
***THE HEPATOPROTECTIVE EFFECT OF POTATO AND APPLE
PEELS AS ANTIOXIDANT ON INTOXICATED RATS WITH CCL4.***

By

Sello, A.A.A.EL.

Home Economies Dept., Faculty of Specific Education, Mansoura
University, Mansoura, Egypt

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Home Economies Dept., Faculty of Specific Education,
Mansoura University, Mansoura, Egypt

Abstract

The aim of this research is to evaluate potato and apple peels as a potential donor of phenolic compounds, and to study the effect of feeding dry powder of potato and apple peels, mixed with basal diet at two concentration (10,20%), on carbon tetrachloride (Ccl₄) intoxicated rats for 4 weeks.

Results of this study showed that potato peel has high levels of copper (0.826), calcium (٣٩,٢), copper (٠,٦٨) and calcium (٢٦,٠٣) ppm. Also the results revealed that total phenols content (as gallic acid %) in potato peel was higher than apple peel (3.2 vs 2.5) respectively.

Among the test groups, total cholesterol was lowest significantly in rats group fed on 10% apple peel (125.4± 5.3mg/dl), followed by rats fed 10% potato peel (114.6±1.32mg/dl), and rats group fed on 20% apple peel (110.3 ± 1.26mg/dl), while the highest decrease was noticed in rats fed on 20% potato peel (95.7± 2.3mgdl) which differ significantly from control (+) (152.2±10.1mg/dl).

Feeding of potato and apple peels at concentration of 20 % does not show any significant values in triglycerides, HDL-cholesterol and VLDL-cholesterol levels as compared to control (-) group.

The results revealed that administration of Ccl₄ to rats leads to significant decrease in AST, ALT, uric acid and creatinine levels in the rats groups receiving the two different concentration (10, 20%) of potato and apple peels when compared to control (+) Ccl₄ group.

Key words: Potato peel, Apple peel, Intoxicated rats, Antioxidant, phenolic compounds.

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Introduction

Intake of dietary fiber and phytochemicals such as polyphenols, carotenoids, tocopherols and ascorbic acid have been related to the maintenance of health and protection from diseases such as cancer, cardiovascular diseases and many other degenerative diseases (Hertog et al., 1993, Block and Langseth, 1994, Criqui ;Ringel, 1994 and Wang and Jiao, 2000).

Peels are the major products obtained during the processing of various fruits and these were shown to be a good source of polyphenols, carotenoids and other bioactive compounds which posses various beneficial effects on human health (Larrauri, et al., 1999; Rodriguez de Sotillo, et al., 1994a and Wolfe et al., 2003).

Phenolics are widely distributed in plants where they act as attractants for certain insects, as free radical scavengers, and in defense against ultraviolet radiation, pathogens and predators (Robards et al., 1999; Treutter, 2001; Solovchenko and Schmitz- Eiberger, 2003; Hagen et al., 2007 and Petkovsek et al., 2007) .Their antioxidant properties are predominantly attributed to phenolic compounds, These compounds contain a large number of double bonds and hydroxyl groups, which generates their antioxidant activity (Lee et al.,2003 and Tsao et al.,2005).

Fruit and vegetable peels have advantages over other herbal extracts, as they are easily identifiable, commonly used by people, rich in various bioactive compounds, and some of their compounds have been characterized in terms of their chemical structures and biological properties through use of structure-activity relationship. Additionally, peels are usually considered waste, so they are obviously cost-effective (Leontowicz,et al., 2003, Parmar and Kar ,2009 and Hamendra, et al 2010).

Potato peel, a waste by product from potato processing, could be considered as a new source of natural antioxidant. Potato peel is found to contain phenolic acids (Lisinska and Leszczynski, 1987) and recently the antioxidant activity of potato peel extract has been studied in food systems (Rodriguez de Sotillo, Hadley, Holm, 1994b). However, convincing evidence for the free radical scavenging activity of potato peel extract is still needed.

Fischer and Bipp (2005) found that potato peel sludge was recognized as a source for glucaric acid.

