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Protective effect of banana and mango peels against lead toxicity in rats

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Abstract

This study was carried out to determine the effect of dry banana peels (Musa Acuminate) and drymango peels *(Mangiferaindica L.)* against lead toxicity in weaning rats. Forty five growing male albino were divided into two main groups. The first group was the negative group (9) rats, the second group (36) rats was exposed to lead acetate and divided into four groups. The subgroup one positive group fed basal diet, the subgroup two fed basal diet containing (15%) banana peels, the subgroup three fed basal diet containing (15%) mango peels, the subgroup four fed basal diet containing (15%) combination of (banana and mango peels) for (6) weeks.

At the end of the experimental period the best result found in group fed basal diet containing (15%) combination banana and mango peels improved daily feed intake, body weight gain, feed efficiency ratio, hemoglobin and serum iron level. Moreover, lead concentration was decreased in serum and also it was improved the concentration of calcium, phosphorous as well as lead in bone of intoxicated rats. Dry peels of fruits were improved liver enzymes and kidney functions compared with positive group.

The histopathology results were agreedwith the results of serum parameters. These results recommend increasing the consumption of banana and mango peels. Nutrition Education Programs are needed to illustrate the importance of banana and mango peels in reducing lead toxicity.

Key words: lead toxicity, banana, mango peels.

Introduction

Lead (Pb) is one of the pervasive and persistent environmental toxic metals. Despite considerable efforts to identify and eliminate sources of pbexposure, this metal remains induces adverse health effects for centuries (**khodamoradi et al., 2015**). According to**World Health Organization (WHO) statisticsthe Institute for Health Metrics and Evaluation (IHME) has estimated that in (2013)**accounted lead exposure for 853 000 death due to long-term effects on health, with the highest burden in low and middle income countries. IHME also estimated that lead exposure accounted for 9.3%of the global burden of idiopathic intellectual disability, 4% of the global burden of ischemic heart disease 6.6% of the global burden of stroke. (Pb)had modest uses in ancient medicines. Today, it used in many products including alkyl-lead petroleum combustion, production, and storage of lead-acid batteries, leaded glass, cement manufacture, production of plastics & ceramics and also found in some imported cosmetics (**karamian et al., 2015)**. Lead (Pb)can damage various body systems; however, the central nervous system is the primary target (**karamian et al., 2015 and Li et al., 2016)**. Several reports have demonstrated that exposure to lead causes deleterious effects on the nervous system, including decrements in iq, impaired cognition, and memory, as well as impaired peripheral nerve functions and related behavioral disturbances (**khodamoradi et al., 2015).** The developmental toxicity of lead has become a significant area of research since children are much more sensitive than adults to learning impairment following low level of lead exposure **(Davis and Svendsgaard, 1987)**.

Lead (Pb) poisoning negatively influenced various body systems particularly, hematopoietic and renal system **(Ercal et al., 1996).** Gastrointestinal, reproductive, circulatory, and immunological pathologies **(patrick, 2006),** reproductive dysfunctions, **(Marchlewicz*et al.*, 1993).** Moreover, lead inhibition of the activities of antioxidant enzymes, including glutathione peroxidase, catalase and superoxide dismutase **(Silbergeld et al., 2000).** Furthermore, stimulation of lipid peroxidation and depletion of antioxidant reserves which was postulated to be major contributors to lead-exposure related diseases **(Patrick, 2006).**

Banana*(Musa Acuminate)* The peel could be a potential source of antioxidant and antimicrobial activities. Ethyl acetate and water soluble fractions of green banana peel displayed high antimicrobial and antioxidant activities. Most of the compounds isolated from green peel, b-sitosterol, malic acid, 12-hydroxystearic acid and succinic acid, showed significant antibacterial activities and low antioxidant activities, while those compounds isolated from water soluble extracts, glycoside and monosaccharide components, displayed significant antioxidant and low antimicrobialactivities **(Matook and Fumio, 2005)**.Banana peel represents about 40% of total weight of the fresh fruit (**Anhwange et al., 2008).** The total amount of phenolic compounds in banana peel has been ranged from 0.90 to 3.0 g/100 g dry weight and gallocatechin is identified at a concentration of 160 mg/100 g dry weight; **Someya et al., (2002).**Other phytochemicals such as anthocyanin, delphinidin, cyaniding; Seymour, and catecholamines have been identified **(Kanazawa and Sakakibara, 2000)** in ripe banana pulp and peel. Recent studies demonstrated that banana peel generally includes higher phenolic compounds than those of banana pulps; **Kondo et al. (2005) and Sulaiman et al. (2011). Subagio et al. (1996**)identified carotenoids such as b-carotene, acarotene and different xanthophylls in the range of 300– 400 lglutein equivalents/100 g. of banana peels. **Gonzalez- Montelongo etal. (2010)**studied the extraction conditions that produce maximum antioxidant activity (Acetone: water (1:1), 25 _C, 120 min). Moreover, the number of extraction steps, temperature and time, have been reported as the most effective factors associated with antioxidant properties of banana peel, respectively.

