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A STUDY OF FUNCTIONAL EFFECT OF HUSK TOMATO FRUIT ON EXPERIMENTAL RATS

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ABSTRACT

In this study, the effect of different levels of husk tomato *(physalis spp.)* as anticarcinogenic on rats was done. Experimental rats composed of 30 male rats consumed standard diet with precarcinogenic oil and reclassified into five subgroups were control, 10% and 15% dry and juice of husk tomato subgroups. The duration of the study was eight weeks. After that, the rats were sacrificed and their bloods and some organs were collected. Serum lipids profile and enzymes activity of alanine aminotransferase (ALT) and aspartate aminotransferase(AST) were determined. Total protein, uric acid and creatinine were also determined. Blood picture and blood free radicals were estimated in addition to the histopathology examination of liver of all rat groups.The results revealed that the fruit consists of husk (9.23%), peel (3.57%), seeds (11.15%), and juice (76.05%).The chemical composition of the fruit was protein (2.28%), fat (0.52%), ash (1.53%), carbohydrates (22.39%) and moisture (73.28%). The energy value was (105.88 K.cal/100 gm.). Also it was found that the precarcinogenic rat groups consumed 15% dry of husk tomato showed significant increased in weight gain compared with control.Total cholesterol, LDLc, total lipids and phospholipid in precarcinogenic rats consumed 10% or 15% dry or juice were significantly decreased. The atherogenic indices of precarcinogenic rat groups consumed 10% or 15% dry or juice were also significantly decreased. Free radical in precarcinogenic rats fed on 10% or 15% dry or juice of husk tomato was significantly decreased .ALT & AST were significantly decreased in precarcinogenic rat groups consumed 10% or 15% dry or juice but the values of creatinine was significantly decreased in rat groups consumed 10% & 15% of dry and 10% juice .The creatinine values was significantly decreased in groups fed on10% dry and 15% juice of husk tomato compared with control. The precarcinogenic rats consumed 10% or 15% (juice or dry) showed significant increased in hemoglobin, haematocrite, total leucocytie count, neutrophils, and eosinophils cells in compared with control group, but significant decreased in lymphocytes compared with control. Microscopical examination of liver rat consumed precarcinogenic oil only had congestion of central vein, and hepatic sinusoids and this lesion appeared less in rat groups consumed husk tomato in 10% or 15% (dry or juice) .

INTRODUCTION

Husk tomato or tomatillo *(physalis spp.)* is a member of the solanaceae family commonly known in Egypt as Harankish which usually consumption as a snacks because its very acceptable and popular sweet taste (Bianchini and Corbetta, 1977 & Ahmed *et al.*, 1998 and Abou-Gharbia and Abou-Tour, 2001).It was noted that Husk tomato contained 81.34% moisture,2.46% crude protein and 5.58% total ash. Ether extract, nitrogen free extract (NFE) and crude fiber content represents 15.59,17.24 and 5.78 % respectively .On the other hand husk tomato considered a good source of minerals and vitamins

(Abou-Gharbia and Abou Tour, 2001& El-Sheikha , 2004 and Mithofer *et al.,* 2005).

Increasing of human activities in modern environment, the chemical agents may represent the major cause of cancer. Cooking and processing of foods can produce toxic and/or carcinogenic compounds in foods, some of these compounds include N-nitrosamines, lipid oxidation and lipid polymerization products and polycyclic aromatic hydrocarbons. Many of these compounds have been shown to be carcinogenic (Harvey, 1985; Plakunov *et al.,* 1987; Hawkins *et al.,* 1990 and Elhassaneen, 1996).

It is worthy to mentioned that, increase intake of green and yellow fruit and vegetables may prevent one third of future cancer cases and protect against oxidative stress of free radicals. It is clear that, husk tomato is a widely used medicinal herb as antioxidant activities and for treating cancer. Seeds of husk tomato are being investigated for antitumor activity and cancer chemopreventive agents. (Foster and Duke,1990; Binkley, 2000 ; Volpe , 2000; Kennely *et al.,* 1997and Wang *et al.,* 2005).

Toxic compounds that come out through the heating process of fat such as high cholesterol levels. Oxidation, which accelerated at higher temperatures used in deep frying, lead to the formation of free fatty acids as result of cleavage and oxidation of double bonds. It also resulted in formation of hydroperoxides which might then undergo further degradation of ketones or free radical formation. Oil used for frying in rats diets lowered its food efficiency by 60%, which reflects the damaging effect of the oil on both diet digestibility and absorption with changes in all measured blood parameters (Galal *et al.,* 1992 and Johansson *et al.,* 1995).

The present investigations were designed to evaluate the chemical composition and nutritional values of husk tomato and stuay the effect of different levels of the fruits as anticarcinogenic on rats consumed precarcinogenic oil diet on nutritional and biochemical parameters also histopathological examinations of liver.

MATERIALS AND METHODS

Materials:

1- Samples preparation:

Fresh husk tomato fruit was obtained from local markets in El-Dakhlia Governorate, Egypt . The fruits were washed with water. The dehusked and cleaned fruits were either used crushed in fresh juice or dried in air oven at 50°c. Dried fruits were grinded in blender, then the powder packaged in polyethylene bags and kept until use, other samples after washing were conducted for the separation of each part.

2. Frying oil:

It is commercial food oil "blend of cotton seed and sunflower oil" obtained from local market, El Dakhlia Government, Egypt. It subjected for boiling several times until frying at 180°c and given to rats in diet with consideration the level of corn oil in standard diet.

3 . Experimental animals :

Thirty male albino rats "Sprague Dowlay Strain" weighing (85±2gm.).The animals were kept under observation and fed standard diet for five days as adaptation period before using the experimental diets. Food and water was provided *ad-libtum*. One kilogram of the standard diet was composed of casein (200 g), corn starch (497 g), sucrose (100 g), vitamin mixture (20 g), mineral mixture (100 g), corn oil (50 g), DL- methionine (3 g) and cellulose (30 g). according to NRC (1995).

