



**THE EFFECT OF CAMEL MILK IN THE TISSUE CHANGES TO THE LIVER OF
LABORATORY MALE RATS TREATED BY CADMIUM**

Lamyaa K. Al-Asskry*¹, Khalid G. Al-Fortosi² and Majde Alali³

¹Department of Pathological Analysis / College of Science / Thi -Qar University- Iraq.

²Department of Biology / College of Science / Thi-Qar University- Iraq.

³Department of Anatomy and Tissue / College of Veterinary Medicine / Basra- University- Iraq.

* Corresponding Author: Lamyaa K. Al-Asskry

Department of Pathological Analysis / College of Science / Thi -Qar University- Iraq.

Article Received on 22/03/2016

Article Revised on 12/04/2016

Article Accepted on 02/05/2016

ABSTRACT

The present study incorporated the effect of milk of camels in histopathological changes in liver organ of laboratory male rats. the study was carried out on 72 mature male laboratory white rats. The males were randomly divided into forth equal groups, each group consist of 12 rats. The first group was intraperitoneally treated with 0.2ml normal 0.9% NaCl physiological saline solution as the control group. The second group was orally given 1ml of camel's milk. the third group was intraperitoneally injected 0.2ml Cadmium chloride (1, mg/kg body weight). The fourth groups was also intraperitoneally injected 0.2ml with Cadmium chloride (1, mg /kg body weight) intraperitoneally then orally given 1ml of camel's milk .the study continue for 30 successive days and the animals weight was measured at the end of each week. The end of the experimental period, sixth animals from each group were sacrificed, The histopathological study has obtain samples from internal organ liver which kept in proven solution to paving preparing tissues sections and the treatment laboratory rats by chloride cadmium. The infection caused aggregation inflammatory cells infiltration, necrosis, degeneration, vagulation of hepatocytes, enlargement of sinusoids, congestion of the central portal vein, besides fibrosis and edema statuses .the treatment with camel's milk was improved in histopathological changes. While, the severity of histopathological changes was decreasing that caused by using of cadmium chloride, the treatment by camel's milk was highly effective in the improvement the changes and repair the histological damages.

KEYWORDS: camel milk, cadmium chloride, laboratory rats, liver.

INTRODUCTION

The liver achieves many important functions of the body's metabolic processes that take place on the proteins, fats and carbohydrates, as well as his role in the plasma protein synthesis. It is one of the most vital organs that have the functions of President during fetal life and after birth (Brzoska et al., 2002). Moreover, liver is an important organ to preserve the body from toxic materials by turning it into less harmful or compounds compounds soluble in water. phagocyte property of some cells and harmful compounds in the blood and so to be easily secreted by the kidney, it is also the liver filtering and cleaning the blood (Hristev et al., 2008). The liver is considered to be the targeted organ first when exposed to cadmium when half of the cadmium absorbed from the body accumulates in the liver quickly (Delraso et al., 2003) for its ability to accumulate soft tissue causing functional changes in the liver tissue (Esrefoglu et al., 2007) where gravity lies in the ease absorbed through the digestive and respiratory organs and in general target kidney, liver and proved that the kidney, liver we store large amounts of cadmium (Thijssen et al., 2007).

Camel milk has a very high percentage of metallic elements such as iron, copper, manganese, sodium, calcium and magnesium (Al-Hashem, 2009) if vitamins and minerals rates increase with the progress during lactation. It has on the effectiveness of protective proteins against bacteria and viruses such as Lacto peroxidase and Lactoferrin and Lysozyme. (Mal and Pathak, 2010). It works to activate Cisplatin used in the treatment of various cancer cases (Al-Numair., 2011) and as an antioxidant, which plays a role in the uptake and the reduction of toxicity of heavy metals (Yilidirim., 2009). The present study aimed to know the influence of toxic cadmium on the liver and the positive impact of camel milk of the elimination of toxic cadmium.

Camels milk samples

The collection of milk samples from the herd of camels with one hump of age (6-8 years). Adopted in the herd fed mainly on grass, which grows in the natural grassland in addition to the dates, bran and water. It was obtained milk samples in a way manual milking (Hand milking). Then-mediated transfer of milk refrigerator

Cooled to the laboratory, were used in the dosage experimental animals.

