DIETARY IRON OVERLOAD, THE GENERATION OF REACTIVE OXYGEN SPECIES AND HEPATOCARCINGENESIS IN EXPERIMENTAL RATS

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DIETARY IRON OVERLOAD, THE GENERATION OF REACTIVE OXYGEN SPECIES AND HEPATOCARCINOGENESIS IN EXPERIMENTAL RAT MODELS

(PART 2)

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In fulfilment of the requirements for the degree of

Doctor of Philosophy

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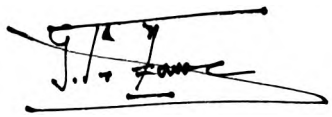
DECLARATION

I, Major (Rtd) George Awuku Asare, declare that this thesis is my own work. It is being submitted, for the degree of Doctor of Philosophy, to the University of the Witwatersrand, Johannesburg. It has not been submitted before, for a degree or examination, to this or any other University.

Signed:  Date: 12/2013

Major (Rtd) George Awuku Asare Johannesburg

DEDICATION

This thesis is dedicated to my wife Betty

CONFERENCE PRESENTATION

1. Asare GA, Kew MC, Mossanda KSA, Siziba K (2003). A study of dietary iron overload in experimental rat models: generation of reactive oxygen species and immunohistochemical detection of DNA damage.

   Poster: 8. European meeting on liver carcinogenesis, Bad Kreuznach, Germany

ABSTRACT

Dietary iron (Fe) overload, originally referred to as Bantu Visceral Siderosis, is an Fe-loading condition that is still prevalent in rural populations of sub-Saharan Africa. The better known Fe loading disease, hereditary haemochromatosis (HH) is frequently complicated by hepatocellular carcinoma (HCC) and, in rare instances this occurs in the absence of cirrhosis. The latter, together with recent evidence that dietary Fe overload in the Black African carries an increased risk for HCC, suggests that excessive hepatic iron may itself be carcinogenic. The aim of the study was to determine if Fe alone could induce HCC in experimental rat models and, if so, to investigate possible mechanisms of hepatocarcinogenesis. 360 Wistar albino rats (*Rattus norvegicus*) were divided into 6 groups. The first group, the control animals, was designated C group. Groups 2 - 6 were Fe-fed alone or in combination with other chemicals: group 2 Fe alone (Fe group), group 3 (Fe + V) vitamins A & E supplementation [50 mg *all* trans-retinol (vitamin A) and 500 mg α-tocopherol (vitamin E) per kg diet], group 4 (Fe - V) received a diet totally devoid of vitamins A & E, group 5 (Fe + ASA) received 20 mg aspirin (ASA) per day, group 6 (Fe + Cu) received 300 mg/kg diet of copper sulphate (CuSO4) supplementation for 12 months followed by 3% copper hydroxide carbonate [$CuCO_3 \bullet Cu(OH)_2$]. Fe-fed rats were originally given 2% carbonyl iron (CI) up to 8 months. This was increased to 2.5% up to 12 months, followed by 0.5% ferrocene (dicyclopentadienyl iron) (*ad libitum*). The rats were monitored for 36 months and were sacrificed periodically and the blood and liver analysed. The following tests were performed: serum Fe, histological hepatic Fe grading, liver Fe concentration (LIC), Superoxide radical ($^{\bullet -}O_2$), Total Antioxidant Status (TAS), Glutathione peroxidase (GPx), Superoxide dismutase (SOD), Catalase (CAT), Vitamin C, Oxygen Radical Absorbance Capacity (ORAC), Malondialdehyde (MDA), FOX II assay for lipid hydroperoxides, 8-isoprostane (8-IP), 4-hydroxynonenal (4-HNE) immunohistochemistry, 8-hydroxy-2'-deoxyguanosine (8OHdG) immunohistochemistry, liver 8OHdG concentration (ELISA), Fluorimetric Analysis of DNA Unwinding (FADU), Ames mutagenicity test, Pulse Field Gel Electrophoresis (PFGE), AST, ALT,AFP and liver histology. Serum Fe reached a plateau after 16 months of Fe feeding. Serum Fe in the Fe-loading group was 2.5 times higher than the control group ($p<0.05$). At 12 months, hepatic Fe grading was 2+. When CI was substituted with ferrocene, Fe-loading was 4+ at

16 months. At 32 months LIC in the Fe groups was 19.8 ± 6.9 mg/g w.wt (33 times above the control group). Fe overload led to the generation of Reactive Oxygen Species (ROS). $^{\bullet-}O_2$ was 2-2.5 times higher in the Fe-fed groups than the control ($p>0.05$). Antioxidant levels (AO) were statistically significant but at different time-points. AO enzymes operated in a dynamic equilibrium and with a compensatory mechanism. The total lipid-soluble AO was 25% that of the total aqueous-soluble AO in the liver ($p<0.05$ at 12 months). The FOX II assay was found to be a better biomarker of lipid peroxidation (LPO) compared to MDA and 8-IP. LPO occurred as an early event of oxidative stress induced by Fe, and this was also detected immunohistochemically. Adducts of DNA oxidative damage i.e. 8OHdG were detected in the Fe-overloaded groups. Furthermore, liver 8OHdG concentration was significantly raised after 12 months ($p<0.05$). DNA strand-breaks were observed by PFGE in the early days of the study. In addition, DNA unwinding was observed and found to be significant between 12 and 20 months in the Fe-loaded groups ($p<0.05$). Mutagens were demonstrated in the liver in the Fe-loaded groups. The C group remained negative throughout with an average reversion frequency of 330 colonies. The Fe-loaded groups had twice this value between 20 and 24 months ($p<0.05$). Liver damage, assessed by AST and ALT levels, commenced after 16 months of Fe-overloading ($p<0.05$). 26% of Fe-overloaded livers examined histologically between 20 and 32 months had iron-free foci (IFF) that stained positive for GST-π. Histologically, neoplastic changes such as IFF were present in all the Fe-fed groups. Multiple IFF was detected in one liver from the Fe + V group. Inclusions resembling Mallory bodies were identified. Others, such as hamartomata, von Meyenburg complexes and Gandy-Gamma bodies, were observed. The presence of fat, focal fat and micro-steatosis was identified. In addition, hepatocellular adenoma was a borderline case in one liver from the Fe group. HCC was present in the liver of one rat in the Fe group. The tumour was 2 cm in diameter and arose in a liver without cirrhosis or fibrosis. AO vitamins and ASA were unable to prevent these histological events. Copper did not show any synergy histologically as a possible co-carcinogen. This study is the first to demonstrate the development of HCC in an animal model of haemochromatosis. Dietary Fe alone may be carcinogenic through a mechanism that involves the generation of reactive oxygen species, LPO, oxidative DNA damage, DNA strand breaks and unwinding, and mutagenesis.

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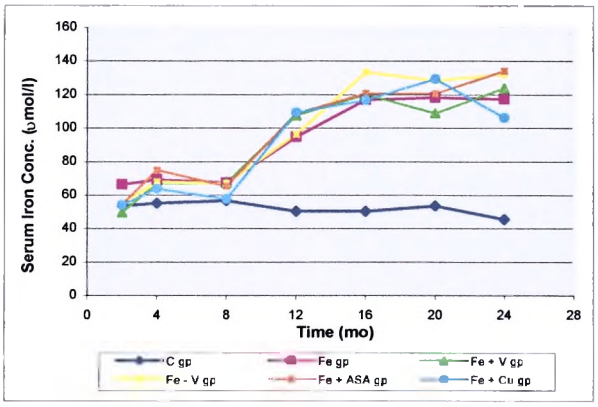


Figure 18. Interaction Plot of Time and Group: Serum Iron levels of iron over-loaded Wistar rats.

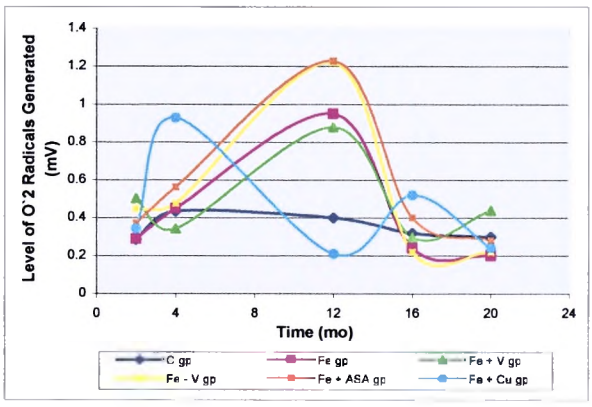


Figure 19. Interaction Plot of Time and Group: Super Oxide radical levels of iron-overloaded Wistar rats.

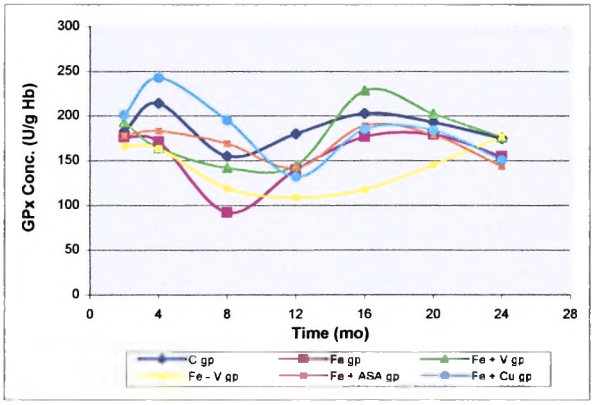


Figure 20. Interaction Plot of Time and Group: Glutathione Peroxidase levels of iron-overloaded Wistar rats.

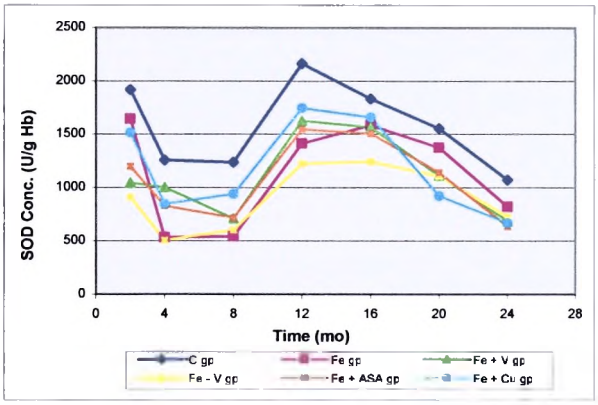


Figure 21. Interaction Plot of Time and Group: SOD levels of iron-overloaded Wistar rats.

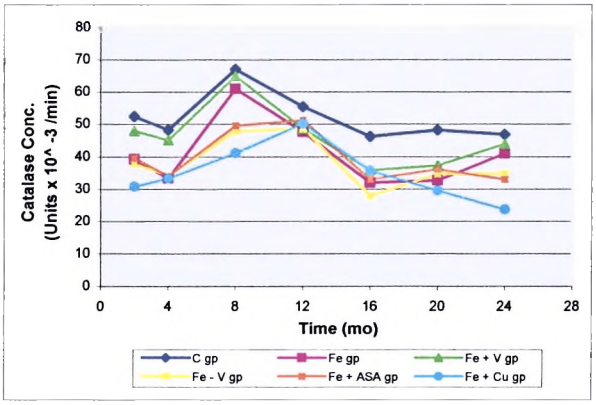


Figure 22. Interaction Plot of Time and Group: Blood Catalase levels of iron-overloaded Wistar rats.

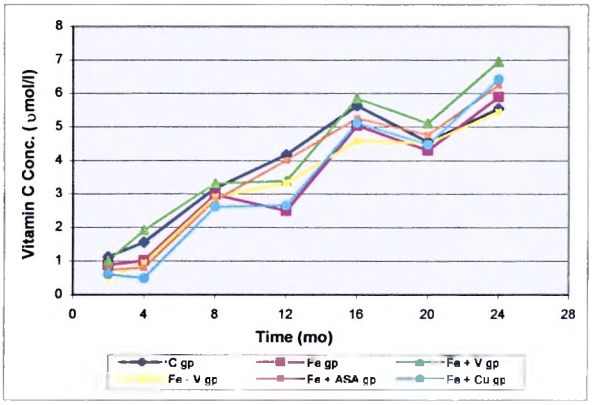


Figure 23. Interaction Plot of Time and Group: Serum Vitamin C levels of iron-overloaded Wistar rats.

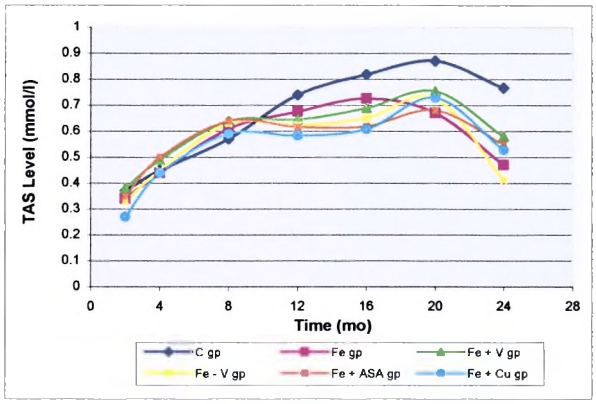


Figure 24. Interaction plot of Time and Group: Sreum Total Antioxidant Status of iron-overloaded Wistar rats.

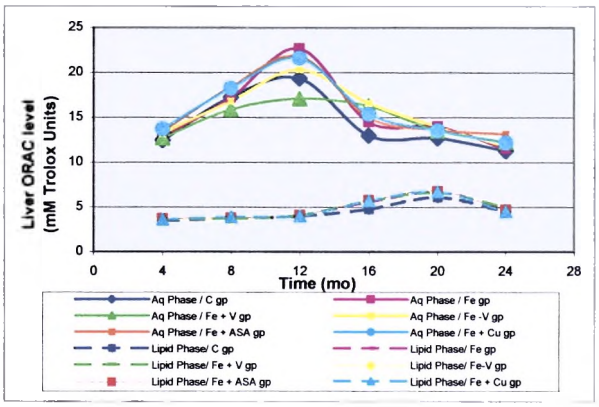


Figure 25. Interaction Plot of Tome and Group: ORAC of aqueous- and lipid-soluble fractions of iron-overloaded Wistar rat liver homogenate.