Flavonoids, an important class of polyphenolic of antioxidant compounds, give protection against pathogens, and herbivores (Heim et al., 2002 and Petkovsek et al., 2007). Phenolics, mainly flavonoids take part in photoadaptation and photodamage processes during fruit development. The extent of UV-B-induced damage to photosystem II of apple skin was well correlated with its quercetin glycoside content (Solovchenko and Schmitz-Eiberger, 2003).

Main phenolic compounds in apple peel are flavanols (epicatechins, catechins, and procyanidins), hydroxycinnamates, dihydrochalcones and anthocyanidin yanidin-3-galactoside (Mayr et al.,1995; Golding et al., 2001; Van der Sluis et al., 2001; and Kondo et al., 2002). The concentration of phenolic compounds decreases sharply in apple flesh and peel during fruit development, but phenolic content is higher in the peel than the flesh at all stages of fruit maturation (Treutter, 2001 and Renard et al., 2007).

Apples, a wide variety of which are available in many countries throughout the year, are one of the most important fruit sources of phenolics (Wolfe et al.,2008). Although apples contain different classes of bioactive compounds (Avad et al., 2000; Tsao et al., 2003; He and Liu, 2007; Lata, 2008).

The peels of apples, in particular, are high in phenolics. During applesauce and canned apple manufacture, the antioxidant-rich peels of apples are discarded. Apple peels are an abundant waste in Chilean dried products industry. This by-product has a high concentration of phenolic compounds that may assist in the prevention of chronic diseases (Valdenegro et al.,2010).

The aim of this research is to evaluate potato and apple peels as a potential donor of phenolic compounds in addition to determine their

amounts in(ppm). This work aims also to study the effect of feeding different concentration of potato and apple peels on hepatotoxic rats injured by CCl₄.

MATERIALS AND METHODS

MATERIALS.

Samples preparation:

1 - Apple peels (Golden Delicious):

Fresh apple peels, obtained from Best Factory, El-Dakahlia Governorate, Egypt at the end of May 2008, were washed three times with tap water and then dried at 70 °C for 5 h using a cross flow drier. The dried peel was powdered using a hammer mill and passed through a 0.5 mm sieve to obtain a fine powder. Samples were stored in freezer until use.

2- Potato peels (*Solanum tuberosum* cv Asterix):

Fresh potato peels, obtained from a local restaurant, El-Dakahlia Governorate, Egypt at the end of December 2008, were washed three times with tap water and then dried at 70 °C for 5 h using a cross flow drier. The dried peel was powdered using a hammer mill and passed through a 0.5 mm sieve to obtain a fine powder. Samples were stored in freezer until use.

1- Rats

Thirty five adult male white rats of Sprague Dawley strain weighing (150-180 grams). The animals were purchased from the Agricultural Research Center, Giza, Egypt.

3- Induction of acute hepatitis in rats:

Carbon tetrachloride (CCl₄) an agent that is used to induced experimental acute hepatitis in rats. It was purchased from El-Gomhorya Co., Egypt in the form of 40% liquid dispensed in 1L plastic bottles.

4 -Kits for biochemical analysis:

Kits required for estimating parameters of lipid profile, liver and kidneys function were purchased from Gamma trade for pharmaceutical.

Methods:

Chemical analysis:

Approximate chemical composition of potato and apple peels [ash, crude protein, crude fat and moisture contents] were determined according to the methods of the A.O.A.C. (2000), While total carbohydrates were estimated by subtracting the difference from initial weight of the samples as follows:-

Carbohydrates% = 100 - (% moisture + % protein + % fat +% ash).

Determination of minerals:

The ashed samples of potato and apple peels were dissolved in 1 % hydrochloric acid and the solutions were used for the determination of the following minerals: Iron, zinc, calcium, selenium, and copper by using atomic absorption spectrophotometer [Perkins-Elmer, Model 2380] according to (Pupsa et al., 1994)

Determination of phenolic compounds.

Phenolic compounds were determined by HPLC according to the method of (Goupy et al., 1999) at Central lab. of Food Technology Research Institute Agric. Res. cent. Egypt.

Scavenging effect on DPPH radicals.

