The Role of Aloe vera against the toxic effect of cadmium in mice

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Abstract

In this study oral supplementation of aloe Vera (1%). w/v in drink water during cd exposure (0.1 mg/kg,intraperitonelly once daily for one month) was investigated in mice for its effective value .animals exposed to cd showed a marginal decrease in glutathione (GSH) and increase white blood corpuscular (WBC) level ,while most of the other clinical blood parameters like red blood cell count (RBCs),hemoglobin,MCV,MCH,MCHC, recorder significant decrease at ($P < 5\%$) in cadmium exposure due to the cadmium after binding to RBC membrane stimulate the ROS and causes the oxidative.Damage to RBC membrane ratio& platelet number, resulting in decrease in hemoglobin.Hepatic reduced GSH,while the activity of alkaline phosphate (ALP),aspartate amino transfers (AST),alanine amino transfers (ALT)& with super oxide dismutase (SOD) activity increase significantly in cadmium exposure due to leakage of enzyme from cytosol of liver that might have entered into blood stream.Concomitant administration of aloe Vera had no protective action against the effect cadmium due to most of biochemical parameters remained un changed with aloe Vera supplementation, so that most of hepatic biochemical variables indicative of oxidative stress show protective no effect of aloe Vera on blood &liver cadmium concentration was noted due to the toxic effect of cadmium by risk complexes formation in the body.

Introduction

Cadmium (cd) is trace element present in soil, water, cd compounds may represent a concern to environmental& occupational health becoming as a result of natural or anthropogenic source ⁽¹⁾. Cd has a century long his troy as human poison &cases of acute intoxication due to oral ingestion ⁽¹⁶⁾. exposure to cd cause damage &ultimately cancer of the skin &various organs including liver & lungs& testes & ovaries & kidneys failure ⁽²⁴⁾.abnormalities of the peripheral vascular &disease of cerebra, vascular &reproductive failure has also been reported in people chronically exposed to cd ^(3,18).The heme metabolism is known to susceptible to alterations induced by drugs and environmental chemicals, offering the chance to use these changes as indicator of damage caused by cd.since most conventional metal chelating agents have toxic side effects or disadvantage ⁽¹⁵⁾. The possibility of dietary intervention or supplementation with naturally occurring dietary nutrients'.To prevent the effects of cd

in populations Of risk, it of interest apositve correlation has also been established between dietary supplementation with certain of vegetables &plants &the reduction of toxic effects of various toxicants, environmental agents including heavy metals ⁽¹⁷⁾.aloe Vera (aloe barbadensis) is used in the traditional medicine of many cultures &said to be beneficial dermatitis &wounds such as peptic ulcer &burns ^(8,18).the fresh gel ,juice &formulated products &have long been used for medical&cosmetic purposes &general health^(5 ,25).in spite of its wide use in folk remedies any influence on various heavy metals metalloid induced altered biochmical&physiological processes have not yet been described indetalis in the present study ,we report the influence of concomitant administration of aloe Vera on cd induced haemological &hepatic disorders in male mice, blood &liver cd concentration too were determination.