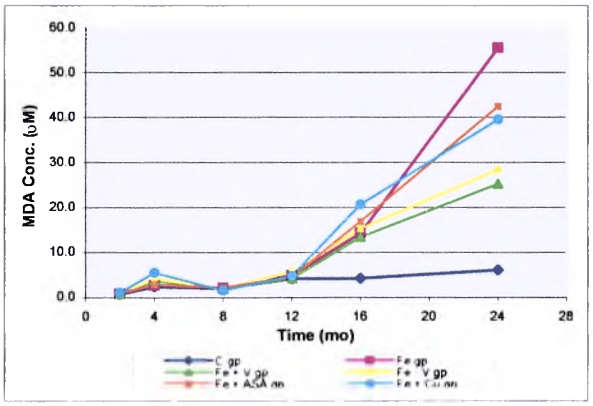


Figure 26. Interaction Plot of Time and Group: Serum MDA levels of iron-overloaded Wistar rats.

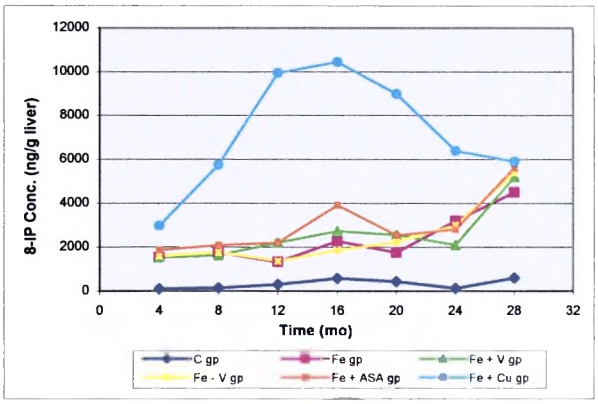


Figure 27. Interaction Plot of Time and Group: Liver 8-isoprostane levels of iron-overloaded Wistar rats.

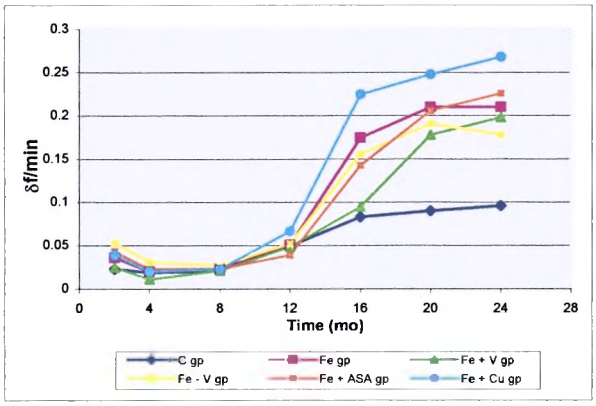


Figure 28. Interaction Plot of Time and Group: Fluorimetric Analysis of DNA Unwinding, of iron-overloaded Wistar rat liver homogenate.

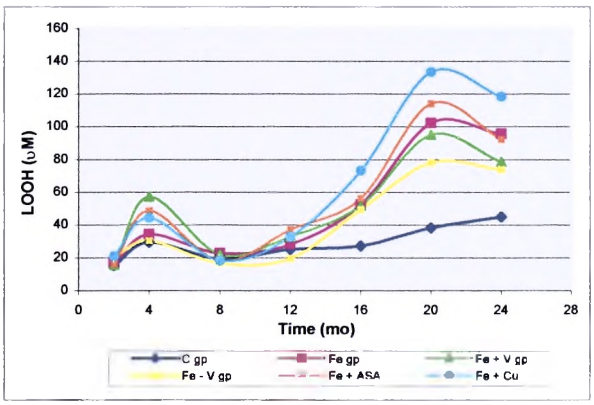


Figure 29. Interaction Plot of Time and Group: Serum Lipid hydroperoxides levels of iron-overloaded Wistar rats using the FOX II assay.

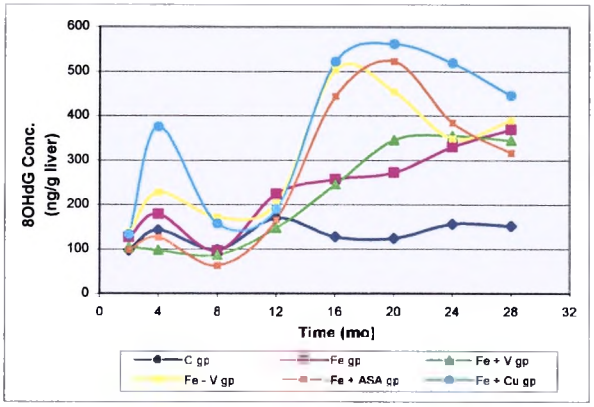


Figure 30. Interaction Plot of Time and Group: Liver 8OHdG levels of iron-overloaded Wistar rats.

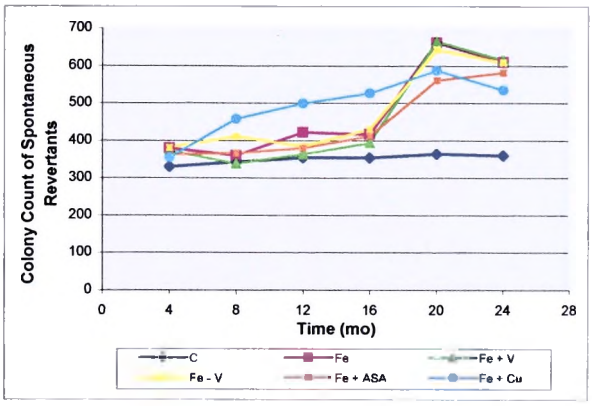


Figure 31. Interaction Plot of Time and Group: AMES mutagenicity test using *Salmonella typhimurium strain* TA 102 on iron-overloaded Wister rat liver homogenate.

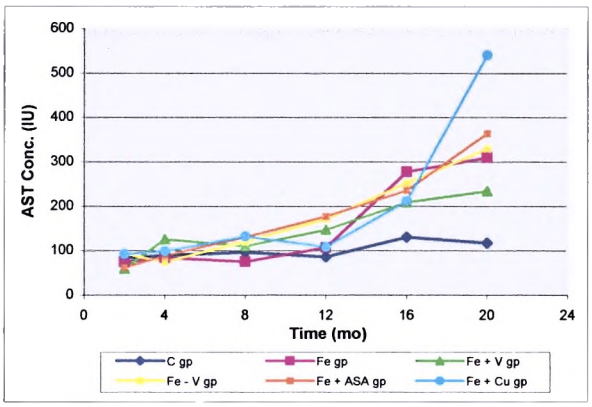


Figure 32. Interaction Plot of Time and Group: AST levels of iron-overloaded Wistar rats.

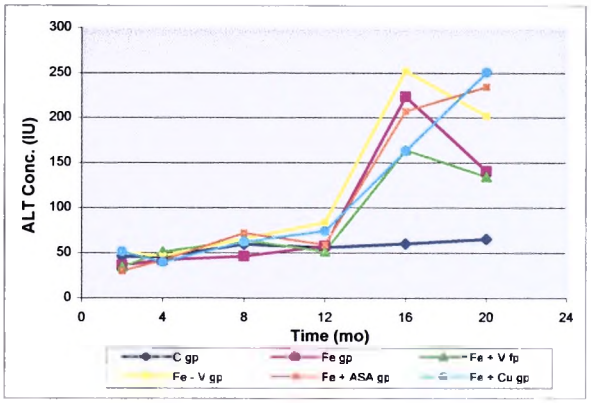


Figure 33. Interaction Plot of Time and Group: ALT levels of iron-overloaded Wistar rats.

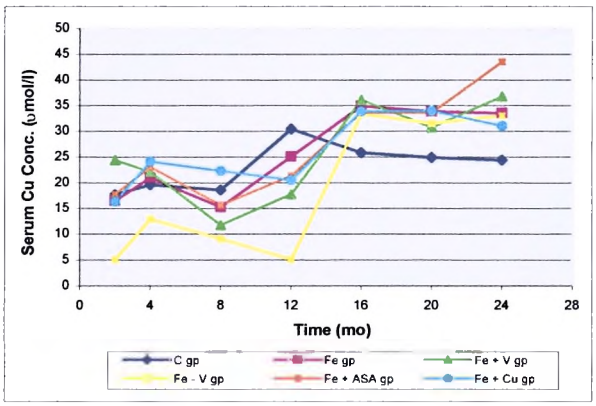
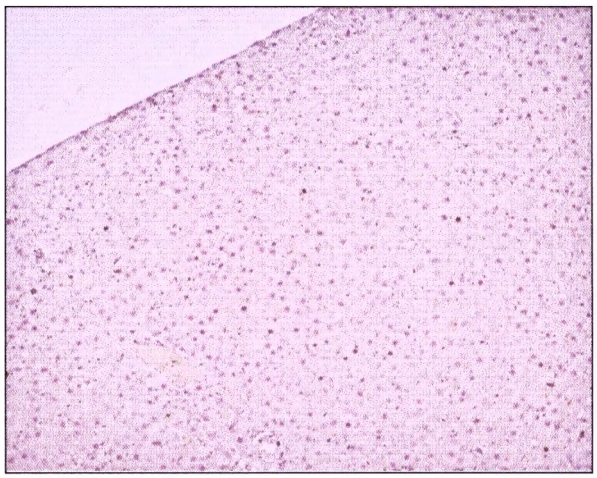


Figure 34. Interaction Plot of Time and Group: Serum copper levels of iron-overloaded Wistar rats.

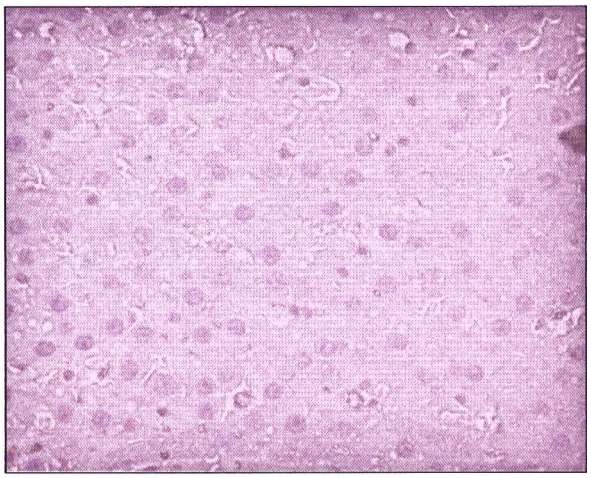
Figure 35

RatLiv C3.4 anti8-OHdG 10c



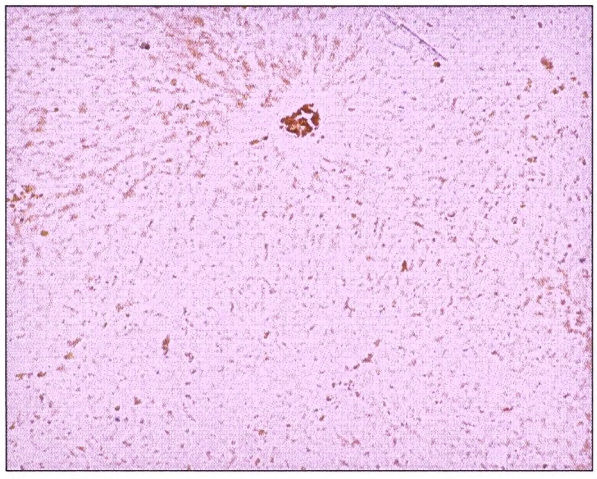
a

RatLiv C3.4 anti8-OHdG 40b



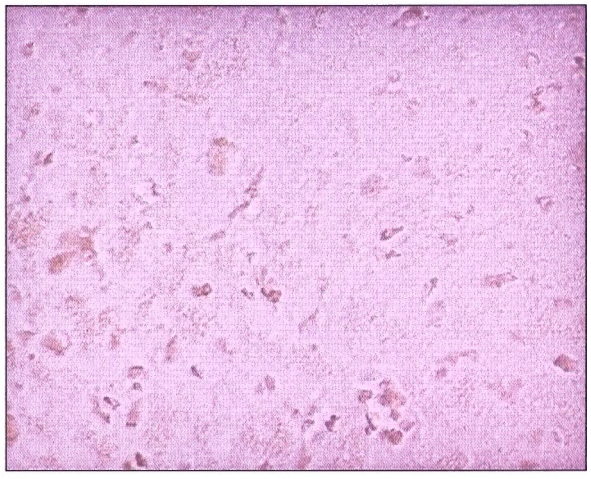
b

RatLiv F3.3 anti8-OHdG 10a



c

RatLiv F3.3 anti 8-OHdG 40a

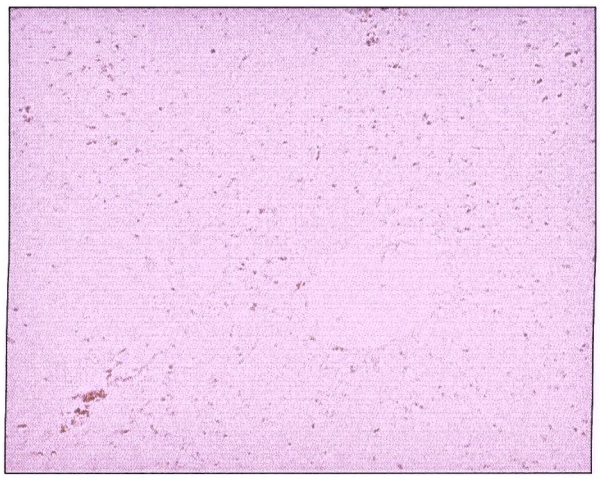


d

Immunohistochemical detection of 8OHdG adducts in normal and iron-overloaded livers. Photomicrographs (*a*) and (*b*) are negative for 8OHdG (control group, normal liver); (*c*) and (*d*) are positive (Fe group, iron-overloaded liver).