Methods:

1. Experimental rats:

It was composed of 30 male rats consumed standard diet with precarcinogenic oil then reclassified into five subgroups which were control, 10% and 15% dry and juice of husk tomato subgroups. The duration of the study was eight weeks. The rats were subjected daily to physical examination for observation of healthy condition such as external appearance, body condition and activity of rats. Food intake was recorded daily. New food was given according to the actual need of each group. The remaining diet from the previous day was weighed and food intake was calculated, the loss or the gain in body weight was estimated every week.The total body weight gain and food intake of experimental period (8 weeks) were also calculated. Food efficiency ratio was calculated at the end of experiment as the following:

Food efficiency ratio (FER) = body weight gain (g) / daily food intake (g).

At the end of the experiment period, the rats were anesthetized by diethyl ether and sacrificed .Blood samples of each rat were withdrawn in two test tubes. The whole blood in the heparenized tube was used for estimation of some biochemical analysis and also to obtain blood picture. The other tubes of blood were left for coagulation then centrifuged at 3000 rpm for 15 minutes to obtain serum for further analysis.Liver of rats were collected and weighed then immersed in 10 % neutral buffered formalin as fixative and then examined histopathologically in the Pathological Department of Veterinary Medicine, Cairo University.

2. Biochemical analysis of serum:

Lipids patterns were estimated by enzymatic colorimetric methods as follows:

a) Serum cholesterol was measured according to Richmond (1973).
b) Serum triglycerides (TG) were determined using the method of Buccolo and David (1973)
c) Serum high density lipoprotein cholesterol (HDL-c) was determined according to Grodon and Amer (1977).
d) Serum total lipid was measured according to Knight *et al.* (1972).
e) Low density lipoprotein cholesterol (LDL-c), very low density lipoprotein cholesterol (VLDL-c) and phospholipids were calculated according to Lee and Nieman (1996). as following :-

VLDL-c = TG / 5

LDL-c = total cholesterol - HDL-c -VLDL-c

Phospholipids = total lipids – (TG + total cholesterol)

Atherogenic index was calculated by dividing LDL-c on HDL-c according to Castelli and Levitar (1977).

3. Liver function was determined as follows:

Serum alanine and aspartate aminotransferase enzymes activities (ALT& AST) were determined according to the method of Reitman and Frankel (1957).

4. Renal function tests were obtained by the following analysis :

- Serum total protein was determined according to Henry (1964).
- Serum urea was estimated using the method of Patton and Crouch, (1977).
- Serum uric acid was estimated according to Trinder (1969).
- Serum creatinine was estimated according to Henry (1974).

5. Biochemical analysis of whole blood:

Whole blood samples were subjected to laboratory analysis for estimation of hemoglobin and packed cell volume (PCV) according to Drabkin (1949) and MC. Inory (1954).

6.Free radicals:

Free radicals were measured according to Borg (1976) by an Electron Spin Resonance Spectroscopy National Research Center. Blood pictures of samples were obtained for the determination of red blood cells (RBCs). The differentiation of white blood cells were also carried out as lymphocyte ,neutrophil ,esinophil , monocyte and reticulocyte cells according to Carleton(1976) .

7. Histopathological examination:

The fixed samples of liver in 10 %neutral buffered formalin were cleared in xylol and embedded in paraffin, 4-5 µm thick section were prepared and stained with Hematoxylin and Eosin (H&E) for subsequent histopathological examination (Bancroft *et al.*, 1996).

8. Statistical Analysis

All the data were statistically evaluated by analysis of variance ANOVA and the significance calculated using student's "t" test. All the results were expressed as mean ± S.D. follow up LSD (SPSS) computer program variation (El-Said, 1978).

RESULTS AND DISCUSSION

1- Chemical composition:

Data concerning the chemical composition, crude protein, total lipids, ash, total carbohydrates, energy values and moisture content of fresh and dehydrated husk tomato products were presented in Table (1). Moisture content in husk, peel, seed, juice and all fruit were 39.01, 80.52, 46.14, 85.83 and 73.28% respectively. The lowest value was found in husk (39.01%). The obtained results are similar to those reported by Abd EL Ghani and El Farra (1994) and Abd El Ghani, *et al.* (2003).

Protein content in husk, peel, seed, juice and all fruit of husk tomato were 1.53, 11.38, 19.25, 7.88 and 8.55% dry weight, respectively. The seeds contained the highest protein (19.25% D.W) while the husk shows a lowest value for protein (1.53% D.W). These results are in accordance with the data found by Bock *et al.*, (1995) who reported that protein content of husk tomato fruits was 11%.

Table (1): Proximate chemical composition of husk tomato fractions.

Chemical constituents		Husk	Peel	Seed	Juice	All fruits
Moisture content*%	W.W	39.01	80.52	46.14	85.83	73.28
	D.M	60.99	19.48	53.86	14.17	26.72
Crude protein (Nx6.25)	W.W	0.93	2.22	10.37	1.12	2.28
	D.W	1.53	11.38	19.25	7.88	8.55
Total lipids%	W.W	3.94	0.96	8.21	0.01	0.52
	D.W	6.46	4.93	15.24	0.09	1.95
Ash%	W.W	6.27	0.59	1.61	0.98	1.53
	D.W	10.27	3.02	3.00	6.93	5.71
Total carbohydrates (by difference)%	W.W	49.85	15.71	33.67	12.06	22.39
	D.W	81.74	80.67	62.51	85.10	83.79
Energy values k.cal/100g	W.W	244.05	82.25	255.28	54.13	105.88

*:Moisture content of fresh husk tomato fruits, results are mean values of three determinations, W.W= Wet weight, D.W=Dry weight

Lipids content in husk, peel, seed, juice and all fruit were 6.46, 4.93, 15.24, 0.09 and 1.95%, respectively. It is clear that juice of husk tomato had low lipids content whereas seeds were characterized by the highest total lipids (15.24%). Ash content of husk was more than that of peel, seed, juice and all fruit of husk tomato. Therefore, ash content decreased remarkably after dehusking process. The same observation was reported by Abd EL Ghani and El Farra (1994) and Abd El Ghani, *et al.* (2003).