Laboratory Animals

Used in this study of laboratory rats type Norwegian White *Rattus norvegicus*, it was obtained from male animal house of the Biology Department / College of Science / University of Thi Qar. It ranged in age between (8-10) a week and weights between (200-250) grams. Rats placed in plastic cages and by (6) rats per cage.

Laboratory animals were treated for conditions within the 12-hour cycle of light and 12 hours of darkness and temperature (22 ± 2) m° (El-Missiry et al., 2000). Which were divided into four groups and by 6 per animal group, according to the totals below:

The first group

(a group control group Control) injected into the peritoneal cavity (IP) using a medical syringe Disposable syring capacity (1) ml to 0.2 ml of physiological solution NaCl concentration of 0.9%.

Second group: - dose orally by oral dosing tube (Stomach tube) (1) mL of camel milk.

Third group: - injected into the peritoneal cavity (IP) using a medical syringe Disposable syring capacity (1) 0.2 ml and cadmium chloride concentration of 1 mg \ kg.

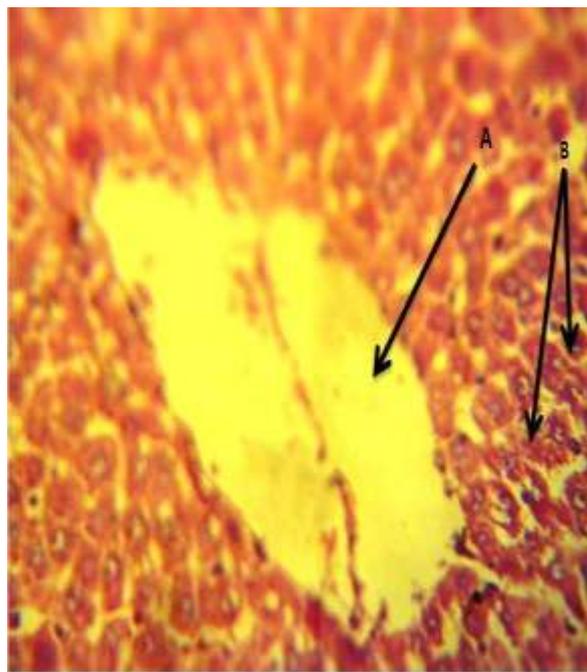
Fourth group: - injected peritoneal cavity (IP) using a medical syringe Disposable syring capacity (1) 0.2 ml and cadmium chloride concentration of 1 mg \ kg. The dose orally by oral dosing tube b (1) mL of camel milk. The dosage and injection all animals experience every day for 30 days in a row.

Dissecting animals, after ether sedation material at room temperature was nephrectomy. It was prepared slides paraffin (histological sections) according to the method described from (Humason, 1978).

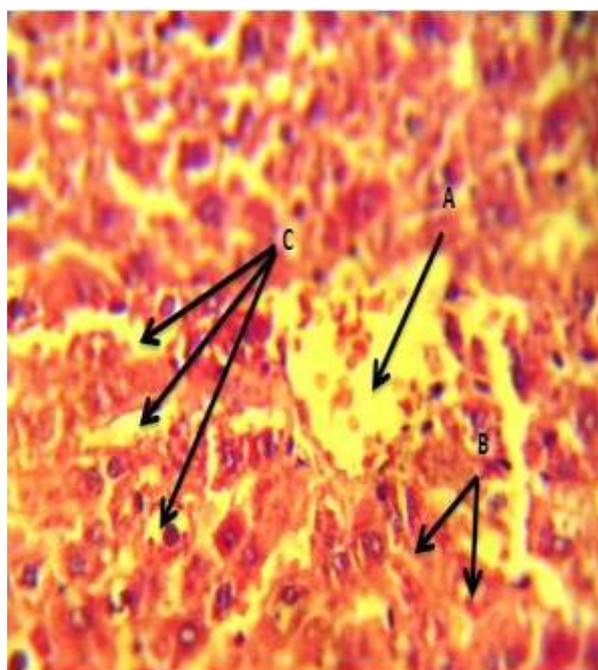
RESULTS

It showed a microscopic examination of the liver of animals group A (control group) and a group that was dosage b (1) mL of milk camels central portal vein with radial form of liver cells appears as in Figures (1.5). It was observed in the microscopic examination of the liver of animals treated with cadmium chloride concentration of 1 mg / kg of body weight histological changes represented enlargement of sinusoids and degeneration of liver tissue and necrosis of the wall of the vein central portal as shown in the Figure (2) and Figure (3) hyperpigmentation, necrosis of the cells liver, loss of the normal form of the order of cells. It was for the camel milk when used in dosages for animals group D (that have been treated with cadmium chloride and then dose camel milk a positive impact as it began effects pathological low intensity of the Figure (5) where we note a slight congestion in the central vein with a slight