The effect of potato and apple peels on DPPH radical was studied, employing the modified method described earlier by Yamaguchi et al. (1998). Briefly, 1.5 ml of DPPH solution (0.1 mM, in 95% Ethanol) was incubated with varying concentrations of the extract (potato and apple peels, 0.75 - 5.0 mg).The reaction mixture was shaken well and incubated for 20 min at room temperature and the absorbance of the resulting solution was read at 517 nm against a blank. The radical scavenging activity was measured as a decrease in the absorbance of DPPH and was calculated using the following equation:

$$\text{Scavenging effect \%} = \frac{1 - A_{\text{Sample}}(517\text{nm})}{A_{\text{Control}}(517\text{nm})} \times 100$$

Experimental Biological Evaluation.

Animals:

Adult male white rats weighing (150-180) were used in this study. All animal were kept under standardized conditions (12h light/ dark cycle, 22oC) and were provided free access to standard diet (Table1) and water.

Table (1): Composition of the standard diet.

Ingredients	g/kg diet
Casein	200
Corn starch	497
Sucrose	100
Vitamin mixture	020
Mineral mixture	100
Corn oil	050
Cellulose	030
Methionine	003

Experimental design:

Experiment:

All rats fed the basal diet for one week before starting the experiment for acclimatization. After the acclimatization period, the rats groups which consist of thirty five rats were divided into six equal group (n=5) as follows:

group1: was fed on basal diet only; control (-Ve).

The other five groups were subcutaneously administered a single dose of CCl₄ (30% V/V) in paraffin oil (1ml/kg) for 2 days from start of the experimental period, to induced acute hepatic damage according to the method described by Nadeen et al. (1996).

group2: was fed on the basal diet only; control (+Ve).

group3: was fed on the basal diet containing 10 % potato peel.

group4: was fed on the basal diet containing 10% apple peel.

group5: was fed on the basal diet containing 20% potato peel.

group6: was fed on the basal diet containing 20% apple peel.

Determination of body weight gain % and feed efficiency ratio in rats:

Daily feed intake per group was calculated through the experimental period (28). The biological values of different diets were assessed by the determination of body weight gain (BWG) and feed efficiency ratio (FER) percent, according to the method of Chapman et al. (1959).

At the end of experimental period all rats were fasted overnight then sacrificed. Blood samples were immediately collected in clean and dried Wiesserman tubes from portal vein and then centrifuged at 3000 rpm for 15 minutes. Serum sample were separated and frozen at -10 C until further determination.

Biochemical analysis:

Total cholesterol, HDL-cholesterol and triglyceride content were determined by enzymatic colorimetric method according to Allian et al. (1974) , Richmond (1973) and Fossati and Principle (1982), respectively.

LDL-cholesterol and VLDL-cholesterol were calculated by the Friedewald Formula according to Friedewald et al. (1972).

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

Plasma total protein was determined by an enzymatic method according to Henry (1964).

Plasma uric acid was estimated by an enzymatic method according to Trinder (1969).

Plasma creatinine was determined according to Henry (1964).

Statistical analysis:

Results of the biochemical estimations of the rats are reported as mean \pm S.E.M. (Standard deviation of Mean). The total variation was analyzed by performing one-way analysis of variance. "LSD (Least Significant Difference) test" was used for determining significance (Sümbüloğlu 1998). Probability levels of less than 0.05 were considered significant.

Results and Discussion

In this work, the nutritional value of the peel was studied in addition to studying the antioxidant activities of potato and apple peels.

A-Nutritional value:

Nutritional value of the peel was studied by determination of its content of protein, oil, ash, carbohydrates and some minerals. In addition to determination of phenolic compounds.

Chemical composition of potato and apple peels samples.

The chemical composition of the potato and apple peels are recorded in Table (2). potato peel has high level of protein and ash (18.9 ± 1.1 g and 5.3 ± 0.93 g) than apple peel has (4.4 ± 2.3 g and 2.5 ± 0.11 g for protein and ash, respectively), while apple peel has high levels of fat and Moisture than that of potato peel (1.7 ± 1.75 g vs 0.99 ± 0.23 g and 15.5 ± 2.9 g vs 4.84 ± 0.16 g) respectively. Data in table (2) showed that carbohydrates content of apple peel exceeded that of potato peel (75.9 ± 1.42 vs 69.97 ± 0.98 g) per 100g on dry weight basis.