Mango*(Mangiferaindica L.)*is one of the most important tropical fruits worldwide in terms of production and consumer acceptance **(FAO, 2012).** Mango byproducts contain significant amounts of phytochemicals, which makes them suitable to be processed for value-added applicationsin functional foods and nutraceuticals**(Ajila etal., 2007, 2010).** Mango peel contains various classes of polyphenols, carotenoids, and vitamins with different health-promotingproperties, mainly antioxidant activity **(Schieber et al., 2003;Ajila et al., 2008; Manthey& Perkins-Veazie, 2009).**

Therefore, the present work was conducted to study the protective effect of banana and mango peels against lead toxicity in rats.

Materials and Methods

Materials:

Banana (Musa Acuminate) and mango (Mangiferaindica L.)were purchased from local market in Egypt.

Albino rats (Sprague - Dawley Strain) weighting (70 ± 5g) were purchased from Helwan Experimental Animals Station.

Casein, vitamins, minerals, cellulose, choline chloride obtained and pure lead acetate were purchased from El-Gomhorya Company, Cairo, Egypt.

Kits measurement of all parameters for biological experimental were purchased from BiconDiagnosemittel GmbH and Co. KG Hecke 8 made in Germany.

Methods:

Banana and mango peels preparation

The peels were removed from the fresh and submitted to thefollowing processes:

1. Fresh peels: banana and mango fresh peels were washed with water and cut into small pieces.
2. Dried peels: peel samples were dried at 50 _C in a hot air oven for 12 h and ground to obtain the particle size of less Than 1.0 mm **(Adejuyitan et al., 2008**).

Chemical composition analysis:

Moisture, total protein, total lipid and fiber were analyzed in banana and mango peels according to **AOAC (2010**).

Determination of total phenolic compounds:

The samples were extracted in terms of the method described by **Garcia-Salas et al. (2010)** and used for spectrophotometric analyses. The total phenolic content of the extracts was determined by a Folin-Ciocalteu phenol reagent method **(Xu andChang, 2007)** using gallic acid as standard. The absorbance was measured with UV/vis spectrophotometer (Varian Cary 50 Scan, Australia) at 760 nm. A mixture of 80% methanol and reagents was used as a blank solution. The total phenolic content was expressed as gallic acid equivalents (μg of GAE/mg dry matter) through the calibration curve of gallic acid.

Mineral composition of fruit peels

The mineral composition of the banana and mango peels was determined according to the methods of the **A.O.A.C. (2005).**

Biological investigations:

Albino rats forty five (Sprague – Dawley strain) of weaning rats, weighting 70 ± 5 g each were was housed in an individual stainless steel cage under hygienic controlled condition. The basal diet was prepared according to **(Reeves et al., 1993)** after this period, the rats were divided into two main groups, as follows: The first main group (9 rats) was fed on the basal diet for another six weeks (42 days) and considered as negative control. The second main group (36 rats) were exposed to lead acetate at (200 mg/ kg from weight rat) daily drinking orally according to **(Newairy and Abdou., 2009)** and divided into four sub groups (9 rats for each). The first one (9 rats) was continued to be fed on basal diet and considered as positive control. From the second to four subgroups (9 rats for each) were fed on basal diet fortified with 15% separately from dried banana, mango peels and mixed from them, respectively.During the experimental period (6 weeks), the diets consumed and body weights were recorded twice weekly and feed efficiency ratio according to **(Chapman et al., 1959).**