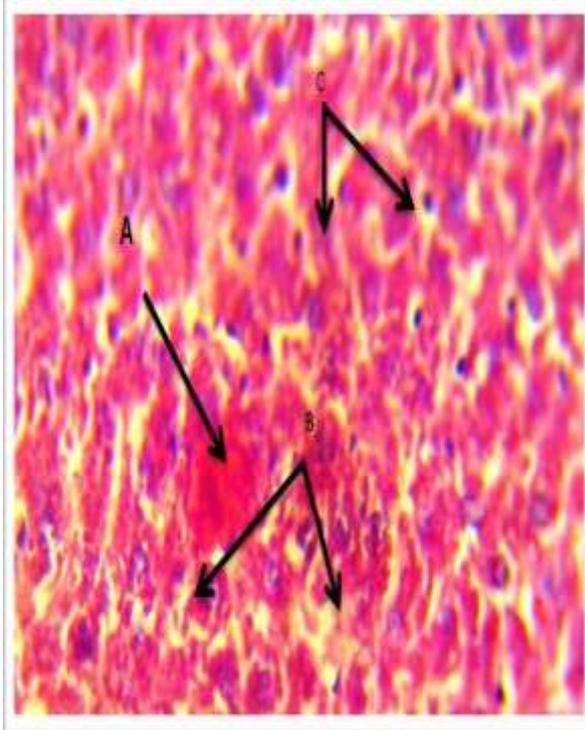
expansion sinusoids with a note form the normal arrangement of cells.



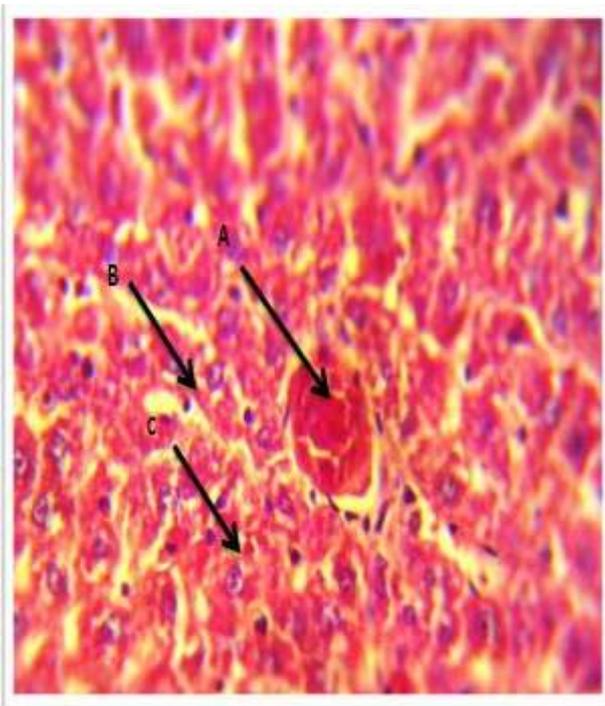
Figure(1) cross- section of the liver tissue rats control group in which notes in to portal vein (A) with the radial form of liver cells (B) power magnification (400 X) (H & E).



Figure(2) cross- section of the liver tissue rats treated 1 mg cadmium chloride per kg of body weight where noted enlargement of sinusoids (A) hepatic tissue degeneration (B) and necrosis of the central portal vein (C) power magnification (400 X) (H & E).



Figure(3) cross- section of the liver tissue rats treated 1 mg cadmium chloride per kg of body weight where noted hyperpigmentation (A) necrosis of hepatocytes (B) the loss of the normal form of the order of the cells (C) power magnification (400 X) (H & E).



Figure(4) section in the treatment of liver tissue treated by cadmium chloride and camel milk shows a slight congestion in the central vein with a slight expansion in sinusoid (B) form the normal order of the cells (C) power magnification (400 X) H & E).