Carbohydrates accounted about 81.74, 80.67, 62.51, 85.10 and 83.79% D.W of the husk, peel, seed, juice and all fruit respectively. The highest amounts of total carbohydrates in juice may be due to the highest amount of total soluble sugars, soluble pectic substances and other related substances. These results are in accordance with those found by Abou-Gharbia and AbouTour (2001)

2- Body weight:

Table (2) demonstrated that mean values ± SD of final weight, body weight gain, food intake and food efficiency ratio of different experimental rats consumed precarcinogenic oil which used several times of frying with 10% ,15% dry and10% ,15%. Body weight gain showed non significant difference meanwhile weight gain of rat groups consumed 15% dry was significantly increased compared with control $p > 0.05$. Food intake and food efficiency ratio (FER) showed non significant difference among control and other groups .These results are in agreement with Vessal *et al.* (1991) who found that treating with *physalis spp.* extract had no effect on body weight

3 - Lipid pattern:

Table (3) represented the mean values ± SD of serum lipid pattern parameters of different experimental rats consumed precarcinogenic oil with 10%, 15% dry and 10%, 15% juice of husk tomato at end of the study. The total cholesterol and LDL cholesterol in rats which consumed 10% or 15% dry or juice were significantly decreased than control ($P < 0.001$) .Total lipids in rats fed with 10% and 15% (dry or juice) showed significant decreased than control ($p < 0.01$) while HDL cholesterol in rats consumed 10% or 15% dry or juice showed significant increased than control ($P < 0.001$, 0.01, &

0.05) respectively, while triglyceride and VLDL cholesterol showed non significant difference Phospholipids in rats consumed 10% or 15% dry or juice showed significant decrease than control ($p<0.01$).

Table (2): Mean values ± SD of body weight gain, food intake and food efficiency ratio of different experimental rats consumed precar-cinogenic oil with10%,15% dry and10% ,15% juice of husk tomato.

Variables / Groups	Initial weight (g)	Final weight (g)	Weight gain (g)	Weight gain	Daily food intake (g)	Food efficiency ratio (FER)
Control	a 85.6 ±1.91	c 165.07 ±48.50	a 79.47 ±18.50	a 92.84 ±16.66	d 16.40 ±4.85	e 4.41 ±1.69
Dry of husk tomato 10%	a 85.8 ±1.75	c 169.15 ±44.86	a 83.35 ±14.86	ab 101.64 ±18.94	d 16.66 ±4.53	e 4.59 ±1.79
Dry of husk tomato 15%	a 85.6 ±1.89	c 179.52 ±41.19	b* 93.92 ±15.19	b* 109.72 ±18.64	d 17.68 ±4.99	e 4.88 ±1.76
Juice of husk tomato 10%	a 85.4 ±1.45	c 170.30 ±45.72	a 84.90 ±15.73	ab 99.41 ±13.54	d 16.90 ±4.53	e 4.62 ±1.73
Juice of husk tomato15%	a 85.6 ±1.54	c 165.62 ±42.06	a 80.03 ±12.06	a 93.48 ±19.13	d 16.27 ±4.15	e 4.54 ±1.70

Significant with control group * P<0.05 ** P<0.01 *** P<0.001. Mean values in each column having different superscript (a,b,c,d and e) are significantly different at P< 0.05.

Table (3): Mean values ± SD of serum lipid pattern parameters of different experimental rats consumed precarcinogenic oil with 10% , 15% dry and 10% , 15% juice of husk tomato during eight weeks of study.

Variables / Groups	TC mg/dl	TG mg/dl	HDLc mg/dl	LDLc mg/dl	VLDLc mg/dl	Total lipids mg/dl	Phospholipids mg/dl
Control	a 88.00 ±4.88	a 74.23 ±12.12	a 25.45 ±4.58	a 47.70 ±7.88	c 14.84 ±2.42	a 377.54 ±7.76	b 215.31 ±12.92
Dry of husk tomato10%	b 62.76*** ±4.43	a 59.03 ±9.41	b 41.13*** ±4.17	b 9.76*** ±7.18	c 11.80 ±1.88	b 250.41** ±6.72	c 128.62** ±14.95
Dry of husk tomato15%	b 63.44*** ±3.96	ab 61.24 ±6.31	b 36.16** ±3.58	b 15.03*** ±7.00	c 12.24 ±1.26	b 251.30** ±7.42	c 126.62** ±11.55
Juice of husk tomato10%	b 69.34*** ±4.63	ab 61.56 ±2.92	b 33.21* ±4.20	c 23.81*** ±7.04	c 12.31 ±0.58	b 252.50** ±3.80	c 121.60** ±8.48
Juice of husk tomato15%	b 63.67*** ±7.91	ab 62.32 ±8.53	b 39.05*** ±5.61	b 12.17*** ±5.78	c 12.46 ±1.70	b 251.99** ±7.56	c 126.01** ±18.18

Significant with control group * P<0.05 ** P<0.01 *** P<0.001 .Mean values in each column having different superscript (a, b, c, d, and e) are significantly different at P< 0.05.

The same observation was reported by Mithofer *et al.* (2005) who found that husk tomato is a used in the treatment of high cholesterol ,also in agreement with Almeida and De Almedia (1991) who showed that husk

tomato is used to treat heart diseases and in accordance with the data found by Abd El Ghani *et al.* (2003) who demonstrated that husk tomato has an effect on the hypercholesterolemic patients .

4- Atherogenic indices and blood free radical:

Table (4) showed that mean values ± SD of atherogenic indices (cholesterol/ HDLcand LDL_c / HDL_c of different experimental rats consumed precarcinogenic oil diet and blood free radical in precarcinogenic oil groups with 10% ,15% dry and 10%, 15% juice of husk tomato. The rat groups which received precarcinogenic oil with 10 % or 15 % (dry and juice) showed significant decreased of atherogenic inidices (cholesterol/ HDLc and LDLc/HDLc) compared with control (P<0.01 & 0.001). Free radical in precarcinogenic rats was significantly decreased in groups consumed 10% or 15% dry than control (P < 0.05). Rat groups fed on 10% or 15% juice showed also significant decreased than control (P<0.05).

These results are in agreement with Dornberger (1986) who found that the active principle of fruits which act as antioxidant save the healthy condition. On the other hand Suneyama *et al.* (1993) found that husk tomato inducing activity against the mouse myeloid leukaemia, and also agree with Kosmeder *et al.* (2002) that's showed that chemical structure of the plant derived anticarcinogenic compounds of husk tomato have revealed strong activity in the immune system. Also Lotito and Frei (2004) recorded that regular fruit consumption lowers the risk of cardiovascular diseases and certain cancers.