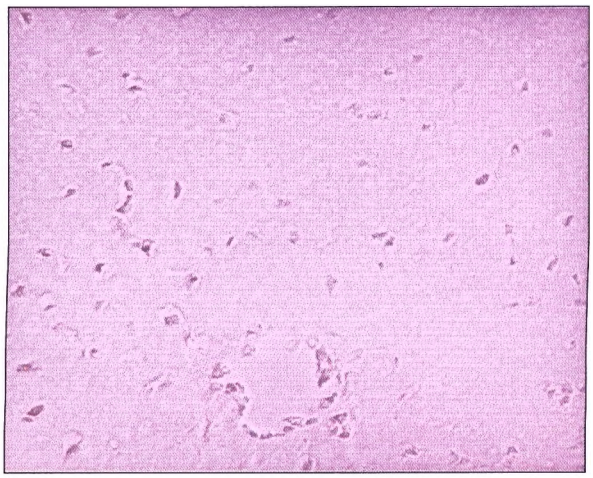
Figure 36

RatLiv C3.4 anti8-OHdG 10c



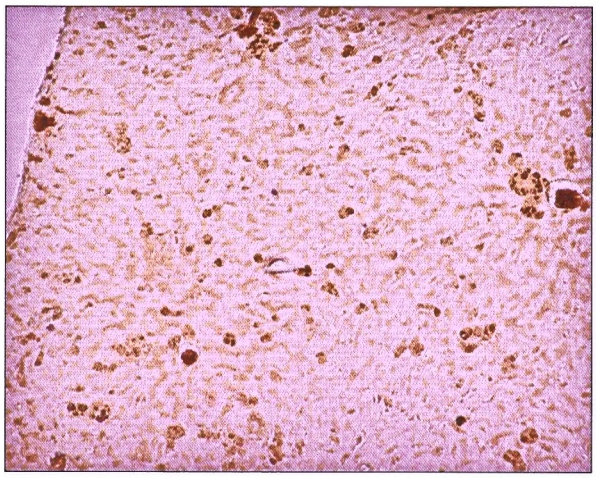
a

RatLiv C3.4 anti8-OHdG 40b



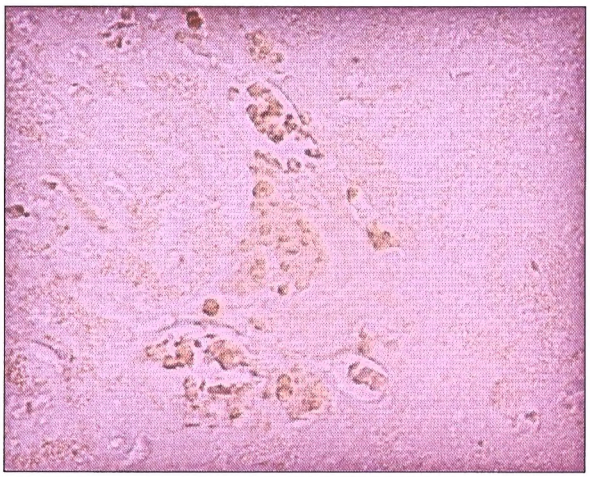
b

RatLiv V3.6 anti8-OHdG 10b



c

RatLiv V3.6 anti8-OHdG 40b



d

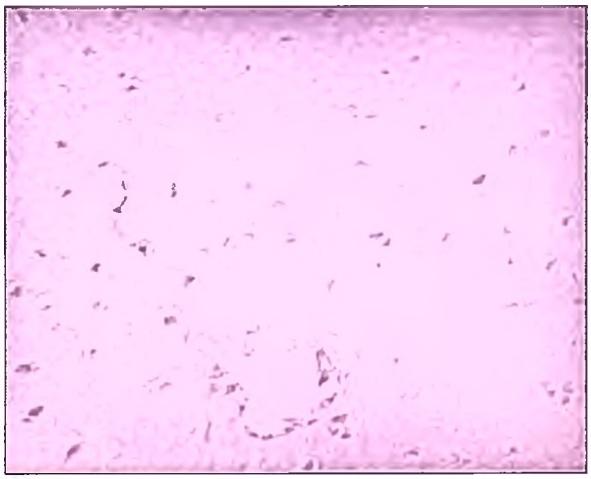
Immunohistochemical detection of 8OHdG adducts in normal and iron-overloaded livers. Photomicrographs (*a*) and (*b*) are negative for 8OHdG (control group, normal liver); (*c*) and (*d*) are positive (Fe + V group, iron-overloaded liver).

Figure 37

RatLiv C3.4 anti8-OHdG 10c

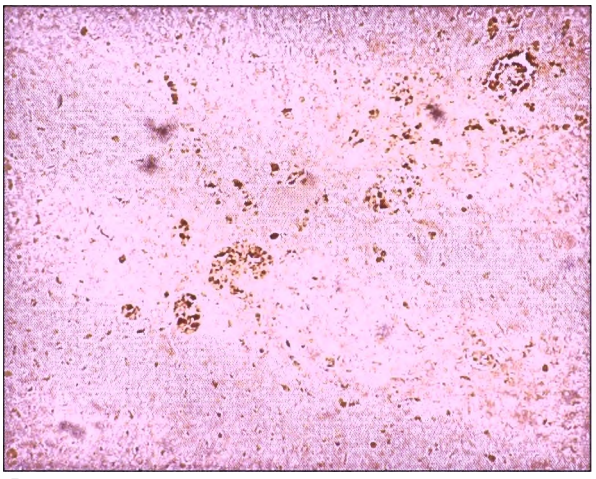
a

RatLiv C3.4 anti8-OHdG 40b



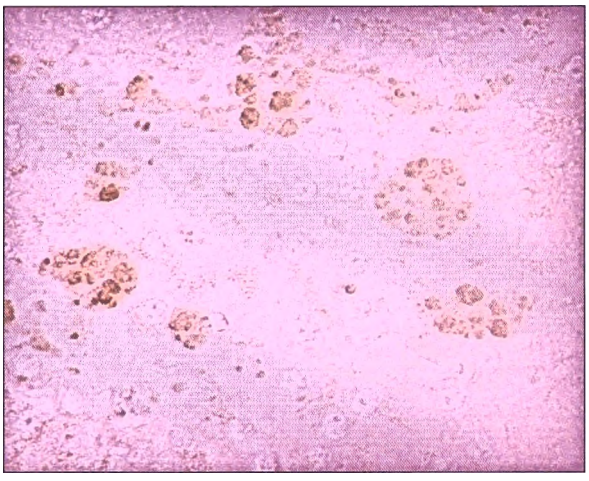
b

RatLiv N3.1 anti8-OHdG 10a



c

RatLiv N3.1 anti8-OHdG 40a

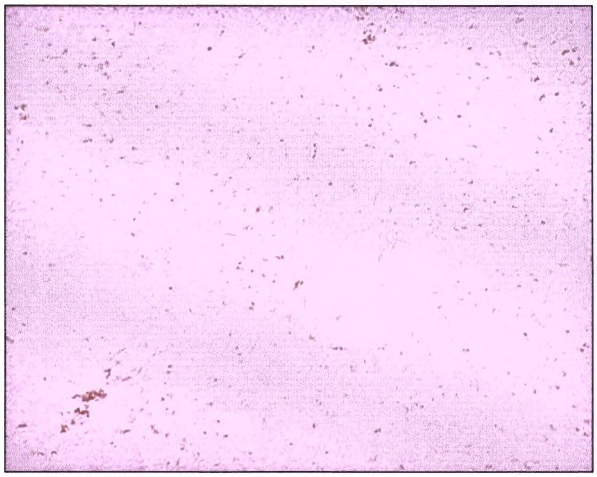


d

Immunohistochemical detection of 8OHdG adducts in normal and iron-overloaded livers. Photomicrographs (*a*) and (*b*) are negative for 8OHdG (control group, normal liver); (*c*) and (*d*) are positive (Fe - V group, iron-overloaded liver).

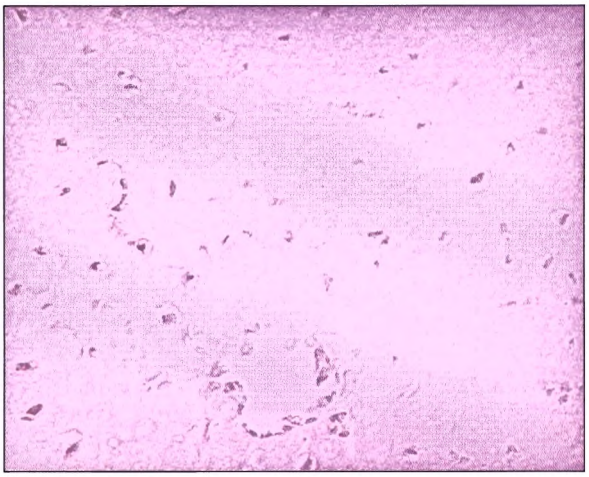
Figure 38

RatLiv C3.4 anti8-OHdG 10c



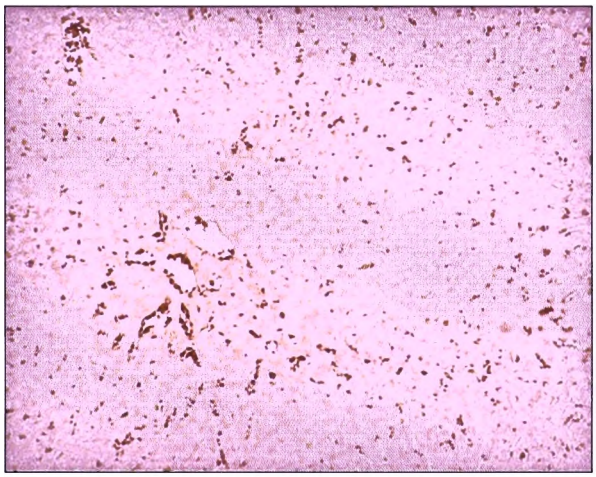
a

RatLiv C3.4 anti8-OHdG 40b



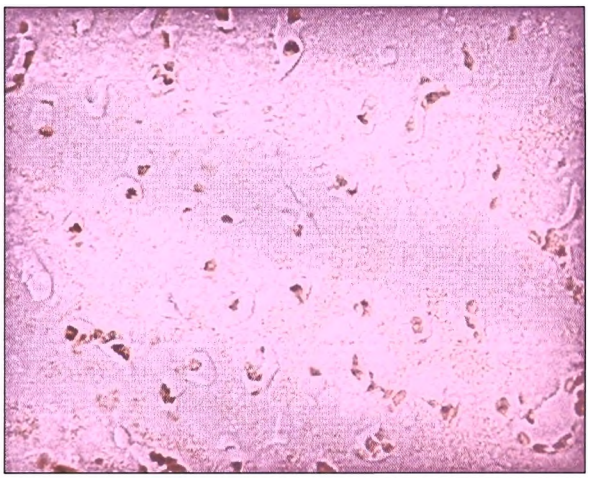
b

RatLiv A3.5 anti8-OHdG 10b



c

RatLiv A3.5 anti8-OHdG 40a

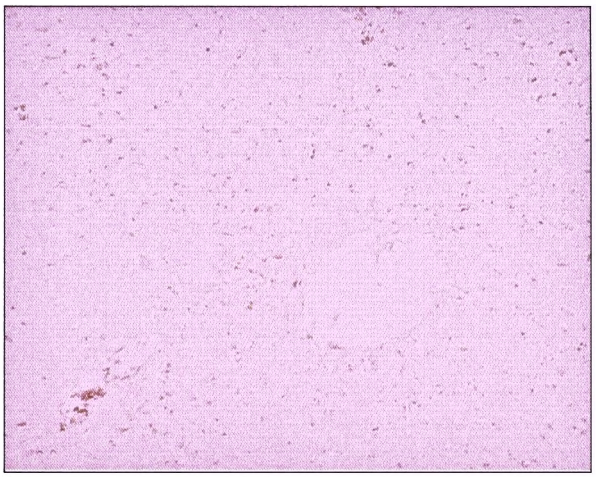


d

Immunohistochemical detection of 8OHdG adducts in normal and iron-overloaded livers. Photomicrographs (*a*) and (*b*) are negative for 8OHdG (control group, normal liver); (*c*) and (*d*) are positive (Fe + ASA group, iron-overloaded liver).