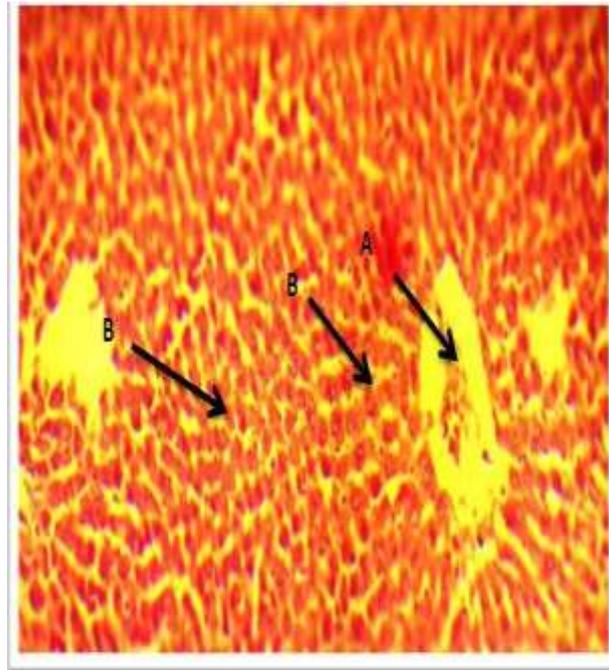


Figure (5) cross- section of the liver tissue rats camel milk doses which noted illustrates the central portal vein (A) with the radial shape of the normal liver cells (B) power magnification(400X) (H & E).

DISCUSSION

The exposure to lead and cadmium, caused a liver damage as the cause infiltration and fibrosis of hepatocytes, increase the effectiveness of enzymes amino transporter Aspartate aminotransferase (AST) and Alanine aminotransferase (ALT), in rats treated with heavy cadmium chloride, lead elements of an indication of the damage to the liver cells and disorder and its function (Jevtovic-Stonimenov *et al.*, 2003; Sipos *et al.*, 2003) by generating free radicals, which in turn affect the antioxidant defense system and thus leads to the tissue damage after exposure to cadmium for a long time (El-Sokkary *et al.*, 2005).

The natural levels of liver enzymes (ALT, AST) an indication of the safety and performance of its functions properly (Adaramoye *et al.*, 2008) and these enzymes rises when the infection acute liver but decreases when long-term exposure to lead as a result of liver damage (Jens and Hanne, 2002). the study results showed that dy, an increase in the effectiveness of the aminotransporter enzymes ALT, AST. This increase is due to the fact that cadmium known high Bofath to link with groups Asalafahdril enzymes containing Alstin and composition of complexes with amino acids and proteins, works cadmium to tear cell membranes leading to empty their contents into the blood Bustamate *et al.* stream., 2002). the direct action of cadmium which causes exposure to increased free radical free radical and understood that they were attacking the cell membranes, leading to the crash of liver cells and then leads to increase ALT, AST to blood serum (Anuradha and Palaniyandi, 2012).

The results also showed that giving camel milk with cadmium cause a decline in the concentration of enzymes to close to control rates and this may be due to reason for this to the effectiveness of camel milk in reducing the unsaturated fatty acids damage by free radicals process of oxidation meta-fat because it contains vitamin (E, C). They questions the effectiveness of anti-oxidant and thereby preserve the membranes of liver cells, which help to keep its components cellular interior and lack of leakage to the outside (Gokalp et al., 2004). It was observed satisfactory cases of minor textile included congestion and hemorrhage simple and degenerative changes and enlargement of sinusoids, and infiltration inflammatory cells around the central vein This confirms that the camel milk effective in healing the changes taking place in the liver, leading to liver tissue fullness sinusoids defense cells as a result of inflammation and perhaps this was why the expansion of the liver sinusoids where said Meredyth and Dacvim (2008) to focus and Ancharasamom accumulation occurs in the structures of the liver cells, leading to harmed and damaged.

Al-Hashem et al. (2009) implied that the use of camel milk improved the liver function in patients with hepatitis and resulted in the use of camel milk. It repairs damaged liver cells and being a rich variety of vitamins has worked vitamin C to increase the activity of enzymes that remove toxins of the liver detoxification enzymes (Ishihara et al., 2000). Also, proteins which available in camel milk have the ability to inhibit or prevent the entry of the virus that causes viral hepatitis Hepatitis C virus (HCV) and compounded within the cellular system has been noticed that lactoferrin has the ability to prevent entry of the virus into the cell and the inhibition of virus multiplication in infected cells when treated milk camels. (El-Fakharany et al. 2008).

