, 970-975. (2002)
8. Imao, K.; Wang, H.; Komatsu, M. and Hiramatsu, M. **Biochem. Mol. Biol. Int.**, 45, 11-23. (1998)
9. Rahmat, A.; Abu Bakar, M.; Faezah, N. and Hambali, Z. **Asia Pacific J. Clinical Nutrition**, 13, S106. (2004)
10. Pacheco, E.; Perez, R. and Schnell, M. **Interciencia.**, 29, 46-51. (2004)
11. Bhatt, B.; Pate, D. and Guloti, O. **J. Maharaja Sayajrao Univ. Barda**, 14, 33. (1965)
12. Black, L. and Bagley, E. **J. Amer. Oil Chem. Soc.**, 55, 228. (1978)
13. Taga,M.; Miller,E.; Pratt,D. **J. Am. Oil Chem. Soc.**, 61, 928-931. (1984)
14. Oyaizu, M. **Jpn. J. Nutr.**, 44, 307-315. (1986)
15. Compbell, J. Methodology of protein evaluation (PAG). Nutr. Document A101 odd. 37, June Meeting, New York. USA. (1961)
16. Trender, P. **Ann. Clin. Biochemist.**, 6, 24. (1969)
17. Allain, C.; Poon, L.; Chan, C. and Richmond, W. **Clin. Chem.**, 20, 4070. (1974)
18. Wahlefeld, A. Triglyceride determination after enzymatic hydrolysis in Bergmeyered W.U., Methods of enzymatic analysis 2nd edition. (1974)
19. Barham, A. and Trinder, P. **Analyst Clin. Chem.**, 97, 142. (1972)
20. Henry, R. Clinical Chem., Principles and Technics, 2nd Edition, Harper and Row, P 525. (1974)
21. SPSS SPSS/PC for the IBM PC/X1. Inc. Chicago, 1L. USA. (1990)
22. Guevarra, M. and Panlasigui, L. **Asia Pacific J. Clinical Nutrition.**, 9, 303-308. (2000)
23. Chen, C.; Zhou, L.; Chen, N. and Paull, R. **Acta Horticulturae**, 553, 99-100. (2001)
24. Lopez, M.; Vattuone, M. and Sampietro, A. **Phytochem.**, 27, 3077-3081. (1988)
25. Gray, J. and Mower, H. **Food Chem.**, 41, 293-301. (1991)
26. Marfo, E.; Oke, O. and Afolabi, O. **Food Chem.**, 22, 259-266. (1986)
27. Schreier, J. and Schreier, P. **Food Chem.**, 26, 201-212. (1987)
28. Ragunathan, V. and Sulochana, N. **J. Ind. Chem. Soc.**, 71, 705-706. (1994)

29. Kondo, S.; Kittikorn, M. and Kanlayanarat, S. **Postharvest Biology Technology**, 36, 309-318. (2005)
30. Yen, G. and Chen, H. **J. Agric. Food Chem.**, 43, 27-32. (1995)
31. Luo, Q.; Cai, Y.; Yan, J.; Sun, M. and Corke, H. **Life Sci.**, 76, 137-149. (2004)
32. Leong, L. and Shui, G. **Food Chem.**, 76, 69-75. (2002)
33. Chinoy, N.; D'Souza, J. and Padman, P. **Reprod. Toxicol.**, 8, 75-79. (1994)
34. Mohamed, A.; Bierhaus, A.; Schiekofer, S.; Tritschler, H.; Ziegler, H. and Nawroth, P. **Biofactors**, 10, 175-179. (1999)
35. Mushtaq, A; Akhtar, M.; Tahira, M. and Gilani, A. Hypoglycemic action of the flavonoids fraction of *Cuminum nigrum* seeds. Dept. of Pharmacology, Quaid. E.A. Zam Medical College, Bahawallur, Pakistan Phytotherapy, Research, 14, 103-106. (2000)
36. Steptoe, A.; Perkins, L.; McKay, C.; Rink, E.; Hilton, S. and Cappucio, F. **Br. Med. J.**, 326, 855-860. (2003)
37. Clliford, A. and Story, D. **J. Nutr.**, 106, 434-435. (1976)
38. Obata, H.; Hosokawa, H. and Yamanaka, Y. **Am. J. Physiol.**, 35, H903-H908. (2000)
39. Anwar, M. and Meki, A. **Comp. Biochem. Physiol.**, 135, 539-547. (2003)
40. Velasquez, M.; Abrahom, A.; Kimmel, P.; Farkas, T.; Zallasi, S. and Michaelis, O. **Diabetologia**, 38, 31-38. (1995)

Received: Feb. 02, 2005
Accepted : March 01, 2005

تأثير ثمار و أوراق الباباظ على بعض التغيرات الحيوية و الفسيولوجية في الفئران المصابة بمرض السكر نتيجة للمعاملة بألوكسان

محمد صبرى محمود[١]، هانى محمد حلمى[٢]، عماد صبرى شاكر[٣]
[١] قسم التغذية و علوم الأغذية – كلية الأقتصاد المنزلى – جامعة حلوان
[٢] قسم الأقتصاد المنزلى – كلية التربية النوعية – جامعة الزقازيق
[٣] قسم الكيمياء الزراعية – كلية الزراعة – جامعة المنيا - مصر

أجريت هذه الدراسة على ثمار وأوراق الباباظ لاستجلاء الأثر المخفض للجلوكوز. تم دراسة محتوى الجلوكوز والفركتوز لثمار البابا ظ بإستعمال جهاز كروماتوجرافيا السائل فائق الأداء. تم دراسة تأثير الثمار بنسب ١٠، ٢٠% والأوراق ٥، ١٠% على نسب كفاءة الغذاء و وزن الجسم و أوزان كبد وكلى الفئران المعاملة بألوكسان لأصابتها بمرض السكرى. وكذلك التأثير على جلوكوز الدم والكوليسترول والترايجلسريد ومستويات اليوريك و الكرياتينين. أظهرت المعاملات لمدة ٤٠ يوماً خفض معقول لمستوى سكر الدم، فى حين لم يحدث تأثر معنوى بالتركيزات تحت الدراسة لمستوى الكولسترول والترايجلسريد فى السيرم. كذلك ظهر نقص مستوى اليوريك و الكرياتينين نتيجة معاملة الفئران المصابة بثمار وأوراق البابا ظ. شملت الدراسة أيضاً توضيح أهمية ثمار وأوراق البابا ظ كمصدر للفينولات وقوتها الإختزالية (النشاط المضاد للأكسدة).

تشير هذه النتائج بأمتلاك ثمار وأوراق البابا ظ لتأثير مخفض لسكر الدم للفئران المعاملة بألوكسان وغير مؤثر على مستوى الليبيدات. وقد يكون هذا التحسن فى مستوى جلوكوز الدم والأعضاء الفسيولوجية راجعاً فى جزء منه إلى التأثير المضاد للأكسدة لثمار وأوراق البابا ظ.