Table (2): Chemical composition of potato and apple peels samples (g/100g).

Variables	Potato peel	Apple peel
Protein	18.9 ± 1.1	4.4 ± 2.3
Fat	0.99 ± 0.23	1.7 ± 1.75
Ash	5.3 ± 0.93	2.5 ± 0.11
Moisture	4.84 ± 0.16	15.5 ± 2.9
Carbohydrate	69.97 ± 0.98	75.9 ± 1.42

Mineral content of potato and apple peels (ppm).

The results in Table (3) showed that potato peel has high levels of copper (0.826) and calcium (39,2) ppm than apple peel (0,78 ppm for copper) and (26,03 ppm for calcium). Concerning zinc and iron, it was found that apple peel has high levels than that of potato peel (0,07 vs 0,02 and 20,7 vs 18,7) ppm, respectively.

The peels of apples have also been recommended as part of an antiatherosclerotic diet due to their rich amounts of total, soluble, and insoluble dietary fiber, total phenols, epicatechin, and gallic and p-coumaric

acids along with concentrations of Na, K, Mg, Ca, Fe, and Mn (Gorinstein, et al., 2001).

Table (3): Mineral content of potato and apple peels (ppm).

Minerals	Potato peel	Apple peel
Zinc(ppm)	٠,٥٢	٠,٥٧
Copper(ppm)	٠,٨٢٦	٠,٦٨
Calcium(ppm)	٣٩,٢	٢٦,٠٣
Iron (ppm)	١٨,٦	٢٠,٦
Selenium (ppm)	٠,٠١٠	٠,٠١٠

Phenolic acids of potato and apple peels.

Polyphenolic compounds are very important fruit constituents, by virtue of their antioxidant activity by chelating redox- active meta ions, inactivating lipid free radical chains and preventing hydroperoxide.

The main phenolic acids identified in potato and apple peels are presented in Table (4). The results showed that potato peel has higher contents of Catechin, Benzoic, Caffiec and Chrisin than apple peel (38.36 vr 37.22, 12.78 vr 9.62, 44.23 vr -- and 3.34 vr --) respectively. While apple peel has higher content of Vanillic, Synergic, Caffeine, Coumaric, Salicylic, Ferrulic and Nariginin than potato peel (78.91 vr 3.95, 6.73 vr --, 3.55 v r --, 6.04 vr 3.18, 80.19 vr 7.87, 12.25 vr – and 17.32 vr 13. 48) respectively. Data in Table (4) showed that total phenol (%) as gallic acid in potato peel was higher than apple peel (3.2 vr 2.5).

The peel expresses a significantly higher concentration of phenolics compared to the flesh (Alonso -Salces et al., 2004; McGhie et al., 2005; Veberic et al., 2005; Petkovsek et al., 2007; Drogoudi et al., 2008).

Potato peel extract had the highest antioxidant activity owing to its high content of phenolic compounds and flavonoids (Sarhan et al, 2010).

Onyenko and Hettiarachchy (1993) indicated that petroleum ether extract of potato peels showed strong antioxidant activity due to the presence of chlorogenic, gallic, cinnamic and ferulic acids as the major antioxidant compounds in the extract.

Nandita and Rajini (2004) showed that, The total polyphenolic content in potato peel extract PPE was found to be 3.93 mg/g powder. The

major phenolic acids present in PPE were predominantly: gallic acid, caffeic acid, chlorogenic acid and protocatechuic acid .

Apple peels were found to contain up to 3300 mg/ 100g dry weight of phenolics (Wolfe and liu, 2003). Apple peel displays a large amount of antioxidant properties (Eberhardt et al., 2000; Wolfe et al., 2003 and Tsao et al., 2005).

Table (4) Phenolic acids of potato and apple peels (ppm).