REFERENCES

1. Brzoska, M.; Moniuszko, J.; Jurczuk, M. and Aolozyn, M. (2002). cadmium turnover and changes of zinc and copper body status of rats continuously exposed to cadmium and ethanol. *Alcohol and Alcoholism*, 37: 213-221.
2. Ettinger, A.; Lamadrid-Figueroa, H.; Téllez-Rojo, M.; Mercado-García, A.; Peterson, K.; Schwartz, J.; Hu, H. and Hernández-Avila, M. (2009). Effect of Calcium Supplementation on Blood Lead Levels in Pregnancy: A Randomized Control Trial. *Environ Health Perspectives*, 117: 32.
3. Adaramoye, O.; Osaimoje, D.; Akinsanya, M.; Nneji, C.; Fafunso, M. and Ademowo, O. (2008). Changes in antioxidant status and biochemical indices after acute administration of artemether, artemether-lumefantrine and halofantrine in rats. *J. Compilation: Basic Clin. Pharmacol. Toxicol.*, 102: 412-418.
4. Jevtovic-Stoimenov, T.; Kocic, G.; Pavlovic, D.; Stajanovic, I.; Cvetkovic, T. and Sokolovic, D. (2003). Effects of caprol on membrane-associated enzymes in lead induced hepatotoxicity in rats. *Acta Fac. Med. Naiss.*, 20: 183-188.
5. Jens, J. and Hanne, H. (2002). A Review on Liver Function Test. The Danish Hepatitis C: at website http://home3.inet.tele.dk/omni/hemochromatosis_iron.htm.
6. Al-Hashem, F. (2009). Camel's milk against aluminium chloride – induced normocytic normochromic anemia, lipid peroxidation and oxidative stress in erythrocytes of white albino rats. *J. biochemistry and biotechnology*, 5: 127-136.
7. Humanson, G. L. (1978). Animal tissue technique 2nd ed., W.H. freeman, Witt. and Company, U.S.A. Pp: 114-130.
8. El-Agamy, E.I. (2006). Camel milk. In: Handbook of milk of non – bovine mammals. Park, Y.W, Haenlein, G.F (EDS.), Blackwell publishing, Iowa, U.S.A., PP. 297 – 344.
9. Ishihara, M.; Itoh, M.; Miyamoto, K.; Suna, S.; Takeuchi, Y.; Takenaka, I. and Jitsunari, F. (2000). Spermatogenic disturbance induced by di-(2-ethylhexyl) phthalate is significantly prevented by treatment with antioxidant vitamins in the rat. *Int. J. Androl.*, 23: 85 – 94.
10. Brzoska, M.; Moniuszko, J.; Jurczuk, M. and Aolozyn, M. (2002). cadmium turnover and changes of zinc and copper body status of rats continuously exposed to cadmium and ethanol. *Alcohol and Alcoholism*, 37: 213-221.
11. El-Sokkary, G.; Abdel-Rahman, G. and Kamel, E. (2005). Melatonin protects against lead-induced hepatic and renal toxicity in male rats. *Toxicology*, 213: 25-33.
12. Hristev, H.; Penkov, D.; Hallak, A.; Kirova, M., Baykov, B. and Blizankov, A. (2008). Serum Protein Changes in Rabbits after Chronic Administration of Lead and Cadmium. *J. Central European Agriculture*, 9: 157-162.
13. Gokalp, D.; Buyukvanli, B.; Cicek, E.; Ozer, M.; Koyu, A.; Altuntas, I. and Koylu, H. (2004). The effect of diazi-non on pancreatic damage and ameliorating role of vitamin E and vitamin C. pesticide *Biochem. Physiol.*, 18: 584-594.
14. Bustamante, P.; Cosson, R.; Gallien, I.; Caurant, F. and Miramand, P. (2002). Cadmium detoxification processes in the digestive gland of cephalopods in relation to accumulated cadmium concentration. *J. Marine environmental. Research.*, 53: 227-241.
15. Meredyth, J. D and Dacvim, M.S. (2008). Copper toxicity in sheep is on the rise in Kansas and Nebraska. Comparative Toxicology, Kansas. State Veterinary Diagnostiz laboratory.
16. El-Fakharany, E.; Ashraf, T.; Abeer, A.; Bakry, M. and Redwan, E. (2008). Potential Activity of Camel Milk-Amylase and Lactoferrin against Hepatitis C Virus Infectivity in HepG2 and Lymphocytes. *Egy. Hep.*, 8: 101-109.
17. Al-Numair, K.; Chandramohan, G.; Alsaif, M; Sundaraselvan G. (2011). Antihyperglycemic effect