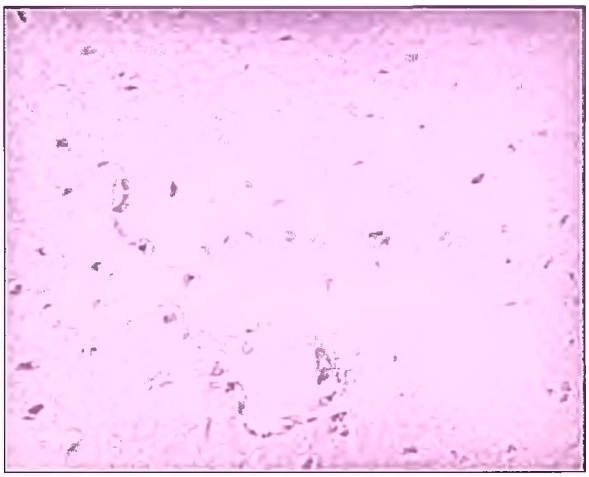
Figure 39

RatLiv C3.4 anti8-OHdG 10c



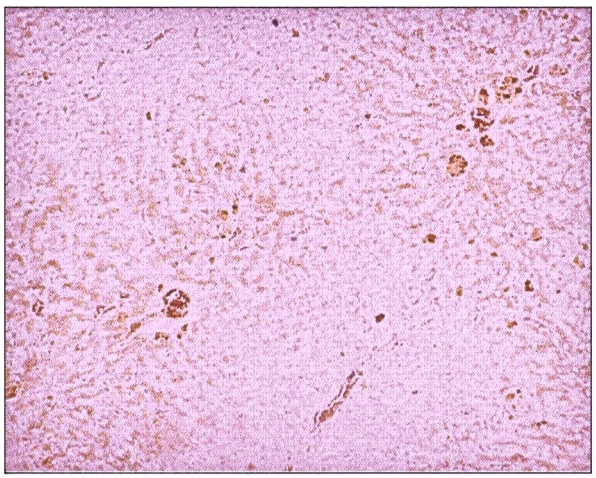
a

RatLiv C3.4 anti8-OHdG 40b



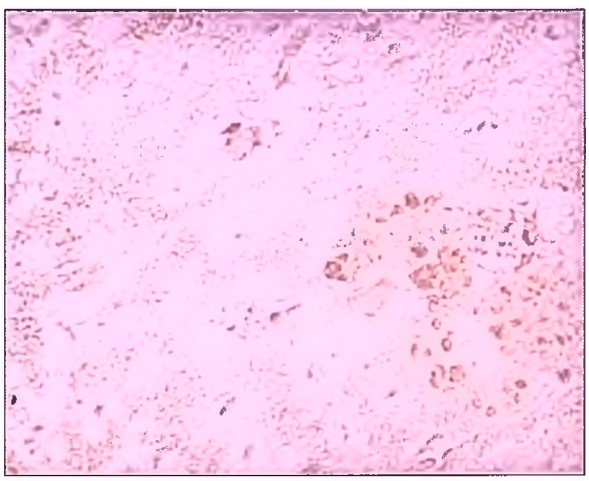
b

RatLiv Cu3.1 anti8-OHdG 10c



c

RatLiv Cu3.1 anti8-OHdG 40c

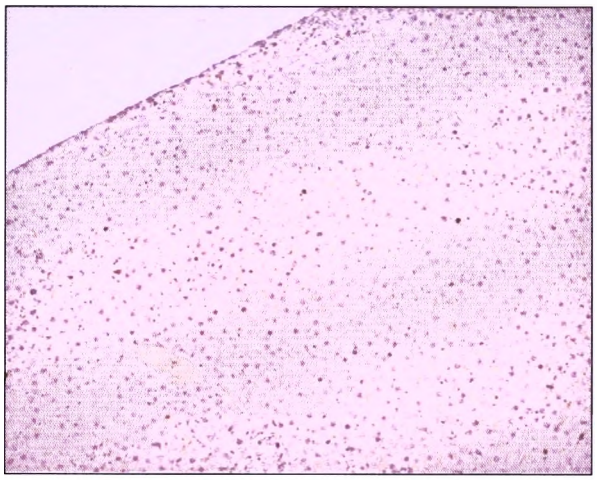


d

Immunohistochemical detection of 8OHdG adducts in normal and iron-overloaded livers. Photomicrographs (*a*) and (*b*) are negative for 8OHdG (control group, normal liver); (*c*) and (*d*) are positive (Fe + Cu group, iron-overloaded liver).

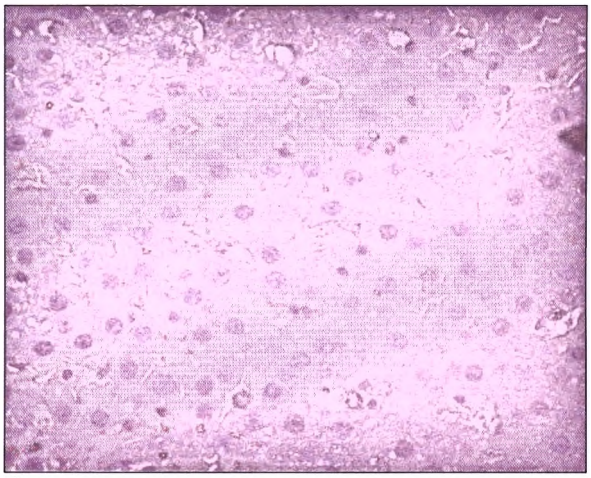
Figure 40

RatLiv Anti-HNE 3 C.7



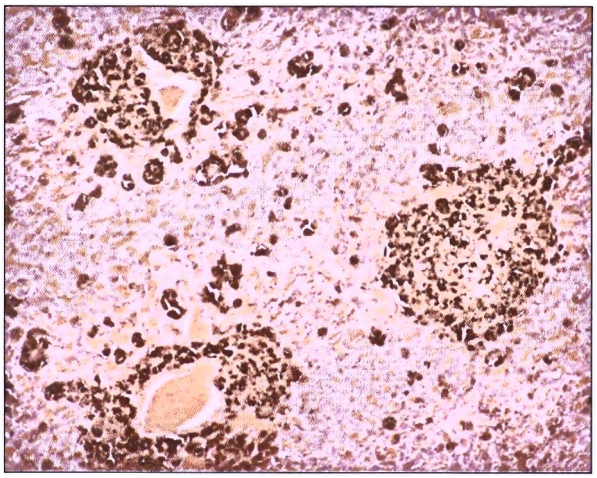
a

RatLiv Anti-HNE 3 C.7.1 40b



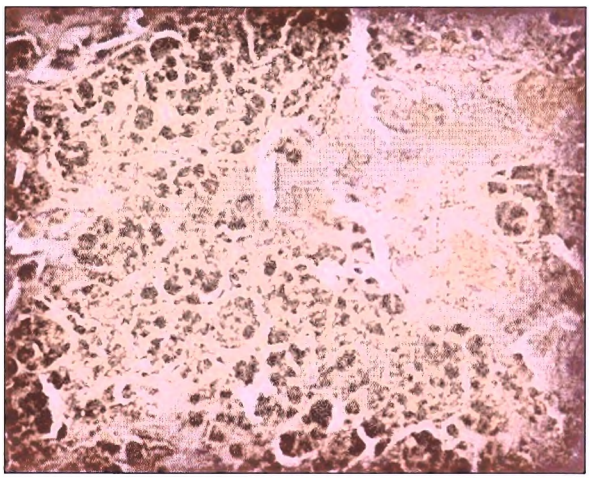
b

RatLiv Anti-HNE 3 F.7.10 10c



c

RatLiv Anti-HNE 3 F.7.10 40a

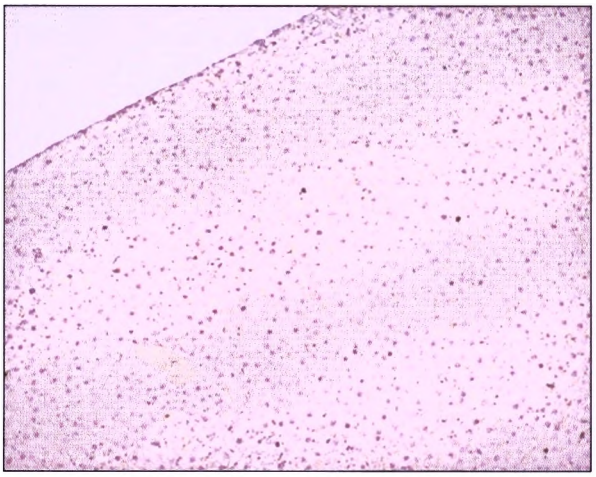


d

Immunohistochemical detection of 4-HNE adducts in normal and iron-overloaded livers. Photomicrographs (*a*) and (*b*) are negative for 4-HNE (control group, normal liver); (*c*) and (*d*) are positive (Fe group, iron-overloaded liver).

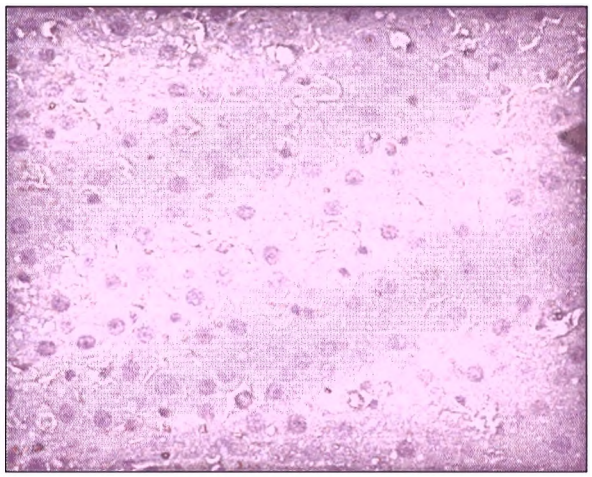
Figure 41

RatLiv Anti-HNE 3 C.7



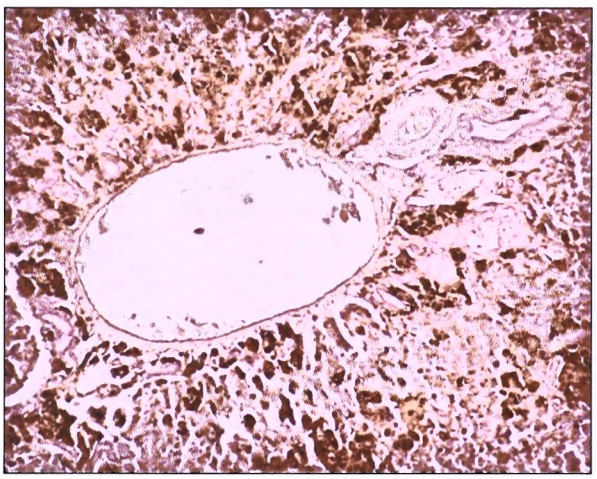
a

RatLiv Anti-HNE 3 C.7.1 40b



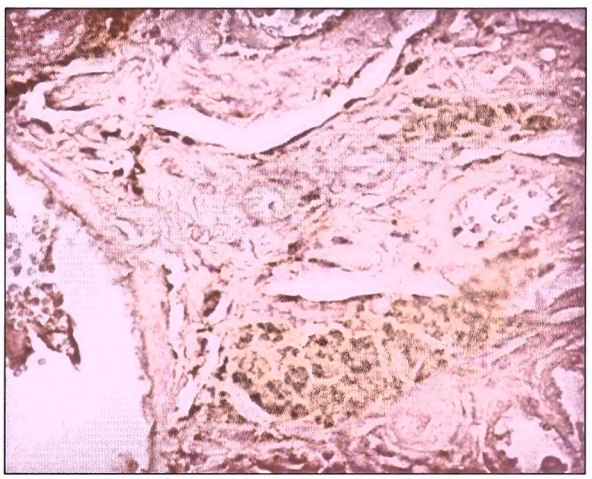
b

RatLiv Anti-HNE 3 V.7.8 10c



c

RatLiv Anti-HNE 3 V.7.8 40c

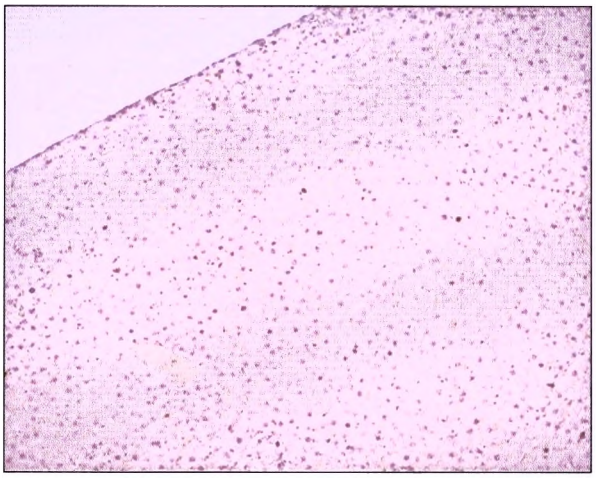


d

Immunohistochemical detection of 4-HNE adducts in normal and iron-overloaded livers. Photomicrographs (*a*) and (*b*) are negative for 4-HNE (control group, normal liver); (*c*) and (*d*) are positive (Fe + V group, iron-overloaded liver).

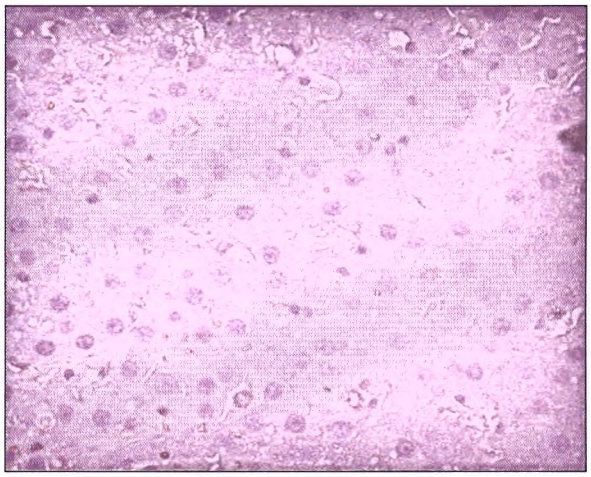
Figure 42

RatLiv Anti-HNE 3 C.7



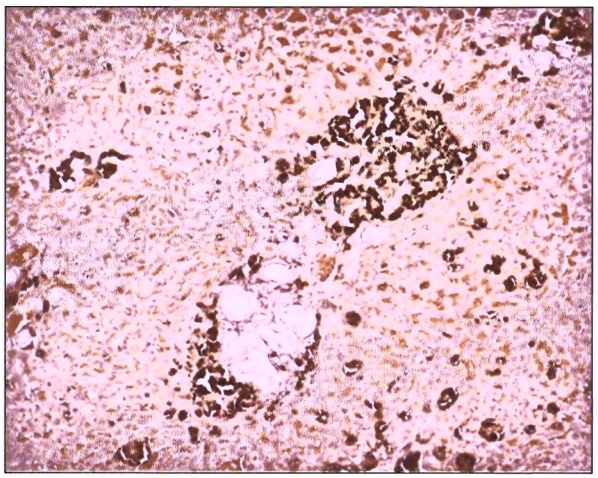
a

RatLiv AntiHNE 3 C.7.1 40b



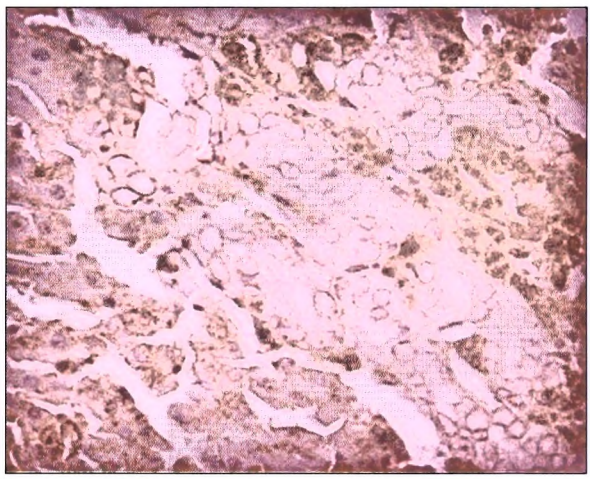
b

RatLiv Anti-HNE 3 N.7.1 10d



c

RatLivAnti-HNE 3N.7.1 40a

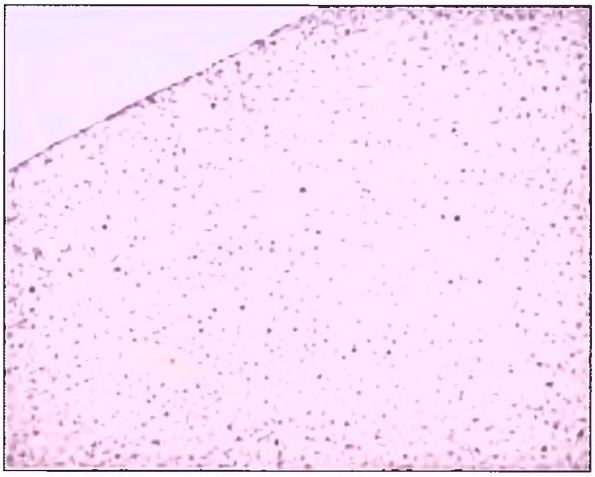


d

Immunohistochemical detection of 4-HNE adducts in normal and iron-overloaded livers. Photomicrographs (*a*) and (*b*) are negative for 4-HNE (control group, normal liver); (*c*) and (*d*) are positive (Fe - V group, iron-overloaded liver).