At the end of the experiment, the animals were fasting overnight, then the rats were anaesthetized and sacrificed, and blood samples were collected. Blood samples were centrifuged and the serum was separated to estimate some biochemical parameters. Blood haemoglobin (Hg) was determined using enzymatic calorimetric method was described by **Young, (1990)**. Lead and iron concentration in serum was determined according to **Parson (2001) andRamsay (1957).**Tibia andorgans as liver, kidney were weighted. Moreover, calcium, phosphorus and lead in bone were determined according to **Carter and Gregorich (2006).**The samples were digested using a mixture of nitric and perchloric acid at ratio of 3:1, then P,Ca and Pb were determined by using atomic absorption spectrophotometer.Liver functions (AST and ALT enzymes) was estimated by **Sherwin (1984)** and kidney function as uric acid, urea and creatinine were determined according to **Haisman and Muller (1977), Henry et al. (1974) and Larsen (1972)**,

Statistically analysis:

The data obtained in the present study was analyzed by ANOVA. For all analyses, when a significant difference (p b 0.05) was detected in some variable, the data means test was applied to evaluate the difference between the samples. The results were analyzed with the aid of the software SAS System for Windows **SAS (2008).**

Results and Discussion

Chemical Composition of banana and mango peels:

The results presented in Table (1) shows that the carbohydrate, fiber and protein content of driedbanana, mango peels were the highest63.0, 13.70 and 6.25% in dried banana peels,meanwhile;mango peels were61.70, 17.33 and 3.61%, respectively.Whereas, the total lipids and ash content were recorded 7.70 and 2.50 in dried banana and also it was 4.23 and 4.88% in dried mango peels, respectively.**HappiEmaga et al. (2007)** showed that the banana peel had higher fat, ash, and total dietary fiber content, but lower protein and starch content than those of the banana peels **Figuerola et al. (2005),Llobera andCanellas (2007) and Marin et al. (2007)**reported by had lower total dietary fiber content than fiber obtained from different sources of fruit industrial by-products (60–78 g/100 g dry matter).

Ashoush and Gadallah (2011*)* studied the effect of mango peels powders (MPP) at different replacing levels (5, 10, 15 and 20%) and mango kernels powders (MKP) at (20, 30, 40 and 50%) on rheological, physical, sensory and antioxidant properties of biscuits were evaluated. The results revealed that MPP had high contents of ash, crude fiber and water holding capacity

(Serafini et al., 1998 and Carbonnea et al.,1998). Consumption of controlled diets high in fruits and vegetables increased significantly the antioxidant capacity of plasma, and the increase could not be explained by the increase in the plasma R-tocopherol or carotenoid concentration **(Cao et al., 1998).** Moreover, epidemiological studies have found that there is a significant negative association between the intake of fruits and vegetables and heart disease mortality ***(*Hertog et al., 1993, 1995; Knekt et al., 1996).**

Flavonoids and other plant phenolics, such as phenolic acids, stilbenes, tannins, lignans, and lignin, are especially common in leaves, flowering tissues, and woodyparts such as stems and barks ***(*Larson, 1988).** The antioxidant activity of phenolics is mainly due to their redox properties, which allow them to act as reducing agents, hydrogen donators, and singlet oxygen quenchers. In addition, they have a metal chelation potential **(Rice-Evans et al., 1995).**

According to the study by **Someya et al. (2002)** total phenolics are more abundant in peel (907 mg/ 100 g dry wt.) than in pulp (232 mg/100 g dry wt.)

Sogi et al., (2013*)* evaluate different drying methods for mango peel and kernel and assess their impact on nutrients, antioxidants and functional properties. Mango peel and kernel were dried using different techniques, such as freeze drying, hot air. Freeze dried mango waste had higher antioxidant properties than those from other techniques. The total phenolics content of dried peel and kernel powders were 2032–3185 and 11,228–20,034 mg GAE/100 g respectively. The cabinet dehydrated mango waste can be utilized in several food applications due to their content of phytochemicals that exert antioxidant properties.

Table (1): Chemical composition of drybanana and mango peels (g / 100g):

Fruits nutrients	Banana peels	Mango peels
Moisture	6.70 ± 02.22	4.92 ± 0.32
Protein	6.25± 0.25	3.61 ± 0.15
Total lipid	7.70 ± 0.10	4.23 ± 0.10
Total carbohydrates	63.00 ± 1.36	61.70 ± 0.15
Fiber	13.70 ± 0.25	17.33 ± 0.61
Ash	2.50 ±1.52	4.88 ± 0.59
Total phenolic (µg of GAE/g)	10.90± 0.10	23.06 ± 0.40

The data were presented as mean±S.D.