- of camel's milk in streptozotocin in diabetic rats. *Asian Life Sci.*, 20: 1-11.
18. Thijssen, S., Maringwa, J., Faes, C., Lambrichts, I. And Kerkhove, E. 2007. Chronic exposure of mice to environmentally relevant, low doses of cadmium leads to early renal damage, not predicted by blood or urine cadmium levels *Toxicology*, 229: 145-156
 19. Yilidirim, O. (2009). The effect of vitamin C and cobalt supplementation on antioxidant status in healthy and diabetic rats. *African J. Biotechnology.*, 8(19): 5053-5058.
 20. Delraso, N.J.; Foy, B.D. Gearhart, J. M. and Frazier, J. M. (2003). Cadmium uptake kinetic in rat hepatocytes correction for albumin binding. *Toxicol Sci.*, 72: 19-30.
 21. Esrefoglu, M., Gul, M., Dogru, M., Dogru, A. and Yurekli, M. (2007). Adrenomedullin fails to reduce cadmium-induced oxidative damage in rat liver. *Exper. and Toxicol. Pathology*, 58: 367-374.
 22. Brzoska, M.; Moniuszko, J.; Jurczuk, M. and Aolozyn, M. (2002). cadmium turnover and changes of zinc and copper body status of rats continuously exposed to cadmium and ethanol. *Alcohol and Alcoholism.*, 37: 213-221.
 23. Ettinger, A.; Lamadrid-Figueroa, H.; Téllez-Rojo, M.; Mercado-García, A.; Peterson, K.; Schwartz, J.; Hu, H. and Hernández-Avila, M. (2009). Effect of Calcium Supplementation on Blood Lead Levels in Pregnancy: A Randomized Control Trial. *Environ Health Perspectives*, 117: 32.
 24. Adaramoye, O.; Osaimoje, D.; Akinsanya, M.; Nneji, C.; Fafunso, M. and Ademowo, O. (2008). Changes in antioxidant status and biochemical indices after acute administration of artemether, artemether-lumefantrine and halofantrine in rats. *J. Compilation: Basic Clin. Pharmacol. Toxicol.*, 102: 412-418.
 25. Jevtic-Stoimenov, T.; Kocic, G.; Pavlovic, D.; Stajanovic, I.; Cvetkovic, T. and Sokolovic, D. (2003). Effects of caprol on membrane-associated enzymes in lead induced hepatotoxicity in rats. *Acta Fac. Med. Naiss.*, 20: 183-188.
 26. Jens, J. and Hanne, H. (2002). A Review on Liver Function Test. The Danish Hepatitis C: at website http://home3.inet.tele.dk/omni/hemochromatosis_iro.n.htm.
 27. Al-Hashem, F. (2009). Camel's milk against aluminium chloride – induced normocytic normochromic anemia, lipid peroxidation and oxidative stress in erythrocytes of white albino rats. *J. biochemistry and biotechnology.*, 5: 127-136.
 28. Humanson, G. L. (1978). Animal tissue technique 2nd ed., W.H. freeman, Witt. and Company, U.S.A. Pp: 114-130.
 29. El-Agamy, E.I. (2006). Camel milk. In: Handbook of milk of non – bovine mammals. Park, Y.W, Haenlein, G.F (EDS.), Blackwell publishing, Iowa, U.S.A., Pp. 297 – 344.