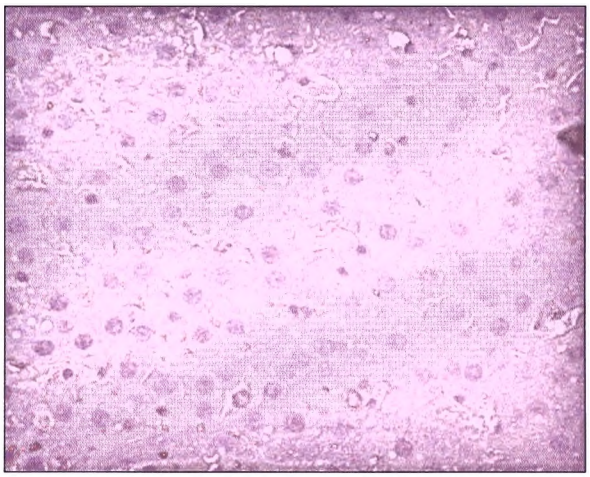
Figure 43

RatLiv Anti-HNE 3 C.7



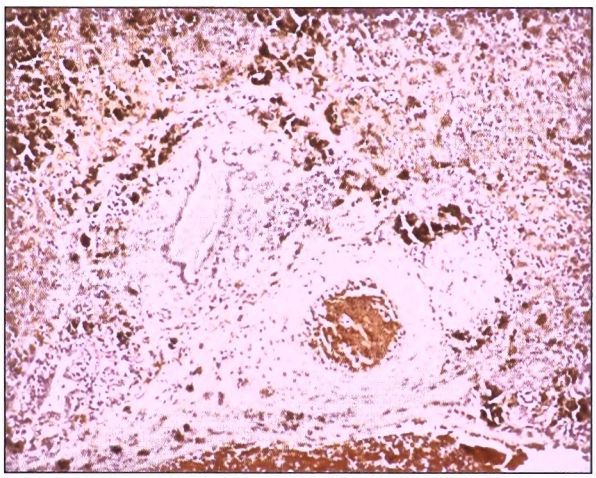
a

RatLiv Anti-HNE 3 C.7.1 40b



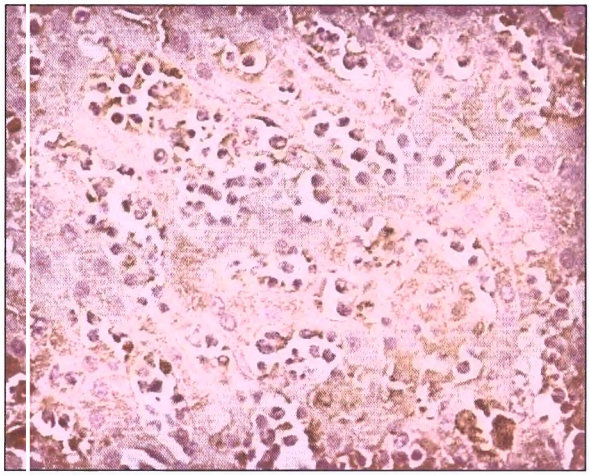
b

RatLiv Anti-HNE 3 A.7.9 10a



c

RatLiv Anti-HNE 3 A.7.9 40b

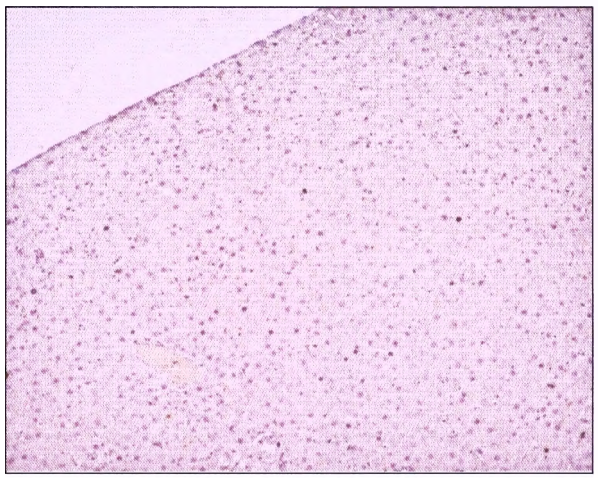


d

Immunohistochemical detection of 4-HNE adducts in normal and iron-overloaded livers. Photomicrographs (*a*) and (*b*) are negative for 4-HNE (control group, normal liver); (*c*) and (*d*) are positive (Fe + ASA group, iron-overloaded liver).

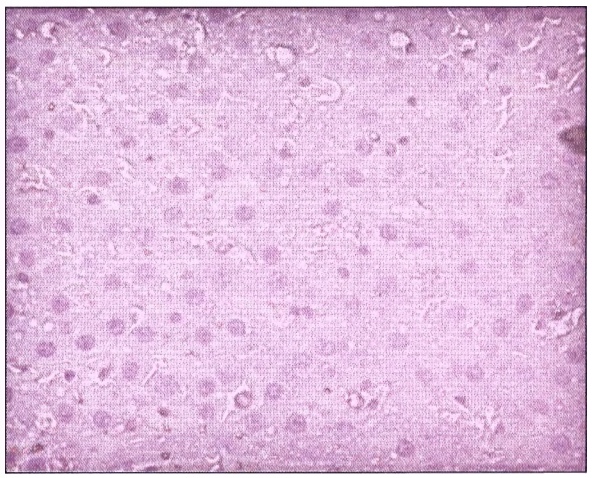
Figure 44

RatLiv Anti-HNE 3 C.7



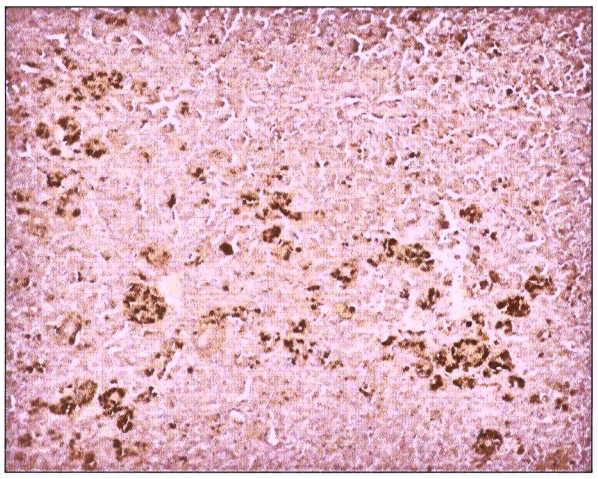
a

RatLiv Anti-HNE 3 C.7.1 40b



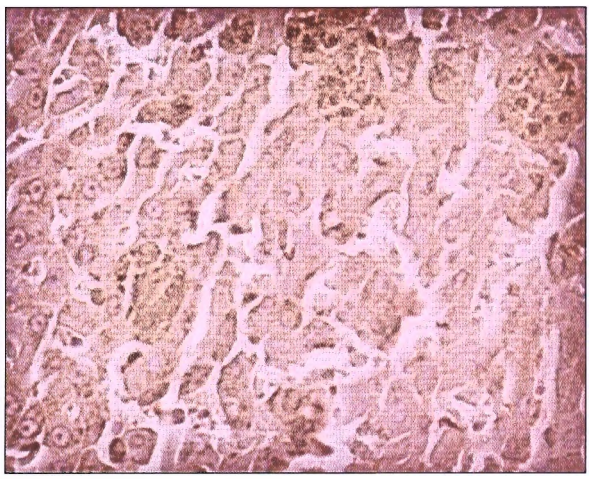
b

RatLiv Anti-HNE 3 Cu.7.5 10b



c

RatLiv Anti-HNE 3 Cu.7.5 40b



d

Immunohistochemical detection of 4-HNE adducts in normal and iron-overloaded livers. Photomicrographs (*a*) and (*b*) are negative for 4-HNE (control group, normal liver); (*c*) and (*d*) are positive (Fe + Cu group, iron-overloaded liver).

Figure 45a : F2.3 Rat Perls' Grade I

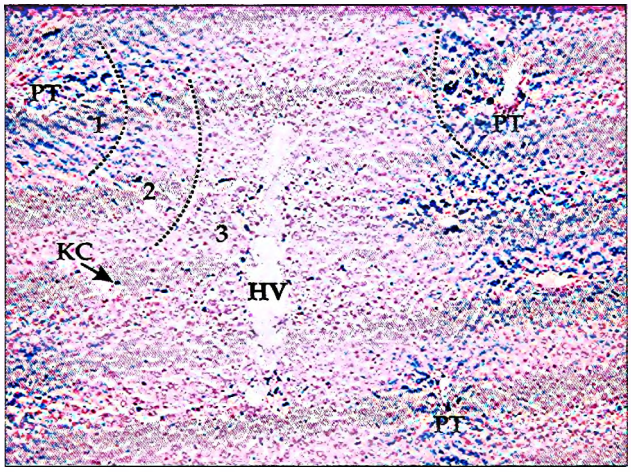


Figure 45b : F3.1 Rat Perls' Grade II

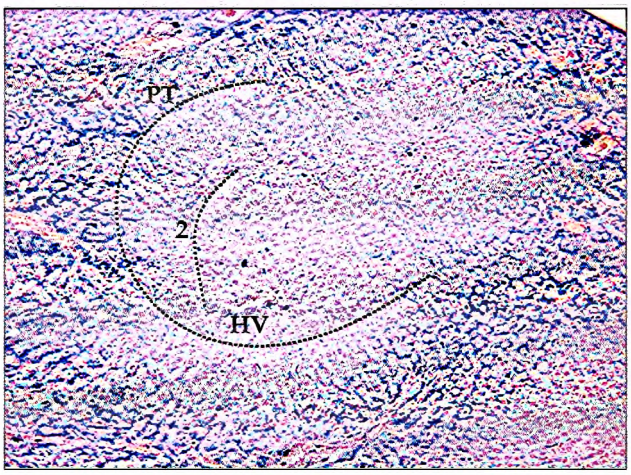


Figure 45c : F7.11 Rat Perls' Grade IV

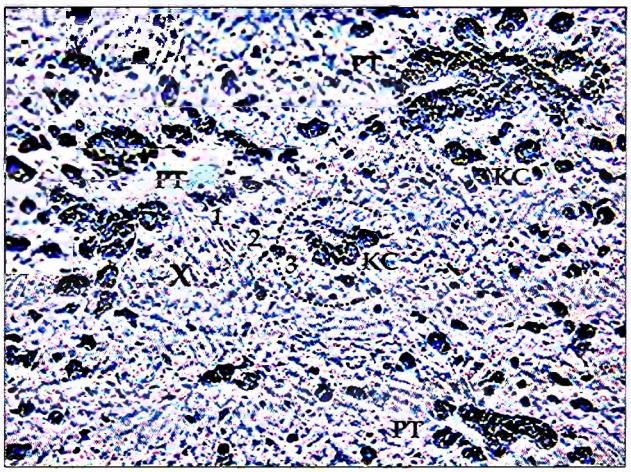


Figure 45: The photomicrographs show hepatic iron deposition as a result of dietary iron overload indicated by Perls ' Prussian blue stain. (a) Demonstrates iron deposition confined to periportal (zone 1) hepatocytes at 8 months, but subsequently progressed to zone 2 at 12 months and by 28 months, no gradient was observed (c). Iron deposition was massive with grade 4 hepatic iron (c). Kupffer cell iron storage also progressed with time. [**1** = zone 1, **2** = zone 2, **3** = zone 3, **PT** = Portal Tract, **HV** = Hepatic Vein, **KC** = Kupffer cell, **X** = Pericanalicular Iron]