Table (4): Mean values ± SD of atherogenic indices (cholesterol/ HDL_c, and LDL_c / HDLc) and blood free radical of different experimental rats consumed precarcinogenic oil diet only or with 10% ,15% of dry and10%,15% juice of husk tomato.

Variables / Groups	Precarcinogenic oil groups		Precarcinogenic oil groups
	Cholesterol/ HDL_c	LDLc/ HDL_c	Free radical
Control	a 3.57 ±0.84	a 1.96 ±0.67	a 334262.50 ±48211.11
Dry of husk tomato 10%	b 1.53*** ±0.22	b 0.24*** ±0.20	e 190568.50* ±98120.59
Dry of husk tomato 15%	b 1.77*** ±0.25	b 0.42*** ±0.23	e 191104.55* ±137974.93
Juice of husk tomato 10%	b 2.11** ±0.31	c 0.73*** ±0.27	e 210087.00* ±88283.95
Juice of husk tomato15%	b 1.63*** ±0.16	b 0.31*** ±0.15	e 214920.90* ±97003.39

Significant with control group * P<0.05 ** P<0.01 *** P<0.001 .

Mean values in each column having different superscript (a, b, c, d, and e) are significantly different at P< 0.05.

5- Liver and kidney functions: :

Table (5) showed the mean values ± SD of serum aminotransferase enzymes activity (ALT&AST), total protein, uric acid and creatinine of rats fed

on precarcinogenic oil with 10%, 15% dry and 10%, 15% juice of husk tomato at the end of study. Serum alanine aminotransferase (ALT) and aspartate aminotransferase anzyme (AST) activity were significantly decreased in rats consumed 10% and 15% dry or 10% & 15% juice compared with control ($p<0.05$).Uric acid value was significantly decreased in groups consumed 10% & 15% dry and 10% juice ($P < 0.01$ & 0.05) respectively compared with control. Creatinine value was significantly decreased in groups fed on 10% dry and 15% juice ($P < 0.05$) compared with control.

These results are in agreement with Stary (1983); Sinha (1987a) Foster and Duke (1990); Rutter *et al.* (1990); Duke and Vasquer (1994) and Mithofer et al. (2005) their estimated that husk tomato purifies the blood, decrease the albumin of the kidney, it was also found that leaves, fruits and roots of husk tomato utilized to fight many diseases such as diabetes, chronic rheumatism,skin,bladder,kidney and liver diseases. Galati *et at.* (2005) recorded that, fruit juice contains many phenol compounds, ascorbic acid, betalains, betacyanins, and a flavonoid fraction, which consists mainly of rutin and isorhamnetin derivatives. Hepatoprotection may be related to the flavonoid fraction of the juice, but other compounds, such as vitamin C and betalains could synergistically, counteract many degenerative processes by means of their antoxidant activity.

Table (5): Mean values ± SD of serum aminotransferase enzymes activity (ALT&AST);total protein, uric acid and creatinine of rats fed on precarcinogenic oil with 10% , 15% dry and10%,15% juice of husk tomato at the end of study.

Variables / Groups	ALT (μ/ml)	AST (μ/ml)	Total proteins (g/dl)	Uric acid (mg/dl)	Creatinine (mg/dl)
Control	a 32.74 ± 3.41	a 23.46 ± 4.40	a 6.96 ± 0.63	a 2.02 ± 0.30	a 1.06 ± 0.24
Dry of husk tomato 10%	b 25.80 * ± 2.77	C 19.52 * ± 2.38	a 5.60 ± 1.02	b 1.00 ± 0.28**	e 0.78 * ± 0.19
Dry of husk tomato 15%	b 26.00 * ± 2.54	c 19.98* ± 2.33	a 6.04 ± 1.05	b 1.50 ± 0.62*	ae 0.86 ± 0.11
Juice of husk tomato 10%	b 25.80 * ± 4.43	c 19.90 * ± 2.32	a 5.82 ± 1.21	b* 1.76 ± 0.75	ae 0.82 ± 0.08
Juice of husk tomato15%	b 26.00 * ± 3.54	c 19.78 * ± 2.17	a 5.74 ± 0.78	ab 1.90 ± 0.07	e 0.78 * ± 0.13

Significant with control group * P<0.05 ** P<0.01 *** P<0.001
Mean values in each column having different superscript (a, b, c, d, and e) are significantly different at P< 0.05.

6 - Blood parameters and blood picture

Data in Table (6) demonstrated that mean values ± SD of some blood parameters and blood picture of different experimental rats consumed precarcinogenic oil with 10% , 15% dry and 10% , 15% juice of husk tomato at the end of study.

Table (6): Mean values ± SD of some blood parameters and blood picture of different experimental rats consumed precarcinogenic oil with 10% ,15% dry and 10%,15% juice of husk tomato at the end of study.

Variables / Groups	Haemog lobin (g/dl)	Haematocrite (PCV)	Red cells count	Reticu locyte	Platelet	Totol leucocytic count	Neutro phils %	Esino phils %	Lymphocytes %	Monocytes %
Control	a 9.7 ±2.03	a 36.08 ±2.82	a 3893000 ±945457.03	c 1.76 ±0.32	d 422400 ±21881.49	a 3800.00 ±632.45	a 38.20 ±8.25	A 2.20 ±0.83	a 53.80 ±7.69	e 5.80 ±2.58
Dry of husk tomato10%	b 14.8*** ±1.34	b 42.38* ±3.00	b 5084000* ±845708.87	c 1.02 ±0.22	d 341000 ±56833.08	b 9040.00** ±2237.85	b 51.20** ±7.39	B 5.00** ±1.22	b 37.80** ±7.04	e 6.00 ±1.58
Dry of husk tomato15%	b 12.08** ±2.22	b 42.24* ±2.18	ab 4572800 ±953086.14	c 1.04 ±0.37	d 347000 ±62209.32	b 9200.00** ±1637.07	b 52.80** ±5.02	B 5.00** ±1.00	b 36.20** ±6.49	e 5.60 ±2.51
Juice of husk tomato10%	b 13.76** ±1.61	b 42.18* ±4.37	ab 4497400 ±1179571.95	c 1.12 ±0.58	d 346000 ±55497.74	b 9000.00** ±2894.82	b 53.80** ±5.5408	B 4.80** ±1.30	b 35.20** ±7.66	e 6.20 ±2.04
Juice of husk tomato15%	b 14.26** ±2.13	b 42.88** ±5.09	ab 4704200 ±917243.80	c 1.30 ±0.54	d 357000 ±61806.14	b 9400.00** ±2908.60	b 53.60** ±5.41	B 4.80** ±1.30	b 37.40** ±7.76	e 4.20 ±2.58

Significant with control group * P<0.05 ** P<0.01 *** P<0.001 .