 30. Ishihara, M.; Itoh, M.; Miyamoto, K.; Suna, S.; Takeuchi, Y.; Takenaka, I. and Jitsunari, F. (2000). Spermatogenic disturbance induced by di-(2-ethylhexyl) phthalate is significantly prevented by treatment with antioxidant vitamins in the rat. *Int. J. Androl.*, 23: 85 – 94.
 31. Brzoska, M.; Moniuszko, J.; Jurczuk, M. and Aolozyn, M. (2002). cadmium turnover and changes of zinc and copper body status of rats continuously exposed to cadmium and ethanol. *Alcohol and Alcoholism.*, 37: 213-221.
 32. El-Sokkary, G.; Abdel-Rahman, G. and Kamel, E. (2005). Melatonin protects against lead-induced hepatic and renal toxicity in male rats. *Toxicology*, 213: 25-33.
 33. Hristev, H.; Penkov, D.; Hallak, A.; Kirova, M., Baykov, B. and Blizankov, A. (2008). Serum Protein Changes in Rabbits after Chronic Administration of Lead and Cadmium. *J. Central European Agriculture.*, 9: 157-162.
 34. Gokalp, D.; Buyukvanli, B.; Cicek, E.; Ozer, M.; Koyu, A.; Altuntas, I. and Koylu, H. (2004). The effect of diazi-non on pancreatic damage and ameliorating role of vitamin E and vitamin C. pesticide *Biochem. Physiol.*, 18: 584-594.
 35. Bustamante, P.; Cosson, R.; Gallien, I.; Caurant, F. and Miramand, P. (2002). Cadmium detoxification processes in the digestive gland of cephalopods in relation to accumulated cadmium concentration. *J. Marine environmental. Research.*, 53: 227-241.
 36. Meredyth, J. D and Dacvim, M.S. (2008). Copper toxicity in sheep is on the rise in Kansas and Nebraska. Comparative Toxicology, Kansas. State Veterinary Diagnostiz laboratory.
 37. El-Fakharany, E.; Ashraf, T.; Abeer, A.; Bakry, M. and Redwan, E. (2008). Potential Activity of Camel Milk-Amylase and Lactoferrin against Hepatitis C Virus Infectivity in HepG2 and Lymphocytes. *Egy. Hep.*, 8: 101-109.
 38. Al-Numair, K.; Chandramohan, G.; Alsaif, M; Sundaraselvan G. (2011). Antihyperglycemic effect of camel's milk in streptozotocin diabetic rats. *Asian Life Sci.*, 20: 1-11.
 39. Thijssen, S., Maringwa, J., Faes, C., Lambrichts, I. And Kerkhove, E. 2007. Chronic exposure of mice to environmentally relevant, low doses of cadmium leads to early renal damage, not predicted by blood or urine cadmium levels *Toxicology*, 229: 145-156.
 40. Yilidirim, O. (2009). The effect of vitamin C and cobalt supplementation on antioxidant status in healthy and diabetic rats. *African J. Biotechnology.*, 8(19): 5053-5058.
 41. Delraso, N. J.; Foy, B.D. Gearhart, J. M. and Frazier, J. M. (2003). Cadmium uptake kinetic in rat hepatocytes correction for albumin binding. *Toxicol Sci.*, 72: 19-30.
 42. Esrefoglu, M., Gul, M., Dogru, M., Dogru, A. and Yurekli, M. (2007). Adrenomedullin fails to reduce cadmium-induced oxidative damage in rat liver. *Exper. and Toxicol. Pathology*, 58: 367-374.
 43. Brzoska, M.; Moniuszko, J.; Jurczuk, M. and Aolozyn, M. (2002). cadmium turnover and changes