Materials and Methods

Chemicals:-cdcl₂ (sigma chemical ,sit louis,MO,USA).aloe Vera was purchased from a local source, (safed musalifarms, Gwalior, india) ground in a blender dissolved ¢rifuged at 5,000 R to remove the fibers . the supernatant stored at room temperature. small quantity of water was added to each of portion of lyophilized aloe Vera powder &the gel was prepared.Experimental animals:-40 male mice weighting (30-35)-gm housed in same condition in stainless cages in air-conditioned room with temperature maintained at 26-27 ° &12h alternating day &night cycles. Mice were allowed standard rat chow diet &vegetables' metal contents of diet in p.p.m(Cu10.0 ZN 40.0,MN 50.0,CO 5.0, Fe75.0) 40 mice were divided randomizly into 4 groups of 10 mice each one have10 mice were treated as below for the period of 1 month. the groups of animals included:-Group(1)as control animals, Group(2)were give Aloe -Vera at 1%in drinking water (w/v),Group (3)-were give cadmium 0.1mg/kg intraperitonally were given ,Group (4)-were give cadmium (0.1mg/kg+Aloe Vera 1%) in drinking water. once.daily the food &water intake was recorded &mice were weighted at the end of weeks one day after the last dose the animals were sacrificed under light ether anesthesia .blood was collected by direct cardiac puncture in heparin zed tubes . one half portion of liver &kidneys were removed ,rinsed in cold saline, weighed &used for various biochemical's variables &metal analysis,the remaining was stored at -20° wet acid digestion with HNO₃ for the determination of blood GSH concentration⁽⁷⁾. 200µl of whole blood was added to 200µl of 10mM solution of (2nitro benzoic acid) (DTNB) in phosphate buffer (pH=7.5) containing 17.5mM Na₂EDTA.samples were centrifuged at 2,000 R for 6min& supernatant used for assay.super oxide dismutase (SOD) activity in brain was assayed spectrophotometrically as described

by⁽⁵⁾. 2.8 ml of reactive mixture (xanthine 0.3mM,EDTAo.67mM,150µM nitroetraazolium blue chloride (NBT),sodium carbonate 0.4 M &bovine albumin 30 mg/30ml) is added to 0.1 ml sample &50µLxanthine oxides incubated at 25 ° for 20 min &mixed with 0.1 ml 8 M copper chloride, the color reaction was measured at 560nm .The activities of alkaline &acid phosphates the (ALP) acid phosphate (ACP) were determined &described by⁽⁹⁾, (a total of 0.5ml of the homogenate was react with 0.1 ml of triton x-100.4ml quantity of alkaline or acid buffer was added to this &the mixture was incubated at 37 ° for 1h.After incubation 0.5ml of 30%trichloroacetic acid (TCA) was added to stop the reaction .the mixture was centrifuged, 2ml of the supernatant were mixed with 6.6ml of distilled water, 1ml of 2.5%ammonium molybdate &0.4 ml of amino-naphol sulfuric acid.optical density was measured at 620nm & the phosphorus liberated was calculated.(ALT,AST) activities were measured in liver⁽²⁰⁾, (the assay system contain 1ml of buffer /substrate solution 0.2ml of liver homogenate (10%w/v) incubated for exactly 60min for (ALT)&30min for (AST) at 37 ° in water bath 1ml of chromogen solution was added , mixed &allowed to stand for 20min at room temperature 10ml of 0.4N NaoH was added subsequently. the extrication was read at 505 nm against blank .the substrate being added after deproteinization. estimation (cd concentration in blood ,liver &kidneys were measured after wet acid digestion using microwave digestion system (CEM,MATTEWS,NC,USA,model MDs-2100).cd was estimated using hydride vapor generation system (Perkin Elmer Model MHS-10) fitted with an atomic absorption spectrophotometer (A AS,perkin Elmer &model A Analytical 100: Uberlingen, Germeny.

Statistical analysis: T-standard test was applied⁽¹⁹⁾.

Results

Table (1) showed the mean hemoglobin (Hb) value in all the fore groups. There was significant decrease ($P<0.05$) in mean value of hemoglobin in cadmium chloride alone treated mice (Group 3) as compared to control (Group 1). However, the mean value in Cadmium chloride with aloe Vera whole plant supernatant (Group 4) was significantly not improved than cadmium chloride alone (Group 3). due to oxidative damage of RBCS membrane Table 2:- summaries serum aspartate. Transaminase & alanine amino transaminase

in control and treatment mice, there Was no significant alterations in serum AST, ALT levels. In normal mice and the values were in normal Limit. In cadmium chloride treated mice (Group 3). There was significant decrease ($P<0.05$) in AST&ALT&ACP Levels as compared to control (Group 1). However, cadmium chloride with Aloe Vera (Group 4) compare with control (Group 1) also recorded decrease in this enzyme due to Hepatic injury following cd exposure, while depletion of SOD activity further support cd induced oxidative injury.