Figure 46a : F7.3 Rat IFF H&E

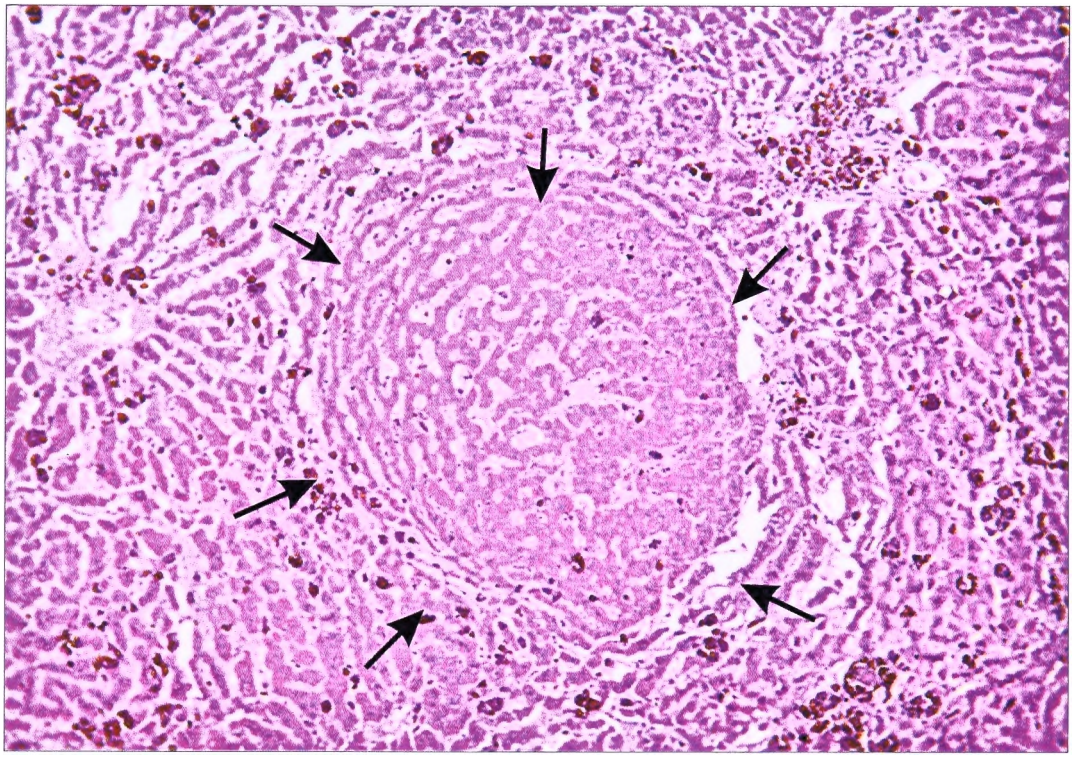


Figure 46b : F7.3 Rat IFF Perls'

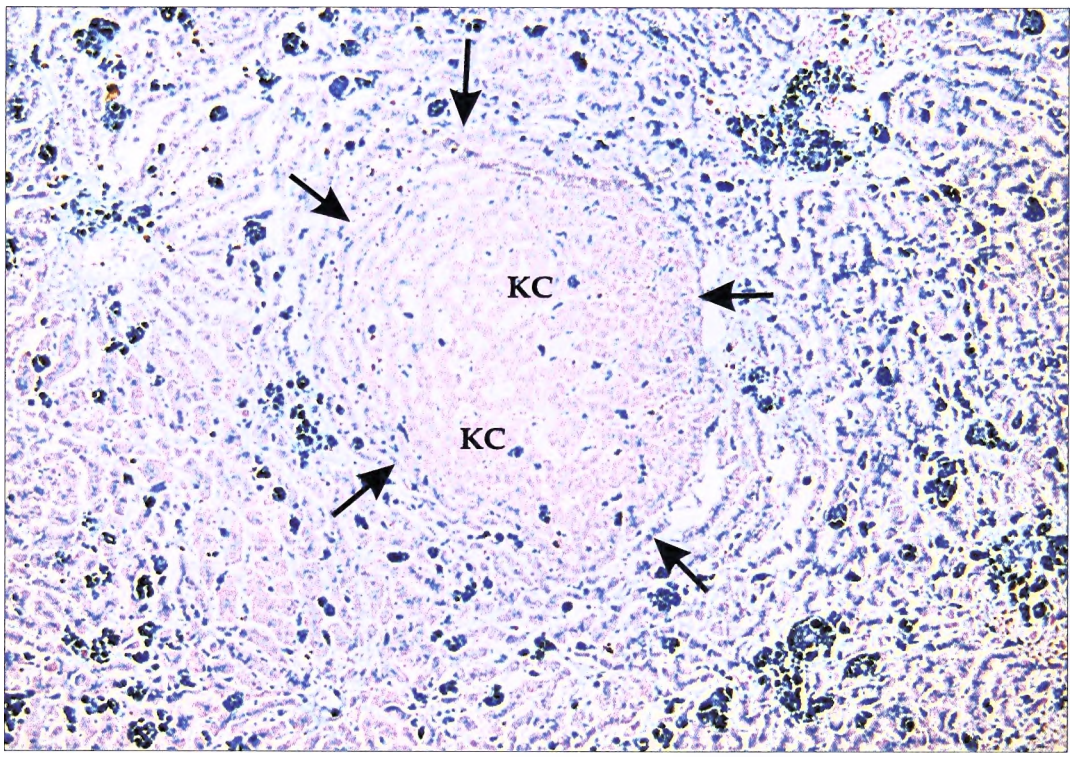


Figure 46 : This figure shows dietary iron overload in the liver with an iron-free focus (arrowed). Photomicrograph (**a**) shows the nodule and surrounding hepatic parenchyma on an H & E stain. In photomicrograph (**b**) iron deposition is indicated by Perls' Prussian blue stain. The iron free nodule with no or very little iron and iron in scattered Kupffer cells is evident and contrasts with the remaining hepatocytes that contain large amounts of iron. [Arrows surround iron free focus, **KC** = Kupffer cells]

Figure 47 : V7.1 Rat IFF H&E

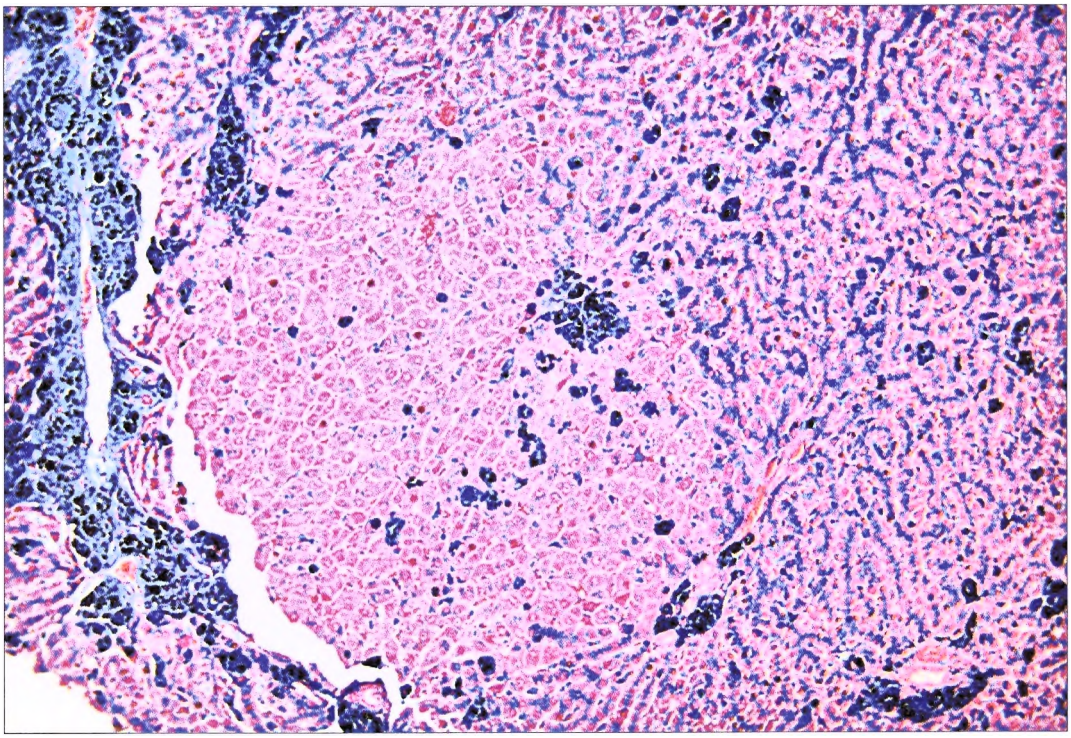


Figure 47 : Another example of the contrast between the heavily iron laden hepatocytes at 28 months in an iron-free focus showing little if any iron in the hepatocytes (H & E stain)

Figure 48 : V7.7 Rat GST-π

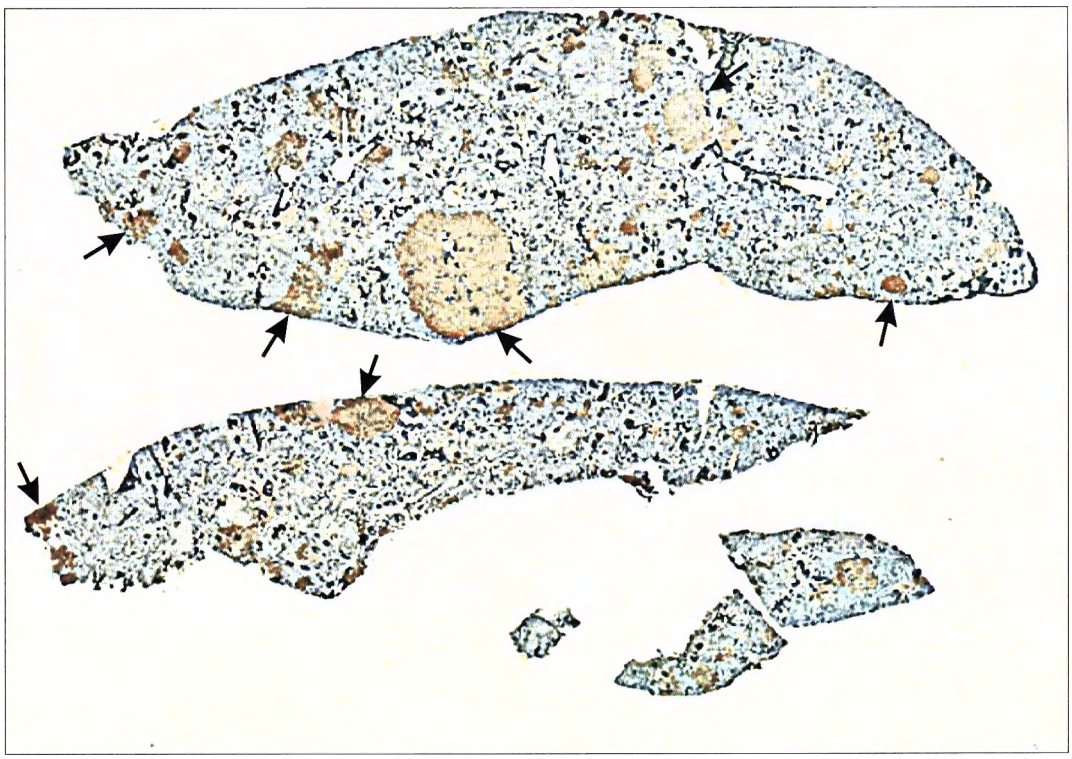


Figure 48 : Counterstaining with GST-π shows the iron-free foci to be positive for this stain, indicating (pre)neoplasia. [Arrows denote iron-free foci]

Figure 49a : ZV7.1 Rat IFF MB H&E

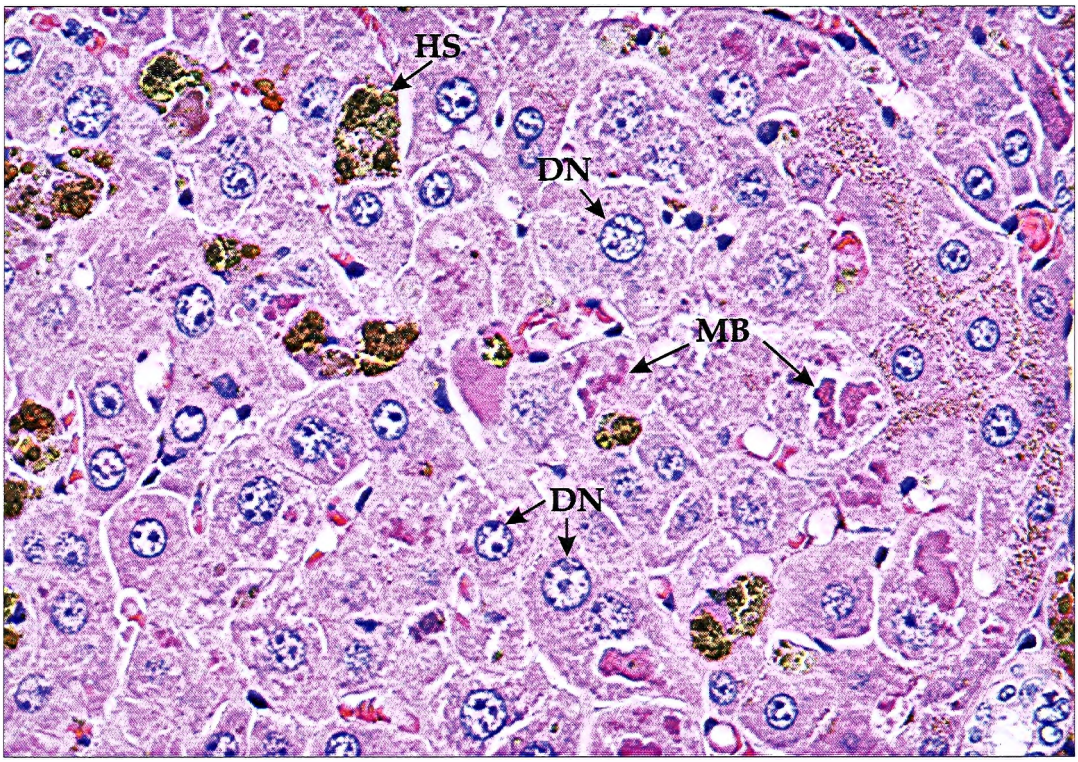


Figure 49b : ZV7.1 Rat IFF MB Perls'