- of zinc and copper body status of rats continuously exposed to cadmium and ethanol. *Alcohol and Alcoholism.*, 37: 213-221.
44. Ettinger, A.; Lamadrid-Figueroa, H.; Téllez-Rojo, M.; Mercado-García, A.; Peterson, K.; Schwartz, J.; Hu, H. and Hernández-Avila, M. (2009). Effect of Calcium Supplementation on Blood Lead Levels in Pregnancy: A Randomized Control Trial. *Environ Health Perspectives*, 117: 32.
 45. Adaramoye, O.; Osaimoje, D.; Akinsanya, M.; Nneji, C.; Fafunso, M. and Ademowo, O. (2008). Changes in antioxidant status and biochemical indices after acute administration of artemether, artemether-lumefantrine and halofantrine in rats. *J. Compilation: Basic Clin. Pharmacol. Toxicol.*, 102: 412-418.
 46. Jevtovic-Stoimenov, T.; Kocic, G.; Pavlovic, D.; Stajanovic, I.; Cvetkovic, T. and Sokolovic, D. (2003). Effects of caprol on membrane-associated enzymes in lead induced hepatotoxicity in rats. *Acta Fac. Med. Naiss.*, 20: 183-188.
 47. Jens, J. and Hanne, H. (2002). A Review on Liver Function Test. The Danish Hepatitis C: at website http://home3.inet.tele.dk/omni/hemochromatosis_iron.htm.
 48. Al-Hashem, F. (2009). Camel's milk against aluminium chloride – induced normocytic normochromic anemia, lipid peroxidation and oxidative stress in erythrocytes of white albino rats. *J. biochemistry and biotechnology.*, 5: 127-136.
 49. Humanson, G. L. (1978). Animal tissue technique 2nd ed., W.H. Freeman, Witt. and Company, U.S.A. Pp: 114-130.
 50. El-Agamy, E.I. (2006). Camel milk. In: Handbook of milk of non – bovine mammals. Park, Y.W, Haenlein, G.F (EDS.), Blackwell publishing, Iowa, U.S.A., Pp. 297 – 344.
 51. Ishihara, M.; Itoh, M.; Miyamoto, K.; Suna, S.; Takeuchi, Y.; Takenaka, I. and Jitsunari, F. (2000). Spermatogenic disturbance induced by di-(2-ethylhexyl) phthalate is significantly prevented by treatment with antioxidant vitamins in the rat. *Int. J. Androl.*, 23: 85 – 94.
 52. Brzoska, M.; Moniuszko, J.; Jurczuk, M. and Aolozyn, M. (2002). cadmium turnover and changes of zinc and copper body status of rats continuously exposed to cadmium and ethanol . *Alcohol and Alcoholism.* 37: 213-221.
 53. El-Sokkary, G.; Abdel-Rahman, G. and Kamel, E. (2005). Melatonin protects against lead-induced hepatic and renal toxicity in male rats. *Toxicology*, 213: 25-33.
 54. Hristev, H.; Penkov, D.; Hallak, A.; Kirova, M., Baykov, B. and Blizankov, A. (2008). Serum Protein Changes in Rabbits after Chronic Administration of Lead and Cadmium. *J. Central European Agriculture.*, 9: 157-162.
 55. Gokalp, D.; Buyukvanli, B.; Cicek, E.; Ozer, M.; Koyu, A.; Altuntas, I. and Koylu, H. (2004). The effect of diazi-non on pancreatic damage and ameliorating role of vitamin E and vitamin C. pesticide *Biochem. Physiol.*, 18: 584-594.
 56. Bustamante, P.; Cosson, R.; Gallien, I.; Caurant, F. and Miramand, P. (2002). Cadmium detoxification processes in the digestive gland of cephalopods in relation to accumulated cadmium concentration. *J. Marine environmental. Research.*, 53: 227-241.
 57. Meredyth, J. D and Dacvim, M.S. (2008). Copper toxicity in sheep is on the rise in Kansas and Nebraska. *Comparative Toxicology, Kansas. State Veterinary Diagnostiz laboratory.*
 58. El-Fakharany, E.; Ashraf, T.; Abeer, A.; Bakry, M. and Redwan, E. (2008). Potential Activity of Camel Milk-Amylase and Lactoferrin against Hepatitis C Virus Infectivity in HepG2 and Lymphocytes. *Egy. Hep.*, 8: 101-109.
 59. Al-Numair, K.; Chandramohan, G.; Alsaif, M; Sundaraselvan G. (2011). Antihyperglycemic effect of camel's milk in streptozotocin diabetic rats. *Asian Life Sci.*, 20: 1-11.
 60. Thijssen, S., Maringwa, J., Faes, C., Lambrechts, I. And Kerkhove, E. 2007. Chronic exposure of mice to environmentally relevant, low doses of cadmium leads to early renal damage, not predicted by blood or urine cadmium levels *Toxicology*, 229: 145-156.
 61. Yilidirim, O. (2009). The effect of vitamin C and cobalt supplementation on antioxidant status in healthy and diabetic rats. *African. J. Biotechnology.*, 8(19): 5053-5058.
 62. Delraso, N.J.; Foy, B.D. Gearhart, J. M. and Frazier, J. M. (2003). Cadmium uptake kinetic in rat hepatocytes correction for albumin binding. *Toxicol Sci.*, 72: 19-30.
 63. Esrefoglu, M., Gul, M., Dogru, M., Dogru, A. and Yurekli, M. (2007). drenomedullin fails to reduce cadmium-induced oxidative damage in rat liver. *Exper. and Toxicol. Pathology*, 58: 367-374.