Mean values in each column having different superscript (a, b, c, d, and e) are significantly different at P< 0.05.

Haemoglobin value was significantly increased in rats which consumed 10% or 15% (dry or juice) compared with control ($P < 0.001$ & 0.01). Haematocrite showed significant increased in rats fed on 10% or 15% (dry or juice) compared with control ($P < 0.05$ & 0.01). Red blood cells count showed significant increased in rats consumed 10% dry while the other groups showed non significant increase compared with control. Reticulocyte, platelets and monocytes showed non significant difference in rat groups consumed 10% & 15% (dry or juice) while total leucocytic count, neutronphils and esinophils cells in rats consumed 10% or 15% of dry or juice showed significant increased compared with control ($P < 0.01$). Lymphocytes in rats consumed 10% or 15% dry or juice showed significant decreased compared with control ($P < 0.01$).

These results are in agreement with Good Hart *et al.* (1983), Sigata *et al.* (1994) and Abd El Ghani *et al.* (2003) their obtained that feeding on (2.0gm) of dried husk tomato (8.7gm)of fresh improve recovery from anemia and increase the concentration of hemoglobin content. Lin (1992) recorded that husk tomato is an effective immune stimulant, is cytotoxic to numerous types of cancer cells and it has antiviral properties. Nagafuji *et al.* (2004) illustrated that, four new withanolides were isolated, along with six known from the active fraction of husk tomato trypanocidal activity against trypomastigotes, an infectious from of T. cruzi, was olso extimated, as well as cytotoxic activity against human uterine carcinoma cells

7- Tissue examination:

7-1 Organs weight

Table (7) showed the mean values ± SD of weight and relative weight of different organs rats fed on precarcinogenic oil with 10%, 15% dry and 10%,15% juice of husk tomato at the end of eight weeks of study. Weight and relative weight of liver, kidney, lungs and brain showed non significant difference in rat groups which consumed 10% or 15% of (dry or juice) compared with control ($P<0.05$). Heart weight and relative weight was significantly decreased in group consumed 15% dry of ($P < 0.05$). Spleen weight and relative weight was non significant difference in all experimental rat groups except rats consumed 10% juice which was significantly decreased compared with control ($P < 0.05$).

These results are in agreement with Soares *et al.*(2003) who claimed that,Seco-steroids from husk tomato are potent immunomodulatory substances and act through a mechanism distinct from that of dexamethasone.

Table (7): Mean values ± SD of weight and relative weight of different organs of rats fed on precarcinogenic oil with 10% , 15% dry and 10%,15% juice of husk tomato after eight weeks of study.

Organs / Groups	Liver		Kidney		Heart		Spleen		Lungs		Brain	
	Weight (g)	Relative %	Weight (g)	Relative %	Weight (g)	Relative %	Weight (g)	Relative %	Weight (g)	Relative %	Weight (g)	Relative %
Control	a 7.31 ±1.33	a 3.22 ±0.22	b 1.32 ±0.11	b 0.58 ±0.03	c 0.74 ±0.20	c 0.32 ±0.04	d 0.76 ±0.01	d 0.33 ±0.03	e 1.24 ±0.05	e 0.54 ±0.09	a 1.35 ±0.04	a 0.63 ±0.14
Dry of husk tomato10%	a 7.78 ±1.05	a 3.48 ±0.25	b 1.31 ±0.05	b 0.58 ±0.02	c 0.72 ±0.31	c 0.32 ±0.02	d 0.76 ±0.02	d 0.34 ±0.07	e 1.53 ±0.06	e 0.68 ±0.11	a 1.43 ±0.03	a 0.64 ±0.07
Dry of husk tomato15%	a 8.98 ±1.41	a 3.60 ±0.07	b 1.51 ±0.12	b 0.61 0.01	d 0.65* ±0.11	d 0.26* ±0.04	d 0.74 ±0.01	d 0.30 ±0.05	e 1.49 ±0.05	e 0.60 ±0.06	a 1.19 ±0.05	a 0.48 ±0.07
Juice of husk tomato 10%	a 7.65 ±1.31	a 3.44 ±0.16	b 1.22 ±0.21	b 0.55 0.02	c 0.70 ±0.11	c 0.31 ±0.02	e 0.60* ±0.03	e 0.26* ±0.02	e 1.28 ±0.03	e 0.58 ±0.05	a 1.31 ±0.01	a 0.60 ±0.12
Juice of husk Tomato 15%	a 7.22 ±1.51	a 3.30 ±0.25	b 1.26 ±0.08	b 0.58 ±0.05	c 0.75 ±0.13	c 0.34 ±0.03	d 0.69 ±0.02	d 0.32 ±0.04	e 1.24 ±0.03	e 0.57 ±0.06	a 1.29 ±0.11	a 0.59 ±0.06

Significant with control group * P<0.05 ** P<0.01 *** P<0.001

Mean values in each column having different superscript (a, b, c, d, and e) are significantly different at P< 0.05.