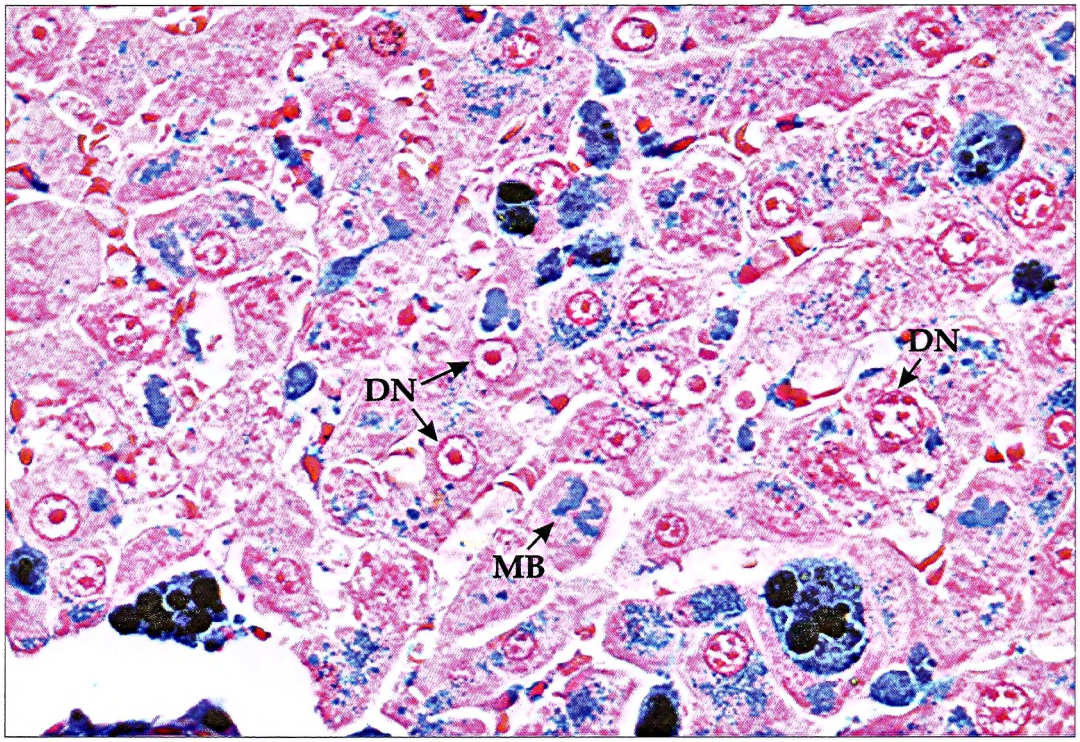


Figure 49: This figure shows a higher power view of an iron-free focus. Amphophilic (purple) intracytoplasmic 'rope-like' inclusions resembling Mallory bodies (**MB**) are evident (arrowed). Large dysplastic nuclei (**DN**) are also seen (arrowed) [H & E stain (**a**), Perls' Prussian blue stain (**b**), **HS** = Aggregates of haemosiderin in Kupffer Cells]

Figure 50a : ZF7.5 Rat IFF Globules H&E

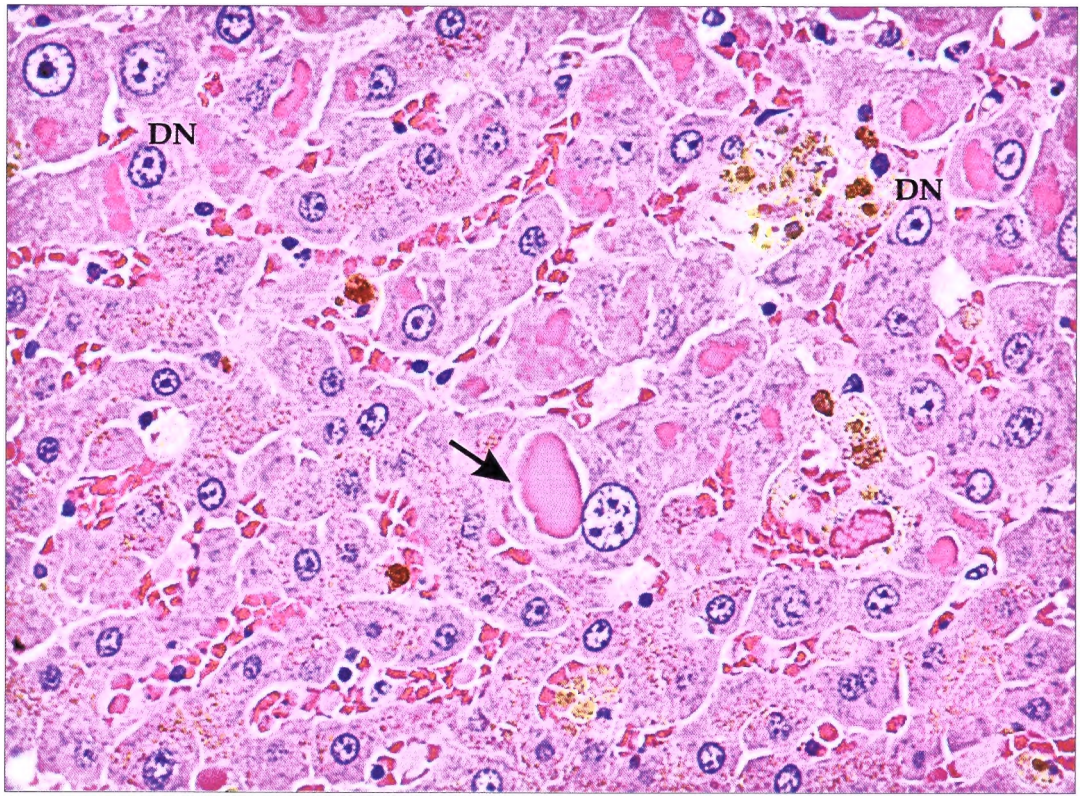


Figure 50b : ZF7.5 Rat IFF Globules Perls'

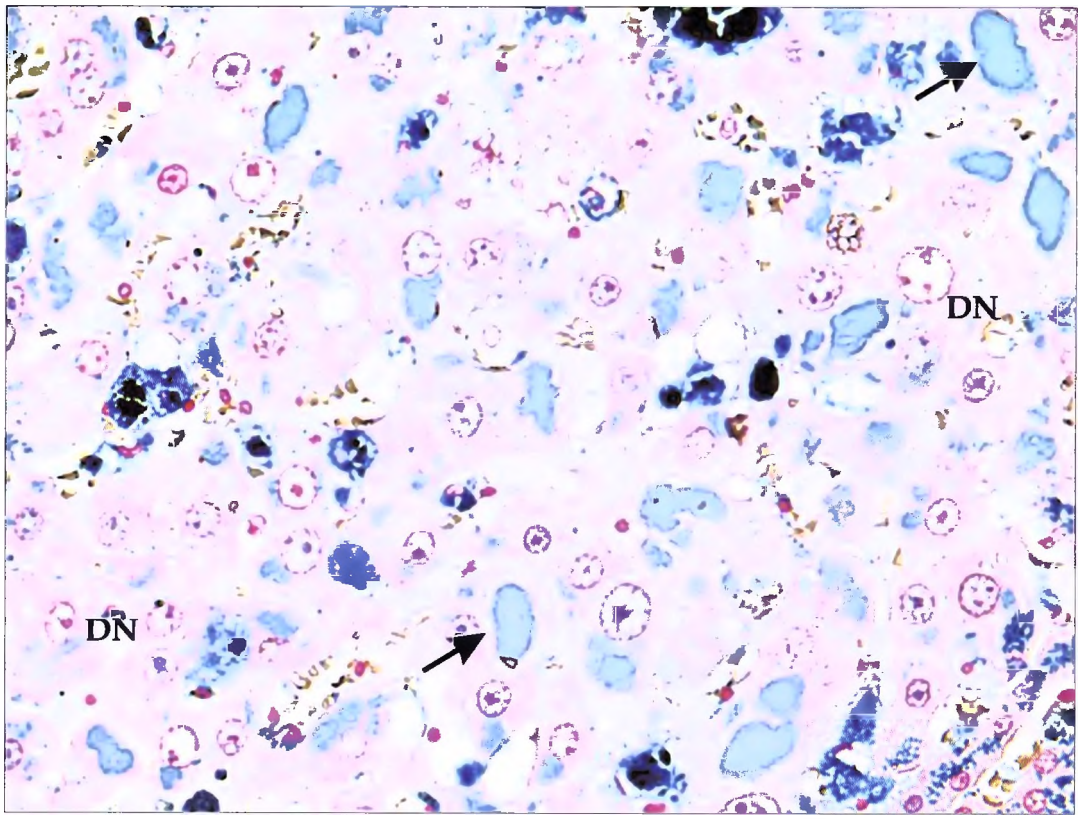


Figure 50: Photomicrograph (H & E stain) demonstrates the presence of globules (arrowed) within hepatocytes of the iron-free focus (a). Similarly, globules are relieved by Perls' Prussian blue stain (b). [DN = Large Dysplastic Nuclei]

Figure 51a : F8.8 Rat HCC wholemount H&E

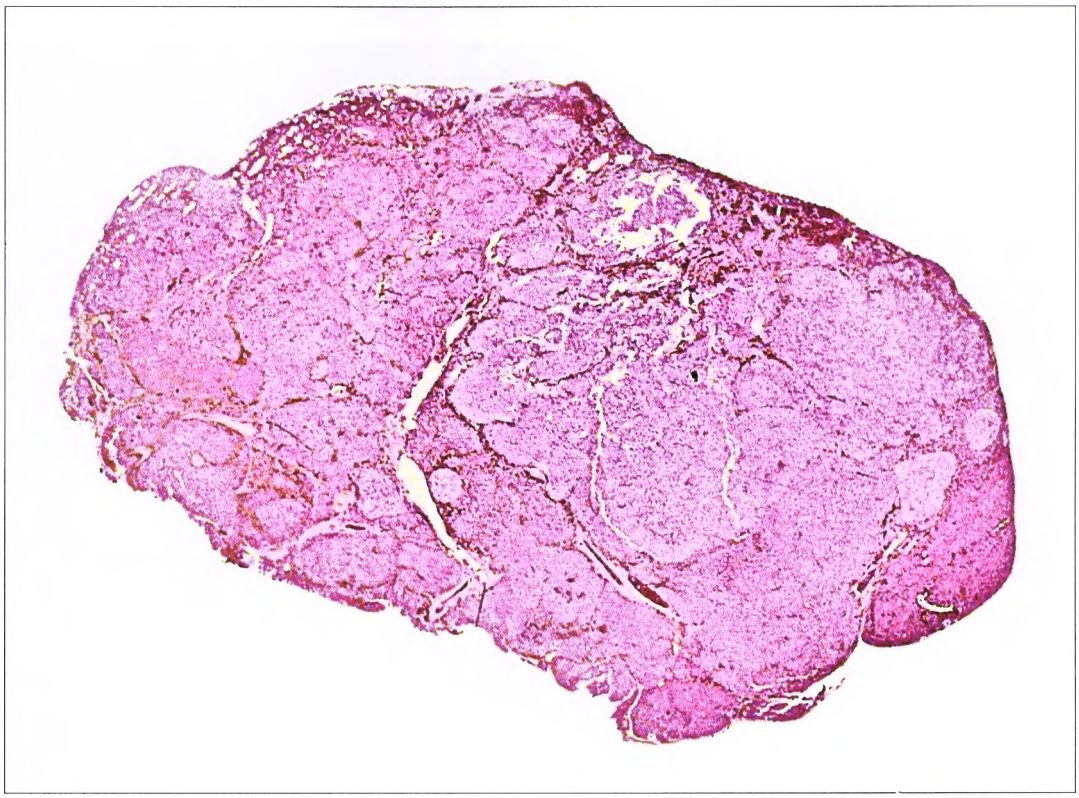


Figure 51b : F8.8 Rat HCC wholemount Perls'

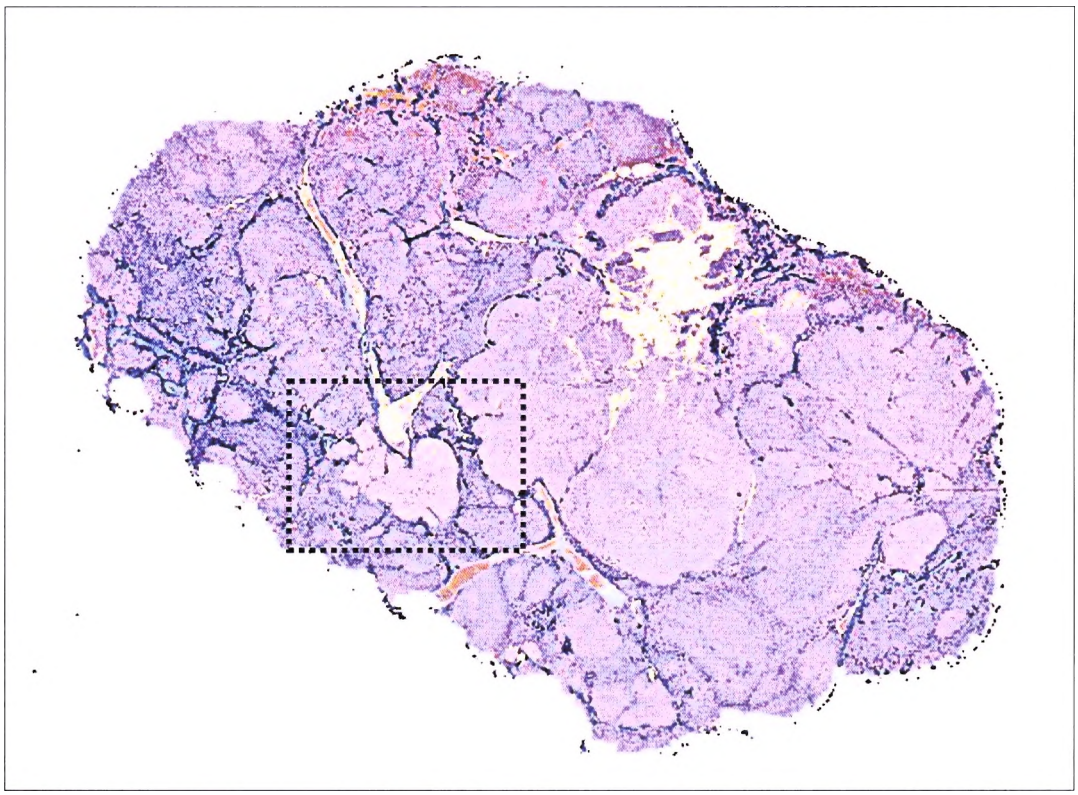


Figure 51: Hepatocellular carcinoma (2cm wholemount) arising in a rat's liver and seen at 32 months [H & E stain (a) and Perls' Prussian blue stain (b)].