Table (1) some physiological parameters of blood in experimental mice.

Groups Para- meters	G ₁ Control M $\pm$ SE	G ₂ aloe vera (1%) M $\pm$ SE	G ₃ cadmium(0.1 M $\pm$ SE	G ₄ aloe vera 1%+cadmium 1% M $\pm$ SE
PCV %	40.4 $\pm$ 3.8	40.0 $\pm$ 3.0	39.6 $\pm$ 3.0	39.8 $\pm$ 5.0
RBCs*10 ⁶ μ l	8.2 $\pm$ 0.90	8.45 $\pm$ 0.6	7.90 $\pm$ 0.2	8.0 $\pm$ 0.9
HB g/dl	13.1 $\pm$ 1.5	13.4 $\pm$ 1.1	13.0 $\pm$ 2.2	13.2 $\pm$ 0.3
MCV ft	49.1 $\pm$ 3.4	49.0 $\pm$ 3.3	48.0 $\pm$ 2.9	47.6 $\pm$ 3.8
McHc %	32.3 $\pm$ 1.4	31.5 $\pm$ 2.9	31.2 $\pm$ 3.2	30.9 $\pm$ 3.1
MCH pg	15.9 $\pm$ 1.1	15.7 $\pm$ 1.3	14.0 $\pm$ 0.1	14.5 $\pm$ 0.9
Platelet count*10 ³ μ l	1.95 $\pm$ 1.0	1.88 $\pm$ 1.32	2.01 $\pm$ 1.5	2.05 $\pm$ 1.6
WBCS/ μ l	6.33 $\pm$ 3.7	6.30 $\pm$ 3.5	7.23 $\pm$ 2.7	7.02 $\pm$ 2.9

• Each group contained ten mice. Mean values in columns with different superscript are significantly variable ($P<0.05$). Mean values in columns with similar superscript are not significantly variable ($P<0.05$).

Table (2) some biochemical's parameters in experimental mice

Parameters	Control group (G1) M $\pm$ SE	Aloe Vera 1% (G2) M $\pm$ SE	Cd 0.1mg/kg I.p (G3) M $\pm$ SE	Cd 0.1mg/kg+Aloe Vera 1% G4 M $\pm$ SE
GSH	4.3 $\pm$ 0.01	4.4 $\pm$ 0.02	4.2 $\pm$ 0.01	4.0 $\pm$ 0.01
ALP	1.48 $\pm$ 0.5	1.5 $\pm$ 0.13	0.86 $\pm$ 0.09	0.75 $\pm$ 0.04
ACP $\circ$	2.47 $\pm$ 0.21	2.3 $\pm$ 0.10	2.57 $\pm$ 0.22	2.2 $\pm$ 0.11
AST	4.0 $\pm$ 0.01	4.2 $\pm$ 0.03	3.93 $\pm$ 0.06	3.88 $\pm$ 0.08
ALT	5.8 $\pm$ 0.34	5.4 $\pm$ 0.24	4.88 $\pm$ 0.12	4.19 $\pm$ 0.22
SOD $\circ$	1.63 $\pm$ 0.14	1.62 $\pm$ 0.21	1.58 $\pm$ 0.16	1.60 $\pm$ 0.24

Table (3) the cadmium concentration in liver and kidneys in all groups

Groups	LIVER	KIDNEYS
	M $\pm$ SE	M $\pm$ SE
G1 control	7.2 $\pm$ 0.32	2.1 $\pm$ 0.03
G2 Aloe Vera	7.3 $\pm$ 0.18	2.4 $\pm$ 0.25
G3 cadmium	8.3 $\pm$ 0.56	3.0 $\pm$ 0.15
G4cd+Aloe Vera	8.3 $\pm$ 0.21	3.2 $\pm$ 0.20