Mineral composition of dry banana and mango peels (g / 100g):

Minerals play a key role in various physiological functions of the body, especially in the building and regulation processes. Fruits are good source of

dietary minerals **(Ismail *et al*.,2011).** The mineral composition of fruit peels is represented in table (2) show that mango peels are high content of calcium 60.63mg and banana peels are high in iron 15.15 mg.
Adlin (2008) and Faigin (2001)reported that the content of a banana peel was55.59%, calcium 0.36%, Phosphor 0.10% and gross energy3727 kcal/kg. Banana peel also contains vitamins C, E, andB6. Vitamin C can act as an antioxidant, while serotonin isthought to play an anti-depressant so as to increase feed intakeand body weight on heat stress conditions.

Table (2): Mineral composition of dry banana and mango peels (mg / 100g):

	Fruits	
Elements (mg/100g dry peel)	**banana**	**Mango**
calcium	19.86 ± 0.24	60.63± 4.58
zinc	1.72 ± 0.17	0.66 ± 0.06
Iron	15.15 ± 0.36	12.79±1.56
Manganese	9.05 ± 0.34	4.77 ± 0.22

Values are means ± standard deviations of three independent analyses.

Body weight gain,total feed intakeand feed efficiency ratio of rats suffering from lead toxicity.

Theresults in Table (3) showed that the control positive reduction in feed intake, body weight gain and feed efficiency when rats exposed to lead toxicity (-8.0, 5.48 and-0.44) compared to negative control group was 13.01, 7.96 and 0.62, respectively. While rats were feed separately 15 % banana peels, mango peels and mixturebanana and mango peelsfortified with basal diet showed that significant increasing values compared with the positive group and the formula 3 (15% mixture with banana and mango peels) give the best result. The present results are supported by the study of the **MingeumJeong et al. (2015)** who reported that body weight of rats treated with 17α-ethinyloestradiol for 6 weeks were lower than that measured in the control group. Dietary guidelines have recommended increased intakes of fruits and vegetables **(Willett et al., 1995)**. The rationale for such a hypothesis of weight loss with increased intake of fruits is based on three premises: the low-energy density of most fruits, their higher fiber composition and a less striking variation of diets high in fruit. In support of this hypothesis, **(Howarth et al., 2001)** indicated that, under fixed energy intake, soluble or insoluble fiber intake increases post meal satiety and decreases subsequent hunger. In addition, this review suggested, at least for short-term follow-up, that high fiber diets decrease energy intake and body weight. Fruit consumption has a potential role in the prevention of overweight and obesity **(Tetens and Alinia, 2009)**.

Table (3): Body weightgain,total feed intakeand feed efficiency ratio of rats suffering from lead toxicity.

Groups	Initial body weight (g)	Body weight gain (g)	Total feed intake (g/day)	Feed efficiency ratio
Control negative	74.0 ± 2.60^{a}	$15.01 \pm 2.25^{a,b}$	7.96 ± 1.02^{b}	0.53 ± 1.02^{a}
Control positive	71.2 ± 3.58^{a}	-8.0 ± 1.30^{d}	5.48 ± 1.01^{c}	-0.44 ± 0.03^{b}
Group 1	73.2 ± 2.44^{a}	$12.93 \pm 2.21^{a,b}$	7.18 ± 0.97^{b}	$0.45 \pm 0.07^{a,b}$
Group 2	72.8 ± 3.47^{a}	$13.33 \pm 0.77^{a,b}$	7.28 ± 0.87^{b}	$0.47 \pm 0.06^{a,b}$
Group 3	69.4 ± 9.85^{a}	19.31 ± 2.97^{a}	9.91 ± 1.01^{a}	$0.48 \pm 0.92^{a,b}$

Values are expressed as mean ± SD.- Significant at $p<0.05$ using one way ANOVA test.- Values which have different letters in each column differ significantly, while those with have similar or letters are not significant

Weight of relative organs rats suffering from lead toxicity

Table (4) revealed that the results of mean weight value the organs as liver, kidney and tibia.These organs were increased when rats exposed to lead toxicity (control positive) 5.12, 1.21 and 1.93 %, respectively compared with negative control group was 2.92, 1.08 and 0.89%, respectively.

Table (4): Percent of relative organs weight in rats suffering from lead toxicity.