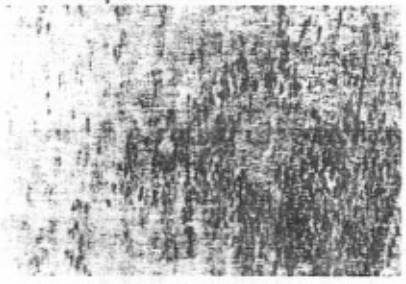
7-2. Histopathological results

Sever histopathological changes were noticed in liver from experimental rats consumed precarcinogenic oil only described as kupffer cell proliferation, hepatic necrosis associated with inflammatory cells infiltration (mainly macrophages and neutrophils) and sinusoidal leucocytosis (Pict.1), liver of rats fed on precarcinogenic oil diet with 10% dry of husk tomato showed congestion of central veins, kupffer cell proliferation and slight vacuolation of some hepatocytes (Pict.2). However, the only histopathological finding in rats consumed precarcinogenic oil with 15% dry was proliferation of kupffer cells (Pict.3). Liver of rats consumed precarcinogenic oil with 10% juice showed marked dilatation and congestion of central veins as well as kupffer cell proliferation (Pict.4). Liver of rats consumed precarcinogenic oil with 15% juice of husk tomato revealed only vacuolar degeneration of some hepatocytes with signet ring appearance of hepatocytes (Pict.5).

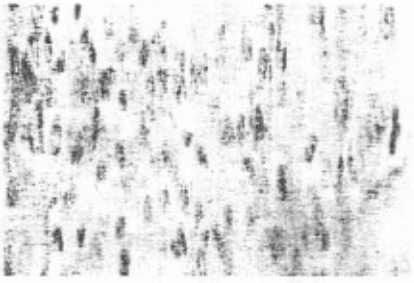
These results are in agreement with results of Brack *et al.* (2004) claimed that, nonopioid analgesics acetyl salicylic acid have side-effects on the gastrointestinal tract (ulcus formation). On coagulation (bleeding and thrombosis), on the renal (renal insufficiency), the pulmonary (bronchospasm) and the hematopoetic systems (agranulocytosis).

Shujing *et al.* (2004) investigated that, husk tomato herbs are widely used in falc medicine as the aqueous and ethanol extracts prepared from the whole plant of were evaluated for their antihepatoma activity.

Pandey *et al.* (2005) recorded that, repeated frying of vegetarian and non-vegetarian foods in edible oil is a common practice round the globe. Fried oil generates polyoyclic aromatic hydrocarbons (PAHs). Which may lead to hazardous effect on human health in vitro cytotoxicity assays in human hepatoma cell line,exposure of cells to RFFO extract at highest concentration of reduced calony forming ability had no significant effect on growth inhibition of cell up to 48h of exposure.RFFO extract has substantial cytotoxic potential through the metabolic activation process of PAHs generated perse.



Pict. (1) : Liver of experimental rats consumed recarcinogenic oil only showing Kupffer cell proliferation as well as hepatic necrosis associated ith inflammatory cells infiltration and sinusoidal leucocytosis (H& Ex 200).



Pict. (2): Liver of rats consumed 10% dry of physalis showing inflammatory cells with hepatic necrosis (H& E x 400).

Pict. (3): Liver of rats consumed 15% dry of physalis showing proliferation of kupffer cells (arrows) (H&E x 200).

Pict. (4) : Liver of rats consumed 10% juice of physalis showing dilatation and congestion of central veins as well as Kupffer cell proliferation (H&Ex 200).

Pict. (5): Liver of rats consumed 15% juice of physalis showing vacuolar degeneration of some hepatocytes (arrows) (H&E x 200).

REFERENCES

Abd El Ghani, Thoraya; Lobna, A.M. Hareedy and Satouta, A. El- Farra (2003): Chemical and biological evaluation of husk tomato fruits as antianemic and hypocholesterolemic agent. J. Agric. Sci., Mansoura-Univ., 26 (8): 4723-39.

Abd-El-Ghani,T.and EL-Farra,S.A. (1994): Nutritional value of husk tomato seeds. Annals-of Agric. Sci., Moshtohor, 32 (3): 1611-22.

Abou-Gharbia, H.A. and Abou-Tour, E.M. (2001): Properties and processing of husk tomato (*Physalis Pruinosa, L.*). J. Agric. Res. Minufiya Univ., 26, (3): 761-81.

Ahmad, S.; Malik, A.; Muhammad, P.; Gul, W.; Yasmin, R. and Afza , N. (1998): Anew withanolide from *physalis peruviana*. Fitoterapia, 69 (5): 433-36

Almeida, E.R. and De-Almedia- E.R. (1991): The presence of acetylcholine in the fruit of physalis edulis. Department de Anibioticos. Fitoterapia, 61, (4): 333-35.

Bancroft J.D. ; Stevens, A. and Turner , D.R.(1996) : Theory and Practice of Histological Technique 4th Ed. New York ,Churchill , Livingstone.

Bianchini, F. and Corbetta, (1977): Health plants. Hamlyn colur guides, Londen, 22-23.

Binkley, J.F. (2000): A review of antioxidant vitamine in disease, The american society of health-system pharmacists mideate clinical meeting, Decem s ber 3-7 Lasvegas, Nevada, 37: 3114-19.

Bock, M.A.; Sanchez-Pilcher, J.; Mckee, L.J. and Ortiz, M. (1995): Selected nutritional and quality analysis of tomatillos (Physalis ixocarpa). Plant Foods for Human Nutr., 48 (2): 127-33.

Borg, D.C. (1976) : Application of electron spinreasonance in biology. *WA.*, ed. Free radicals in biology, ol .1:69. New York : Academic press. In Pryor

Brack, A.; Rittner, H.L. and Schafer, M. (2004): Non-opioid analgesies for perioperative pain therapy. Risks and rational basis for use. Klinik fur anesthesiology und operative intensivmedizin, charite-Universitatsmedizin berlin, campus Benjamin frankin, berlin. Alexander.brack@charite.de 53 (3): 263-80.

Buccolo,G. and David,H. (1973) : Quantitative determination of serum triglyceride by use enzymes. Clin. Chem.,19: 419-32.

Carleton, H. (1976): Carleton's Histopathological Technique 4th ed, Lonodon, Oxford University press, New York , Toronto.

Castelli ,T. and Levitar, Y. (1977):.Atherogenic ,index Curr Presc p39.

Dornberger, K. (1986): Studies on the potential antineaplastic active constituents of *physalis alkekengi* L. Var. Franchetii Mast. Pharmazie 41 (4): 265-67.