Phenolic compounds (ppm)	Test Results	
	Potato peel	Apple peel
Catechin	38,36	37,22
Vanillic	3,90	78,91
Synergic	-----	6,73
P.OH Benzoic	12,78	9,62
Caffeine	----	3,00
Coumaric	3,18	6,04
Salicylic	7,87	80,19
Ferrulic	-----	12,20
Nariginin	13,48	17,32
Cinnamic acid	0,88	0,72
Caffiec	44,23	----
Chrisin	3,34	----
Total Phenol (%) as gallic acid	3,2	2,0

B) Antioxidants activity of potato and apple peels extract.

1- Scavenging effect on DPPH radicals.

DPPH radical scavenging abilities of potato and apple peels extract along with the reference antioxidant BHT(butylated hydroxy toluene) are shown in Table (5) and expressed as percentage reduction, the scavenging activity of potato peel at concentration of 500 ul/ml was 93.4±1.4% followed by BHT 91.4 ±1.8% then apple peel 86.5±5.1%.

In addition at concentration of 250 ul/ml, the results revealed that the potato peel was the excellent radical scavenger with 82.63±3.1% followed by BHT with value of 77.6 ±2.2% then apple peel 74.03±2.06% .

The results also showed that potato peel was the best radical scavenger with $74.46 \pm 1.2\%$ followed by BHT $72.53 \pm 6.07\%$ then apple peel $55.96 \pm 2.9\%$ at concentration of 200 ul/ml.

Besides, a concentration of 100 ul/ml was the best radical scavenger with a value of potato peel ($62.73 \pm 1.6\%$) followed by the value of BHT ($48.53 \pm 6.51\%$) then apple peel (32.86 ± 4.1) .

However, convincing evidence for the free radical scavenging activity of potato peel extract is still needed , Nandita and Rajini (2003) studied that antioxidant activity of PPE· employing in vitro assay systems, such as inhibition of lipid peroxidation, DPPH/superoxide/hydroxyl radical scavenging, and iron ion chelation, in order to understand the mechanisms of its antioxidative activity.

Chemical structure of phenolics makes them ideal as antioxidant compounds, free radical scavengers and metal chelators, more powerful as compared to vitamin C (Rice-Evans et al., 1997 and Guo et al., 2003).

The peel has substantially higher phytochemical content and greater antioxidant activity (Łata et al., 2009). These antioxidants obtained from potato have free radical scavenging effects (Singh et al., 2011).

Table (5): Scavenging effect (%) of potato and apple peels on (DPPH) radical.

	BHT	Potato peel	Apple peel
100Ul/ml	48.53 ± 6.51	62.73 ± 1.6	32.86 ± 4.1
200ul/ml	72.53 ± 6.07	74.46 ± 1.2	55.96 ± 2.9
250ul/ml	77.6 ± 2.2	82.63 ± 3.1	74.03 ± 2.06
500ul/ml	91.4 ± 1.8	93.4 ± 1.4	86.5 ± 5.1

Each value is the Mean \pm SD.

C) Biological results.

Effect of feeding different concentration of potato and apple peels on daily feed intake, body weight gain, and food efficiency ratio in toxicated rats.

A significant decreases of daily food intake, body weight gain and food efficiency ratio were noticed in control (+) group when compared to all experimental groups administered CCl4.

Feeding on potato and apple peels powder to CCl₄ intoxicated rats at concentration of 10 and 20% increase significantly daily food intake when compared to control (+) group, while rats groups fed on 10% potato and apple peels have daily food intake values of (11.44±0.46g/day) and (10.66±0.66 g/day) which were not significant when compared to control (-) group (11.36±0.77 g/day) as shown in Table (6).

Concerning body weight gain (BWG) percent, administration of CCl₄ revealed significant decrease in BWG% in control (+) group when compared to the treatment groups. Data in Table (6) shows that the highest significantly in (BWG%) was seen in rats group fed on 20% potato peel (63.23±2.05), followed by rats group fed on 20% apple peel (59.1±1.1), when compared with control (+) group(24.13±1.04).

The intake of caffeic acid from foods, mainly from tomatoes or potatoes was estimated to be about 0.2 mg/kg body weight per day (National research council 1996).