.Groups	Weigh of organs rats		
	Liver (%)	Kidney (%)	Tibia (%)
Control negative	2.92±0.42[b]	1.08±0.24[a]	0.89±0.08[b]
Control positive	5.12±0.22[a]	1.21±0.76[a]	1.93±0.43[a]
Group 1	2.99±0.35[b]	0.89±0.11[a,b]	1.47±0.41[a,b]
Group 2	2.15±0.32[b]	0.92±0.52[a,b]	1.39±0.43 [a ,b]
Group 3	3.02±0.07[a]	1.18±0.16[a]	1.31±0.54[a]

Values are expressed as mean ± SD.- Significant at $p<0.05$ using one way ANOVA test.- Values which have different letters in each column differ significantly, while those with have similar or letters are not significant

Serum lead, iron and blood hemoglobinof rats suffering from lead toxicity.

The concentration of lead and iron in serum and blood hemoglobin were determined and the results are reported tin Table (5). The concentration of lead in serum was increased significantly when rats were exposed to lead toxicity 41.13 mg/dl (control positive) compared with negative control group was 29.29 mg/dl. When rats fed 15% mixture of banana and mango peels significant reduction in serum lead level compared with positive control group which was close to the normal rats control group. These results were agreement with **Esfandiar and Mahmoud (2012) and El-Nahal(2010)** they showed that, serum lead levels decreased significantly ($p< 0.05$) in the artichoke- treated group compared to lead-intoxicated rats without treatment.

While the serum concentration of iron and the value of hemoglobin in blood were significantly decreased in control positive (26.11 and 9.79 mg/dl)than the negative control group was 38.93 and12.91 mg/dl.The rats fed on mixture of banana and mango peelswas significant increased in serum iron level and hemoglobin in blood (33.91 and 12.96 mg/dl) than positive control group. Which are similar results to that recorded by **Khanet al.(2008) andEl-Nahal(2010)** who showed that the lead acetate administration lead to reduced Hb and PCV. Similarly, **Szymezak et**

al.(1983) observed that Hb level was reduced after intoxication with lead acetate in dose of 400 mg / kgof the fodder. The results were agreed with that obtained by**Ali andBlunden (2003)** who reported that treatment of rats with the black cumin seeds extract for 12 weeks has induced an increased in the hemoglobin level.

Table (5): Serum lead, iron and blood hemoglobinof rats suffering from lead toxicity.

Groups	Serum lead (mg/ dl)	Serum iron(mg/dl)	Blood hemoglobin (mg/dl)
Control negative	29.29±5.07[b]	38.93±4.71[a]	12.91±1.50[a]
Control positive	41.13±5.74[a]	26.11±5.38[b]	9.79±0.40[b]
Group 1	31.42±3.45[a,b]	32.87±7.06[b]	11.94±1.05[a,b]
Group 2	32.81±2.41[a,b]	31.73±1.06 [b]	11.54±0.68[a,b]
Group 3	29.52±0.32[b]	33.91±5.08[a]	12.96±1.06[a]

Values are expressed as mean ± SD.- Significant at $p<0.05$ using one way ANOVA test.- Values *which have different letters in each column differ significantly, while those with have similar or letters are not significant*

Calcium, phosphorus and lead in Tibia of rats suffering from lead toxicity

Table (6) revealed that the results concentration of both calcium and phosphorus in tibia rats experimental were significantly decreased when rats were exposed to lead toxicity (control positive) 6.11, 5.11g/100g and 443mg/kg compared with negative control group were 9.81, 8.16 g/100g and 0.311mg/kg, respectively. The rats fed onmixture from banana andmango peelsthe results showed that significant increasedin calcium and phosphorus concentration in tibia 8.50 and 7.16 g/100g compared with the positive control group. On the contrary lead concentration in bone was significant decreased (0.351 mg/kg) compared with rats fed on banana and mango peels was 0.361 and 0.390 mg/kg, respectively. These results were agreement with**Abd -Elhalim et al. (2008) , Hamiltom andFlaherty (1994) and Bagchi andPreuss(2005)** who found that lead accumulation in rats has caused reduction in femoral bone mass density (BMD) compared with the untreated rats with lead intoxicated of similar age.**Imran et**

al.(2011),Chen et al. (2010) and Naser et al. (2015) concluded that banana and mango peels improve the concentration of calcium, phosphorous in bone as well as lead in bone of intoxicated rats

Table (6): Calcium, phosphorus and lead in Tibia of rats suffering from lead toxicity.