Discussion

The animal did not show any abnormal behavior & none done during the experimental period .blood cadmium concentration & changes in some physiological variables in blood of cadmium exposed animals are presented in table (1) Similar observations were recorded where cadmium after binding to RBC membrane stimulate the ROS and causes the oxidative damage to RBC membrane, resulting in decrease in hemoglobin ⁽²²⁾.The hemoglobin levels in mice were decreased after 2 weeks when cadmium was administered in the dose of 500 p.p.m in drinking water as reported by ^(6,19) in rats for compare with mice ⁽¹²⁾.The changes in some hepatic biochemical variable indicative of oxidative stress following exposure to cd either alone, The concentrations of biomarker enzymes namely ALT and AST were increased in serum due to leakage of enzyme from cytosol of liver that might have entered into blood stream which could have been the reason for increased levels of these enzymes in cadmium chloride treated mice, These enzymes have been proved to be an excellent indicator of cadmium chloride-induced hepatocellular damage in mice ⁽²¹⁾.In combination with aloe Vera reported in table (2) marginal decrease in reduced GSH

contents was noted while oxidative glutathione contents remained un changed on cd exposure, hepatic ALP activity decreased ,while no significant change in ACP activity was noted a decrease in cellular GSH concentration has been inversely correlated with lipid peroxidation in the liver ^(13,14) therefore the in increase GSH could presumably protect the organ from cadmium induced lipid peroxidation A marginal decrease in hepatic GSH correlated with increase in hepatic cd concentration A significant decrease in AST&ALT activates suggests hepatic injury following cd exposure, while depletion of SOD activity further support cd induced oxidative injury(table2) co-administration of aloe Vera ,particularly at the highest does, provided a significant recovery in the depleted AST&ALT,SOD activities while the two lower doses had no effect ⁽¹⁴⁾. reported a significant & apparent role for decreased activity of SOD in the induction of aloe Vera has not been described in details ⁽²⁴⁾.Recently reported antioxidant components in aloe Vera such as isorabaichromone showed a potent anti oxidative activity & super oxide anion scavenging activities ⁽¹⁹⁾.

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الدور التضادي لنبات الصبر ضد التأثير السمي للكاديوم في الفئران

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الخلاصة

تمت دراسة تأثير نبات الصبر المجهز في ماء الشرب بنسبة 1% مع الكاديوم الذي تم حقنة في البريتون بنسبة 0,1 ملغم /كغم من وزن الجسم في الفئران , إذ لوحظ انه في حالة إعطاء الكاديوم بشكل مفرد حدوث ارتفاع ملحوظ في معظم المعايير الفسلجة والكيوحيوية تحت مستوى معنوي 5% شملت (عدد كريات الدم البيض,وكريات الدم الحمراء,ونسب الهيوكلوبين وأعداد الصفيحات الدموية, وأنزيمات الكبد المتمثلة بالأنزيمات الناقلة للامين AST,ALT إضافة إلى أنزيم SOD التاكسدي وALP,ACP الأنزيمات الحامضية والقاعدية) يعود السبب في ذلك إلى ان الكاديوم يرتبط مع كريات الدم الحمراء ومن ثم حفز عملية الاكسدة المدمرة للكريات. أما ما يخص الارتفاع الملحوظ لكريات الدم البيض فسببها هو الجهاز المناعي كردود فعل طبيعية في حالات الالتهابات. كما يشار إلى الارتفاع الحاصل في معظم أنزيمات الكبد إلى التأثير السمي للكاديوم على الخلايا الكبدية, كما ان إعطاء نبات الصبر بشكل مرافق لحقن الكاديوم لم يسجل أي تغير وقائي مضاد واضح في معظم المعايير المذكورة أعلاه وحتى في تركيز الكاديوم في تلك الأعضاء بسبب الجهد التاكسدي الحاد للكاديوم وتكوينه المعقدات الضارة للجسم.