On the other hand, the results showed that food efficiency ratio of CCl₄ intoxicated rats control (+) (0.153±0.05) decrease significantly in comparing with control (-) group (0.27±0.064), rats group fed on 10, 20% potato peels and 10, 20% apple peels (0.18±0.2, 0.24±0.4, 0.176 and 0.19±1.5) respectively.

Table (6): Effect of feeding different concentration of potato and apple peels on daily feed intake (g/day), body weight gain percent (BWG %), and feed efficiency ratio (FER) in hepatotoxic rats.

Group	Mean of daily food intake (g/day)	Body weight gain (BWG %)	Food efficiency ratio
Control(-)Ve	11.36±0.77da	54.96±0.41a	0.27±0.064a
Control(+) ^{Ve} Ccl ₄	8.8±0.65b	24.13±1.04b	0.153±0.05b
10% potato peel	11.44±0.46da	49.83±0.94bd	0.18±0.2c
20% potato peel	13.33±0.28c	63.23±2.05ea	0.24±0.4d
10% apple peel	10.66±0.66a	33.36±2.01bc	0.176±0.0e
20% apple peel	12.1±0.77d	59.1±1.1be	0.19±1.5f

Each value is the mean + SD of 5 rats.

The values in the column with the same superscript are not significant different at P < 0.05.

Effect of feeding potato and apple peels powder on serum constituents in hepatotoxic rats.

Data in Table (7) revealed that administration of CCl₄ to rats leads to significant decrease in serum total cholesterol, triglyceride, LDL-cholesterol and VLDL-cholesterol levels than those of control (+)Ve Ccl₄.

Among the test group, total cholesterol decreased significantly in all the treated rats whereas the least increase was found in the group fed on 10% apple peel (125.4± 5.3mg/dl), followed by rats group fed on 10% potato peel (114.6±1.32mg/dl), and the group fed on 20% apple peel (110.3 ± 1.26mg/dl), while the highest decrease was in rats fed on 20% potato peel (95.7± 2.3mgdl) which differ significantly from control (+) (152.2±10.1mg/dl).

These results agreed with that of Lazaroy and Werman (1996), they found that after four weeks, the rats fed on potato peel showed a 40% decrease in plasma cholesterol content and a reduction of 30% in hepatic fat cholesterol level.

Results in Table(7), indicated that all the test groups either control(-) or rats groups fed on potato peel 10 and 20% and rats groups fed on apple peel 10and 20% revealed significant decrease in triglycerides, LDL-cholesterol and VLDL-cholesterol levels in comparing with that of control (+) CCl₄ group.

The highest reduction percentages in triglycerides, LDL-cholesterol and VLDL-cholesterol levels were noticed in the rats group receiving 20% potato peel (50.95, 82.82 and 49.82 %) respectively, followed by rats group receiving 20 % apple peel (46.38, 59.3, and 47.4 %) respectively, followed by rats group receiving 10% potato peel (30.72, 50.1, and 39.3 %) respectively, while the lowest reduction percentage in rats receiving 10 % apple peel were (18.93, 32, and 18.99%) respectively.

Feeding of 20 % potato peel recorded non significant values in total cholesterol and LDL-cholesterol levels when compared to control (-) group as shown in Table (7).

On the other hand, significant increase in HDL-cholesterol level of rats receiving 20 % potato peel (69.8± 2.4 mg/dl) was noticed when compared to control (+) group (42.2±1.7 mg/dl), rats receiving 10 % potato

peel (57.4±1.6mg/dl), rats receiving 10% apple peel (48.1±7.4mg/dl) and rats receiving 20% apple peel (62.9±3.1mg/dl).

Feeding of potato and apple peels at concentration of 20 % showed non significant differences in triglycerides, HDL-cholesterol and VLDL-cholesterol levels when compared to control (-) group as shown in table (7). Apple peels is also reported to have antioxidative potential according to various in vitro methods such as total radical-trapping antioxidative potential values, which also correlate with their polyphenolic conten. Peels of fruits have also been found to be antiperoxidative in hypercholesterolemic diet-fed animals (Leontowicz, et al., 2002, Hamendra,et al., 2010).

So it is advised by using potato and apple without removing peel to the patients with hyperlipidemia or those exposed to atherosclerosis.