Groups	Calcium (g/100g)	Phosphorus (g/100g)	Lead (mg/Kg)
Control negative	9.81±1.00[a]	8.16±0.96[a]	0.311±0.465[b]
Control positive	6.11±0.30[b]	5.11±2.05[b]	0.443±0.510[a]
Group 1	7.80±0.50[a,b]	6.18±1.80[a]	0.361±0.115[a,b]
Group 2	7.11±0.10[a,b]	6.00±1.10[a]	0.390±0.345[a,b]
Group 3	8.50±1.00[a]	7.16±0.70[a]	0.351±0.362[b]

Values are expressed as mean ± SD.- Significant at $p<0.05$ using one way ANOVA test.- Values which have different letters in each column differ significantly, while those with have similar or letters are not significant

Effect of banana and mango peels on serum liver enzymes of rats suffering from lead toxicity.

Results in Table (7) showed that rats were exposed to lead toxicity control positive was significantly increased level of aspartate amino transferase(AST) and alanine amino transferase (ALT) in serum (104.92 and 35.94 U/L) compared with negative control group was 65.00 and 12.92 U/L, respectively. The resultant in the same table revealed that the rats fed on banana peels;mangopeels and mixture of them were reduction in the elevated serum activity of AST and ALT level compared with positive group. These results agreement with **(Khan et al., 2008, Saeed .,2015 and El - Tantawy ., 2015)** who reported that, the activities of ALT and AST in serum were significantly increased in lead exposed rats**(Mosa and Khalil, 2015, El Makawy et al , 2015)**showed that banana peelsand mango peels have good protective effects against acute hepatic injury in rats.

Table (7):- Effect of banana and mango peels on serum liver enzyme of rats suffering from lead toxicity.

Groups	Serum AST(U/L)	Serum ALT(U/L)
Control negative	65.00±11.10[c]	12.92±3.63[c]
Control positive	104.92±3.11[a]	35.94±26.79[a]
Group 1	85.67±24.51[b]	21.10±17.54[b]
Group 2	89.61±31.14[b]	25.34±17.11[a,b]
Group 3	82.11±51.10[b]	19.61±13.17[b]

Values are expressed as mean ± SD.- Significant at $p<0.05$ using one way ANOVA test.- Values *which have different letters in each column differ significantly, while those with have similar or letters are not significant*

Effect of banana and mango peels on serum kidney functions of rats suffering from lead toxicity.

Results in Table (8) also showed that increased in the concentration of uric acid, urea and creatinine in positive group (2.87, 147.92 and 0.98 mg/dl) than negative control group was 1.82, 97.21 and 0.57 mg/dl, respectively.Whereas, the rats fed banana peels,mango peels and combination of them were significant reduction and the best result group was fed on mixturebanana and mango peels. These results are agreement with **El- Shenawy et al. (2009), Nabil et al. (2013), Abd El-Ghany et al. (2015) and Salah et al. (2015)** they reported that there were significant increased in serum creatinine, urea, uric acid and globulin of lead intoxicated rats**.** The results from this study revealed that rats treated with the aqueous extracts of the three cultivars of Musa acuminata pose no threat to the liver. Conversely, aqueous extracts of Saro cultivars showed increase in the biomarkers of the kidney. Thus, intake of peel extracts of M. acuminata,particularly the Saro cultivar, as a drug might lead to potential kidney problems in the management and/or treatment of hypertension and other cardiovascular related diseases (**ChidiEdenta et al, 2017)**.

Table (8):- Effect of banana and mango peels on serum kidney functions of rats suffering from lead toxicity.

Groups	Uric acid (mg/dl	Urea (mg/dl)	Creatinine (mg/dl)
Control negative	1.82±0.26[c]	97.21±16.10[d]	0.57±0.27[c]
Control positive	2.87±0.71[a]	147.92±43.60[a]	0.98±0.47[a]
Group 1	2.00 ±0.04[a,b]	104.91±4.00[c]	0.64±0.07[c,b]
Group 2	2.01±0.034[a]	109.05±83.10[c]	0.68±0.08[c]
Group 3	1.81±0.27[c]	103.12±3.11[c]	0.63±0.53 [b, c]

Values are expressed as mean ± SD.- Significant at $p<0.05$ using one way ANOVA test.- Values which have different letters in each column differ significantly, while those with have similar or letters are not significant

Histopathologicalresults:

The histopathological results were agreedand in same line with the results of serum parameters.