Drabkin DI. (1949): The standardization of heamoglobin measurments, Am. J. Med. Sci., 21 (7): 710.

Duke; James and Vasquer R. (1994): Amazonian ethnobotanical dictionary CRC pess Inc: Beca raton, F.L

Elhassaneen, Y.A. (1996) : Biochemical and technological studies on pollution of fish with pesticides and polycyclic aromatic hydrocarbons. Ph. D Thesis, Fac. Agric. Mansoura Univ. Egypt.

El-said, F. (1978): Statistical psychology measurement of human brain.Dar Alfkr.Alaraby.

El-Sheikha,A.F. (2004): Technological, chemical and microbiological studies on some packed foods, Thesis. Faculty of Agric., Minufiya Univ.Egypt.

Foster, S. and Duke. J.A. (1990): Afield guide to medicina plants eastern and central N. America. Houghton Mifflin Co.

Galal, S.M.; Bekheit, M.A. and Aly, M.H. (1992): Physical, chemical and biological evaluation of sunflower seed oil used for frying-Bull. Nutr.inst ,Cario, Egypt. 12 (1): 28-47.

Galati, E.M.; Mondello, M.R. and Miceli, N. (2005): Opuntia ficus indica (L.) mill. Fruit juice protects liver from carbon tetrachlorice-induced injury. Pharmaco-Biological Department, School of pharmacy, University of Messina, Vill. SS. Annunziataltaly. Sep: 19 (9): 796-800.

Good Hart, R.S. and Shills, M.E. (1983): Modern Nutrition in Health and Disease,.6th Ed. Lea and Febiger, Philadelphia.

Grodon,T. and Amer;M. (1977) : Determination of HDL.J.Med.,62:707.

Harvey, R.G. (1985): Polycyclic Hydrocarbons and Carcinogenesis. ACS Symp. Ser. 283, Am. Chem. Soc. Washington, D.C.

Hawkins, E.W.; W.W. Walker ; R.M. Overstreet ; T.F. Lytle and J.S. Lytle (1990) : Carcinogenic effects of some polycyclic aromatic hydrocarbons on the Japanese Medaka and Guppy in waterborne exposures. The Science of the Total Environment. 94 : 155-167.

Henry, R. J. (1964): *Clinical Chemistry*, Harper and Row publishers, New York, p.181.

Henry, R.J. (1974): *Clinical Chemistry*, Principles and Techniques, 2nd Edition. Harper and Row, p.525.

Johansson, M. ;Agagerstad, M. and Bgere, L. (1995): Influence of frying fat on the formation of heterocyclic amines in fried beefburgers and residues.Food-and-Chemical Toxicology,33 (12):992-1004.

Kennely, E.J. Gerhauser, C. Song, L.L. and kinghorn, A.D. (1997): Induction of quinine reductase by withanrlides isolated from physalis philadelphica (Tomatillos). College of pharmacy, Univ. of Illinois at Chicago. USA. J. of Agric and Food Chem., (10): 3771-77.

Knight, J.A; Anderson, S. and Rawie, J.M. (1972): Enzymatic determination of total lipid, Clin. *Chem.* 18: 199.

Kosmeder, J.W. Pezzuto, J.M. Riboli, E. and Lambert, R. (2002): Novel plant derived anticarcinogens,Nutr. and lifestyle, College of pharmacy Univ. of Illinois, Chicago, USA. 343-47.

Lee,R. and Nieman,D. (1996) : *Nutritional Assessment*. 2nd Ed. Mosby, Missouri, USA.

Lin, Y.S. (1992): Immunomodulatory activity of various fractions derived from *Physalis angulata* L.extract. Amer.J.Chinese Med.,20 (314): 233-43.

Lotito S.B. and Frei, B. (2004): The increase in human plasma antioxidant capacity after apple consumption is due to the metabolie effect of fructose on urate, not apple-derived antioxidant flavonoids. Radic boil Med. Jul. 15; 37 (2): 251-8.

Mc Inory (1954): Amicro heamatocrit for determining the packed cell and hemoglobin concentration on capillary blood. J. Clin., Path., (7): 32.

Mithofer, A.; Wanner,G. and Boland, W. (2005): Caracteristics and morphologies of plants and fruits, Med. plants in Brazil. 137 (3): 1160-68.

Nagafuji, S. Okabe, H.; Akahane, H. and Abe, F. (2004): Trypanocidal constituents in plant 4. withanolides from the aerial parts of physalis angulata. Biol and pharm, Faculty of pharmaceutical Sciences, Fukuoka Univ. Japan. 27, (2): 193-7.

NRC (1995): National Research council: Nutrient requirments of laboratory animals, Fourth revised edition, National Academy Press. Washington, DC. PP.29-30

Pandey, M.K. Pant, A.B. and Das, M. (2005): In vitro cytotoxicity of polycyclic aromatic hydrocarbon residues arising through repeated fish fried oil in human hepatoma Hep G2 cell line. Food Toxicology Laboratory, Indutrial Toxicology Research Centre, Mahatima Gandhi Marg, P.O. Box 80, Lucknow 226001, India. 23 .

Patton, C. J .and Crouch, S. R. (1977): Anal .Chem ., 49:464-169.

Plakunov,I.; T.A. Smolarek ; L.D. Fischer ; J.C.Wiley and W.M. Baird (1987): Separation by ion-pair high-performance liquid chromatography of the glucuronid, sulafate and glutathione conjugates formed from benzo (a) pyrene in cell cultures rodents, fish and humans. Carcinogenesis. 8 : 59-66.

Reitman,S .and Frankel, S. (1957) : Enzymatic determination of liver function. Am. J .clin .path, 28-56.

Richmond, W. (1973): Enzymatic determination of cholesterol. Clin. Chem.19, 1350-56.

Rutter, R.A.; Ferreyra, R. and Ayala Flore, F. (1990): Catalogo de plantas utiles de la Amazonia peruana. Institute linguistico de Verane. Yarinacocha, peru, 32 (3): 141- 42.

Shujing, W.U.; Lean Teik N.G.; Chen – Ching Hsein and Wang, S.S. (2004): Antihepatoma activity of physalis angulata and P. Peruviana extracts and their effects on apoptosis in human hep G 2 cells. Life Sciences, Kaohsiung Medical Univ. Taiwan. 74, (16): 2061-73.