Table (7): Effect of feeding potato and apple peels powder on serum lipids pattern in toxicated rats.

Group	Cholesterol (mg/dl)	Triglycerides (mg/dl)	HDL-c (mg/dl)	LDL-c (mg/dl)	VLDL-c (mg/dl)
Control(-)Ve	94.86±1.66a	54.7±1.83a	67.3±2.35ae	19.6±8.4a	11.02±0.58a
Control(+)VeCCl4	152.2±10.1b	110.23±3.85b	42.4±1.7b	87.7±9.1b	22.06±0.7b
10% potato peel	114.6±1.32ed	67.36±7.12d	57.4±1.6d	43.76±2.72d	13.4±1.4d
20% potato peel	95.7±2.3a	54.06±1.67a	69.8±2.4e	15.06±0.77a	10.8±0.34a
10% apple peel	125.4±5.3c	89.36±0.66c	48.1±7.4bc	59.6±7.1c	17.87±0.13c
20% apple peel	110.3±1.26e	59.1±1.05a	62.9±3.1da	35.7±4.3de	11.62±0.39a

Each value is the mean + SD of 5 rats.

The values in the column with the same superscript are not significant different at P < 0.05.

Effect of feeding potato and apple peels powder on serum levels of AST(U/L), ALT (U/L)), uric acid (mg/dl) and creatinine (mg/dl) in toxicated rats.

Data in Table (8) revealed that administration of CCl4 to rats lead to significant decrease in AST, ALT, uric acid and creatinine levels in the rats groups receiving the two different concentration (10, 20%) of potato and apple peels when compared to control (+) CCl4 group.

Results in Table (8), indicated that all test groups have significant decrease in AST level where its value in the rats receiving 20 % potato peel

was 25.3 ± 5.2 u/l, in rats group receiving 20% Apple peel (39.3 ± 5.7 u/l), in rats group receiving 10 % potato peel (51.46 ± 3.9 u/l) and rats group receiving 10 % apple peel (68.83 ± 3.35 u/l) when compared to control (+) group (79.96 ± 3.1 u/l).

Data presented in Table (8) revealed a significant increase in ALT level of control (+) CCl₄ group when compared to all groups. The lowest decrease was seen in the group receiving 20 % potato peel (33.26 ± 0.9 u/l) which was more than that of control (-) group (31.93 ± 0.55 u/l) and less than that of group receiving 20 % apple peel (39.36 ± 1.25 u/l).

It is well known that carbon tetrachloride CCl₄ has been widely used in animal models to investigate chemical toxin-induced liver injury (Lee. et al., 2005). The CCl₄ produced damage to liver cells and was followed by the significant increase in serum alanine aminotransferase (ALT) activity and hepatic lipid peroxidation after 24 h. Increased lipid peroxidation is a mechanism which is commonly suggested to explain the progression of liver damage and the development of fibrosis, and eventually cirrhosis in experimental animals and in alcoholic liver disease (Goldani et al., 2007).

Major phenolic compounds have been reported to exert free radical scavenging and anti- peroxidative effect in liver microsomes, hepatocytes and erythrocytes (Liu et al., 1992).

Feeding of 20 % potato peel did not record any significant differences in AST, ALT and creatinine when compared to control (-) group as shown in table (8).

Data in Table (8) shows that uric acid and creatinine increase significantly in control (+) group (6.96 ± 0.95 and 2 ± 0.1 mg/dl) respectively, when compared to all group.

Peel extract not only quenches DPPH radicals but also lowers hepatic lipid peroxidation values induced by CCl₄ and H₂O₂ (Dixit, et al., 2008).

Feeding of potato and apple peels at concentration of 20 % did not record any significant differences in uric acid when compared to control (-) group as shown in Table (8).

Table (8): Effect of feeding potato and apple peels powder on serum levels of AST (U/L), ALT (U/L)), uric acid (mg/dl) and creatinine (mg/dl) in toxicated rats.