<u>Histopathological Changes of liver:</u>

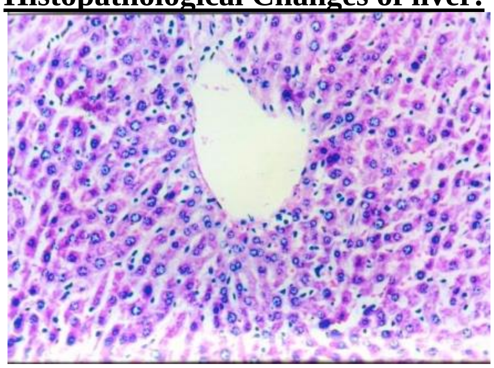


Photo. (1): Liver of control –ve rat showing the normal histological structure of hepatic lobule (Hand E X 200).

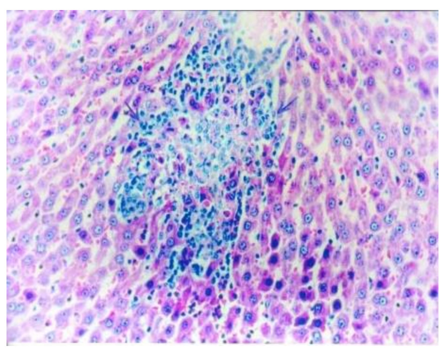


Photo. (2): Liver of control +ve rat showing focal area of hepatic necrosis completely replaced by leucocytic cells infiltration (Hand E X 200).

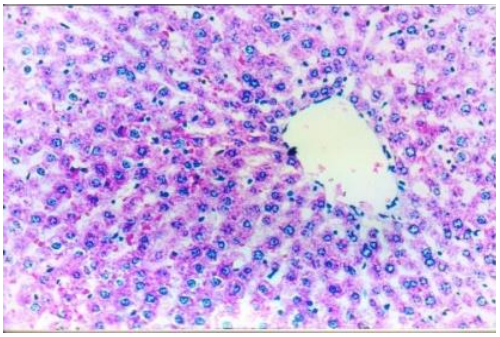
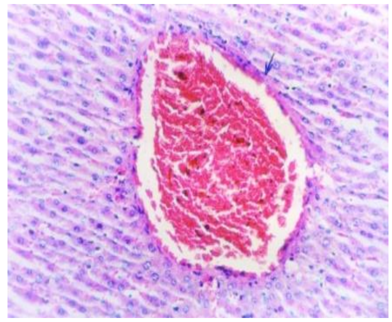


Photo. (3): Liver of intoxicated rat fed on diet containing “1 5% banana peels" showing no histopathological changes (Hand E X 200).



Photo(4): Liver of intoxicated rat fed on diet containing " 1 5% mango peels " showing dilatation and congestion of central vein (Hand E X 200).

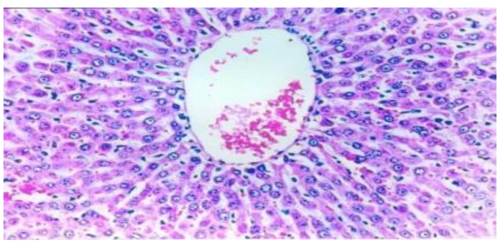


Photo (5): Liverof intoxicated rat fed on diet containing " 7.5% banana peels and 7.5 mango peels " showing no histopathological changes (Hand E X 200).

Histopathological Changes of bone:

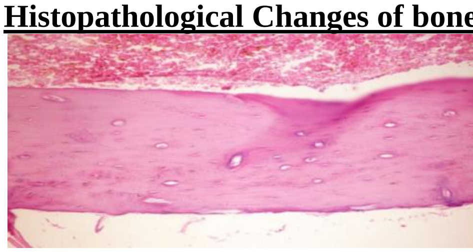


Photo. (6): Bone of rat from control negative group fed on basal diet showing no histopathological changes (H & E X 200).

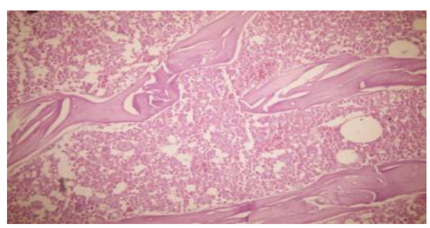


Photo. (7): Bone of rat exposed to lead toxicity as “positive control group" showing thin trabecular bones and enlarged medullary cavity (H & E X 200).

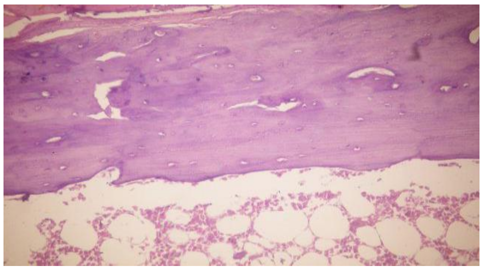


Photo. (8): Bone of intoxicated rat fed on diet containing 15% banana peels showing normal thickness cortical bone (H & E X 200).