Sigata, M. T.; Ramirez, B. C. E.and Pena- Lomeli, A. (1994): Determination of simple sugars and acidity in accessions of husk tomato (*Physalis ixocapa Brot.*). Revista- Chapingo-Serie-Horticulture, 1 (2): 141-43.

Sinha, S.C.; Ali, A.; Bagchi, A.; Sahai, M. and Ray, A.B. (1987a): Physalin dicanols new biogenetic precursors of C28- steroidal lactones from physalis minima var. indica. Plant medica, 53 (1): 55-57.

Soares, M.B.;Bellintani, M.C.and Santos, R. (2003): Inhibition of macrophage activation and lipopolysaccaride-induced death by seco-steroids purified from physalis angulatah L. Centro de pesquisas Goncalo moniz, Rua Waldemar falcao, 121-Brotas-FIOCRUZ, 40295-001 BA, Salvador, Brazil. 10; 459 (1): 107-12.

Stary, F. (1983): Poisonous plants. Hamlyn Colour Guides, London.On line. Colorado.edu/archive/1999/permaculture/msg01565.htm1.

Suneyama,R.; Kuroyanagi,M.; Umehara, K. and Uene, A. (1993): Physalin and neophysalins from physalis alkekengi Var. Francheti and differentiation inducing activity. Phytochems Univ. of Shizuoka, Japan, 34 (2): 529-33 .

Trinder P. (1969): Determination of uric acid. Am.Clin. Biochem., 6:24-27.

Vessal, M.; Mehrani, H.A. and Omrani, G.H. (1991): Effects of an aqueous extact of physalis alkekengi fruit on estrus cycle reproduction and uterine creatine kinase BB. Isozyme in rats. J. Ethno pharmacology,Shiraz Univ.medical sciences,Iran, 34 (1): 69-78.

Volpe, S. (2000): Vitamins and minerals for active people in: sportnutrition; Aguide for the profession working with active people. Ediled by C.A Rosenbloom. The Amircan Detetic ASSO. Chicago, 68-69.

Wang, S. S.; Lin, D.L. (2005): Antihepatoma activity of physalis angulata and *P.* peruviana extracts and their effects on apoptosis in human Hep G_2 cells. Life Sci 5, 74 (16): 2061-73.

دراسة التأثير الوظيفى للحرنكش على فئران التجارب

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في هذا البحث تم دراسة تأثير الحرنكش كمضاد للشقوق الحرة والسرطانات فى فئران التجارب.أجريت الدراسة على ثلاثين من ذكور الفئران قسمت فيما بينها إلى خمس مجموعات متساوية. المجموعة الأولى استخدمت كمجموعة ضابطة (كنترول) بينما الأربع مجموعات المتبقية أعطيت أربعة مستويات من الحرنكش مع زيت تعرض لدرجة حرارة عالية عدة مرات وذلك عن طريق الفم يوميا ولمدة ثمانية أسابيع وهذه المجموعات كالتالى: المجموعة الثانية و الثالثة أعطيت ١٠و١٥%مسحوق جاف بينما المجموعة الرابعة و الخامسة أعطيت ١٠و١٥%من المستخلص العصيرى للحرنكش .فى نهاية التجربة تم ذبح الفئران للحصول على الدم وبعض الأعضاء الداخلية للفئران, بعد ذلك تم تقدير ليبيدات الدم وإنزيمات الكبد (ألأسبارتات والبيروفات أمينو ترانسفيريزيس AST & ALT) كذلك تم تقدير البروتين الكلى،حمض اليوريك ،الكرياتينين . وكذلك الشقوق الحرة و صورة الدم للفئران موضع الدراسة كما اجريت بعض الفحوصات الهستوباثولوجية على كبد الفئران فى المجموعات المختلف

وقد أظهرت النتائج ما يلى:

وجد أن ثمار الحرنكش تتكون من القشرة الخارجية "الغلاف" بنسبة ٩,٢٣% والقشرة الداخلية بنسبة ٣,٥٧% والبذور بنسبة ١١,١٥% والمستخلص العصيرى يمثل ٧٦,٠٥% أظهر التركيب الكيميائى للحرنكش أحتواء الثمار على ٢,٢٨% بروتين، ٠,٥٢% دهن و ١,٥٣% رماد و ٢٢,٣٩% كربوهيدارت و٧٣,٢٨% رطوبة بينما كانت الطاقة الحرارية ١٠٥,٨٨ كيلو كالورى لكل ١٠٠جم.

بالمقارنة بالمجموعة الضابطة أثبتت النتائج نقص معنوى فى مستوى الكولسترول الكلى والجلسريدات الثلاثية واللبيوبروتيذات منخفضة الكثافة والدهون الكلية والفوسفوليبيدات فى جميع الفئران المتناولة للحرنكش الجاف والعصير كما سجلت النتائج نقص معنوى فى مؤشر تصلب الشرايين (الكولسترول على اللبيوبروتينات عالية الكثافة) و(اللبيوبروتينات منخفضة الكثافة على اللبيوبروتينات عالية الكثافة) فى جميع مجموعات الدراسة. بالمقارنة بالمجموعة الضابطة ثبت نقص معنوى فى أنزيمات الكبد (ALT, AST) فى جميع الفئران المتناولة للحرنكش الجاف والعصير .كما أظهرت النتائج نقص معنوى فى مستوى حمض اليوريك والكرياتينين فى جميع مجموعات الدراسة. أثبتت النتائج نقص معنوى فى الشقوق الحرة للمجموعات المتناولة للزيت المغلى لعدة مرات للفئران المستهلكة للحرنكش الجاف والعصير بنسبة ١٠ و ١٥%

شوهد فى النتائج الباثولوجية لأنسجة الكبد أنه يوجد احتقان فى الوريد الوسطى مع نزيف فى خلايا الكبد وضيق فى مجرى الصفراء فى الفئران المتناولة للزيت المغلى لعدة مرات بينما كان ذلك أقل وضوحا فى نفس الفئران المتناولة للحرنكش بنسبة ١٠% و ١٥%.