Group	AST (U/L)	ALT (U/L)	Uric acid (mg/dl)	Creatinine (mg/dl)
Control(-)Ve	27.63±5.48a	31.93±0.55a	2.1±0.22ad	0.53±0.66a
Control(+)VeCcl4	79.96±3.1b	56.1±0.9b	6.96±.95b	2±0.1b
10% potato peel	51.46±3.9d	43.23±0.98d	2.73±2.1ac	1.13±0.15d
20% potato peel	25.3±5.2a	33.26±0.9a	2±4.1d	0.53±1.1a
10% apple peel	68.83±3.35c	46±1.15c	3.06±0.15c	1.73±2.1c
20% apple peel	39.3±5.7e	39.36±1.25e	2.4±1.3dac	0.73±1.4e

Each value is the mean + SD of 5 rats.

The values in the column with the same superscript are not significant different at $P < 0.05$.

Conclusion

In the present study, Phenolic compounds are ubiquitous in plants as potato and apple peels when are consumed; these phytochemicals contribute to the intake of natural antioxidants. So the health benefits of potato and apple peels are largely due to the antioxidant and the large number of phytochemicals,

So it is advised by using potato and apple without removing peel to the patients with hyperlipidemia or those exposed to atherosclerosis and can protect the injury of liver. .

Therefore, it is suggested that further work utilizing of potato and apple peels as source of phenolic compounds could offer diverse opportunities for nutraceutical and functional food applications and could be performed on the isolation and identification of the main components in potato and apple peels to be used in drugs and food preservatives.

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التأثير الوقائي لقشور البطاطس والتفاح على الكبد كمضادات أكسدة في

الفئران المسممة برباج كلوريد الكربون

اماني احمد عبد القادر سلو

قسم الاقتصاد المنزلي- كلية التربية النوعية- جامعة المنصورة

الهدف من البحث هو تقييم قشور البطاطس والتفاح كمعطي للمركبات فينولية ودراسة تأثير التغذية على التركيزات المختلفة (٢٠,١٠٪) من قشور البطاطس والتفاح المطحونة الجافة بعد خلطة بالوجبة الاساسية على الفئران المسممة كبديا برباج كلوريد الكربون لمدة اربع اسابيع.

أشارت النتائج إلي وجود مستوى عالي من الحديد (٠,٨٦٦) والكالسيوم (٣٩,٢) في قشور البطاطس عن قشور التفاح حيث كان الحديد (٠,٦٨) والكالسيوم (٢٦,٠٣) ppm وكانت (%) للمركبات الفينولية الكلية مقارنة بحمض الجالليك في قشور البطاطس أعلى من قشور التفاح (٢,٥٧٢ ٣,٢) على التوالي.

ولوحظ وجود انخفاض معنوي في مستوى الكوليسترول الكلي في مجموعات الفئران المصابة والتي تغذت على ١٠ ٪ قشر التفاح (mg/dl ٥,٣+١٢٥,٤) تليها مجموعة الفئران التي تغذت على ١٠ ٪ قشر البطاطس (mg/dl ١,٣٢ + ١١٤,٦) تليها مجموعة الفئران التي تغذت على ٢٠ ٪ قشر التفاح (mg/dl ١,٢٦ + ١١٠,٣) بينما كان أعلى نقصان في مجموعة التي الفئران تغذت على ٢٠ ٪ قشر البطاطس (mg/dl ٢,٣ + ٩٥,٧) الذي اختلف معنويا عن المجموعة الضابطة الموجبة (١٥٢,٢ + ١٠,١ mg/dl).

التغذية على قشور البطاطس والتفاح بتركيز ٢٠٪ في الوجبة الاساسية في مجموعات الفئران المصابة لا يمثل دلالة معنوية في مستوى الجلوسيريدات الثلاثية والليبيروتينات المرتفعة الكثافة والليبيروتينات المنخفضة الكثافة جدا عند مقارنتها بالمجموعة الضابطة السالبة.

كما اشارت النتائج ان مجموعات الفئران المصابة التي تناولت التركيزات المختلفة (١٠- ٢٠٪) من قشور البطاطس والتفاح سببت نقص معنوي في مستوى AST ALT وحمض اليوريك والكرياتينين عند مقارنتها بالمجموعة الضابطة الموجبة.