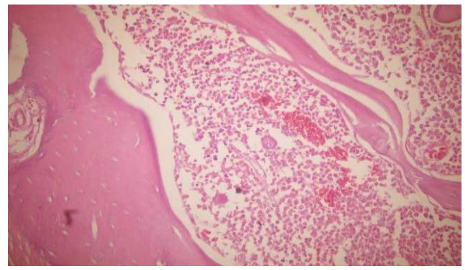


Photo. (9): Bone of intoxicated rat fed on diet containing 15% mango peels showing no histopathological changes (H & E X 200).

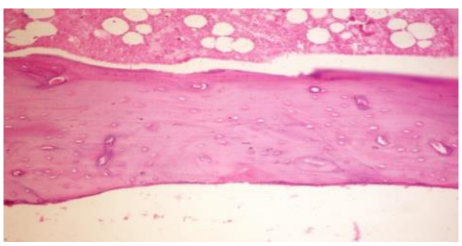


Photo. (10): Bone of intoxicated rat fed on diet containing 15% mix. of all dried peels showing no histopathological changes (H & E X 200).

Conclusion and recommendations:

The present study is scientifically proved that dried banana peels and dried mango peels intake produced great therapeutic effects against lead toxicity and improvements serum lead, iron, blood hemoglobin, calcium, phosphorous, bone, liver enzyme activities and kidney function. The best results showed in group fed diet contain (15%) mix of dried banana and mango peels compare another groups .They could be considered a cheapest nutritious food supplement for sensitive groups .Raising the nutrition awareness with such fruit type for its qualities and biologically effects, it deserves and paying attention for its cultivation, marketing, storage and technological food industries.

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التاثير الوقائى لقشور الموز و المانجو الجافه ضد سميه الرصاص فى الجرذان

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الملخص العربى

تهدف هذه الدراسه لمعرفه تاثير اضافه كلا من قشر الموز و قشر المانجو المجففان للوجبه الأساسية ضد سميه الرصاص فى الجرذان. تم اجراء الدراسه على عدد (45) جرذ من نوع ذكر الالبينو البيضاء فى فترة النمو وتم تقسيمهم الى مجموعتين رئيسيتين, المجموعة الاولى(المجموعه الضابطه السالبه) (٩) جرذان. اما المجموعة الثانيه (36) جرذ قد تعرضت للتسمم بالرصاص و قسمت الى اربع مجموعات بكلا منها (٩) جرذان. المجموعه الاولى تغذت على الغذاء الاساسى (المجموعة الضابطه الموجبه) و الثانيه تغذت على الغذاء الاساسى يحتوى على (١٥%) قشر موز ,الثالثه تغذت على الغذاء الاساسى يحتوى على (١٥%) قشر مانجو, الرابعه تغذت على الغذاء الاساسى يحتوى على (١٥%) خليط (٧.٥% قشر موز + ٧.٥% قشر مانجو) لمده (٦) اسابيع. اثناء فترة التجربة تم حساب كلا من معدل الزيادة فى وزن الجسم , كمية الطعام المتناول و كذلك معدل كفأة الغذاء و فى نهايه التجربة تم تجميع عينات الدم وتقدير هيموجلوبين الدم ثم تقدير كلا من الحديد ,الرصاص , انزيمات الكبد, ووظائف الكلى فى السيرم و تقدير كلا من مستوى الكالسيوم و الفسفور و الرصاص فى العظام. اظهرت النتائج ان الجرذان التى تناولت خليط قشور الموز و المانجو كانت تمثل افضل النتائج فى معدل الزياده فى الوزن و الطعام المتناول و معدل كفأة الطعام و تحسين فى مستوى الهيموجلوبين و الحيد و انزيمات الكبد ووظائف الكلى و حدوث انخفاض فى مستوى الرصاص فى السيرم مقارنه بالمجموعة الضابطة الموجبة و اكدت نتائج الفحص الهستوباثولوجى نفس النتائج السابقه. لذلك توصى الدراسه بعمل برامج للتوعيه الغذائيه لتوضيح اهميه قشور الموز و المانجو فى خفض خطر الاصابه أو التلوث بالتسمم بالرصاص.

الكلمات المفتاحيه: التسمم بالرصاص , قشر الموز, قشر المانجو.