Figure 52 : F8.8 Rat HCC Perls'

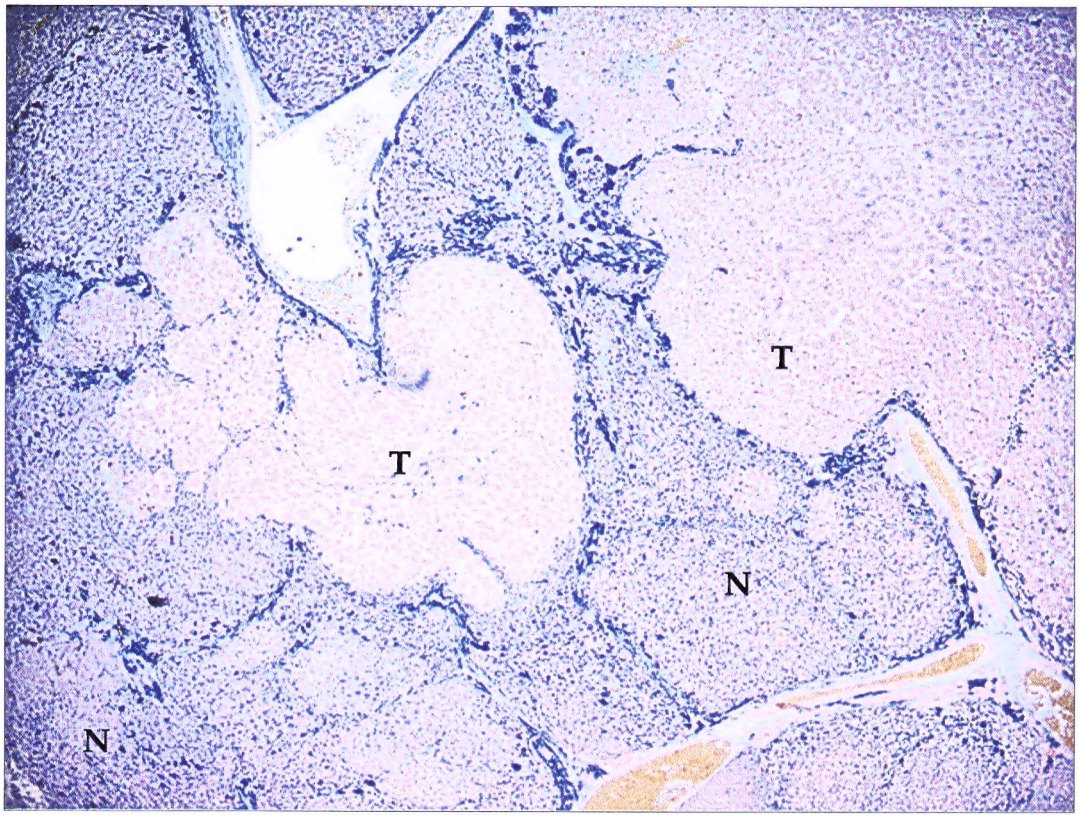


Figure 52 : This figure shows a higher power view of the area blocked in Fig 51b demonstrating small areas of normal liver tissue (N), seen contiguous with the tumours (T). Additionally, there was no fibrosis or cirrhosis (Perls' Prussian blue stain).

Figure 53 : F8.8 Rat HCC (pseudoglandular) H & E

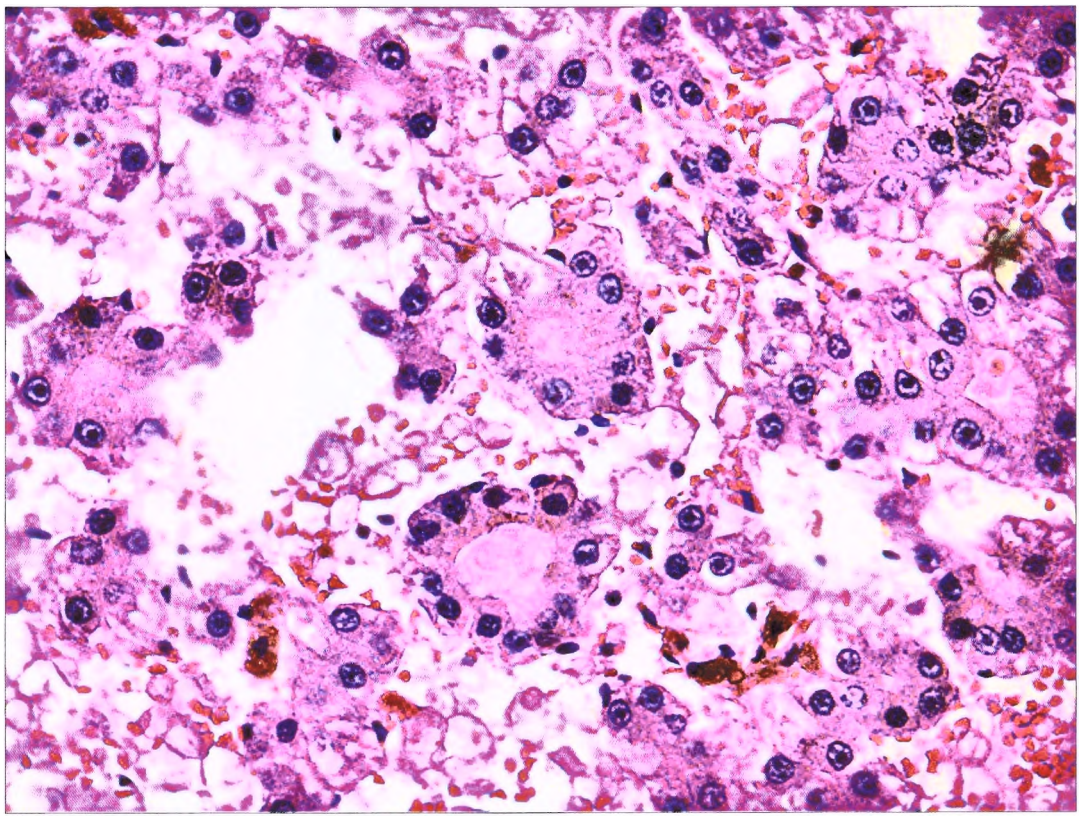


Figure 53 : Photomicrograph (H & E stain) showing pseudoglandular HCC after 32 months of iron loading.

Figure 54 : F8.8 Rat HCC (pseudoglandular) Perls'

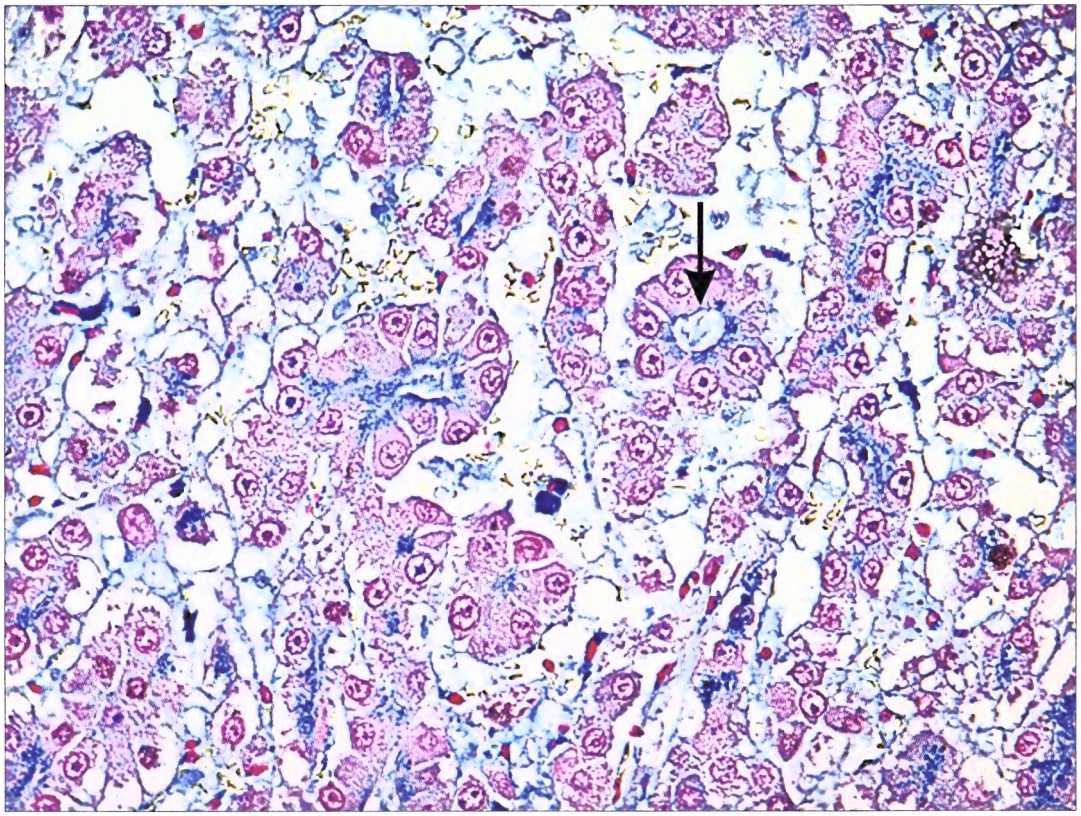


Figure 54 : Perls' Prussian blue stain of photomicrograph shows pseudoglandular HCC with iron at the canalicular pole (arrowed).

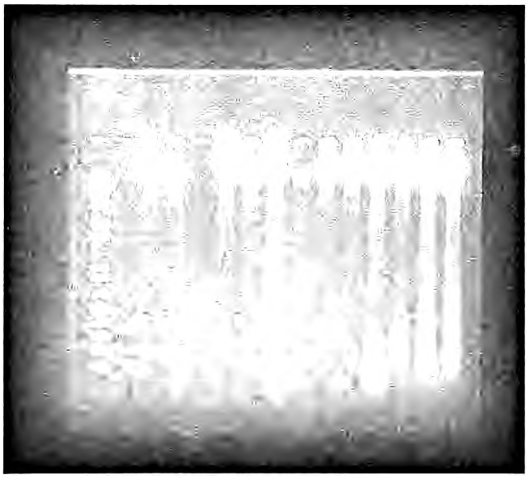


Figure 55. Pulsed Field Gel Electrophoresis (PFGE). Lane 1 = 50 kb marker, Lanes 3 & 4 = C group DNA, lanes 6 & 7 = Fe group DNA, lanes 8 & 9 = Fe + V group DNA, lanes 10 & 11 = Fe – V group DNA, lanes 12 & 13 = Fe + ASA group DNA, lanes 14 & 15 = Fe + Cu group DNA. PFGE was run for 17 hrs under the following conditions: 0.9% agarose gel, ν = 4.5V, initial switch time = 0.1s, final switch time = 200s, current = 180 mA, pump rate = 75, temp $\approx 20^{o}$C. DNA was obtained from Wistar rats after 4 months iron loading. The figure demonstrates that DNA strand breaks occur as an early event of iron-overloaded-induced oxidative stress.

Appendix A

Table 19x

Correlation Analysis

Treatment=A

PEARSON CORRELATION COEFFICIENTS
PROB > |R| UNDER H0: RHO=0
NUMBER OF OBSERVATIONS

	FE	ALT	AST	O2	GPX	SOD	TAS	CAT	LPO	OHDG_8	FADU	VIT_C	MDA	AMESN	ORAC_L	ORAC_A	IP_8	CU
FE FE	1.00000 32	0.68922 <.0001 28	0.59575 0.0008 28	0.06688 0.7856 19	0.09070 0.6215 32	0.16588 0.3642 32	0.42633 0.0150 32	-0.28759 0.1105 32	0.71174 <.0001 32	0.62826 0.0001 32	0.67818 <.0001 32	0.78944 < 0001 32	0.64160 0.0003 27	0.38743 0.0417 28	0.56901 0.0016 28	-0.27197 0.1615 28	0.17861 0.3632 28	0.67507 < 0001 32
ALT ALT	0.68922 < 0001 28	1.00000 29	0.65704 0.0001 29	-0.43447 0.0556 20	0.34268 0.0688 29	0.27796 0.1443 29	0.48035 0.0084 29	-0.47941 0.0085 29	0.84434 <.0001 29	0.77638 <.0001 29	0.79023 < 0001 29	0.73695 < 0001 29	0.88994 < 0001 24	0.46237 0.0200 25	0.85932 <.0001 25	-0.41433 0.0395 25	0.46650 0.0187 25	0.62941 0.0003 29
AST AST	0.59575 0.0008 28	0.65704 0.0001 29	1.00000 29	-0.31315 0.1788 20	0.36180 0.0538 29	0.16162 0.4023 29	0.63277 0.0002 29	-0.12774 0.5090 29	0.69720 < 0001 29	0.83399 <.0001 29	0.84237 <.0001 29	0.75977 < 0001 29	0.69187 0.0002 24	0.76824 <.0001 25	0.85868 <.0001 25	-0.25809 0.2129 25	0.34878 0.0875 25	0.59329 0.0007 29
O2 O2	0.06688 0.7856 19	-0.43447 0.0556 20	-0.31315 0.1788 20	1.00000 20	-0.15999 0.5004 20	0.43972 0.0524 20	0.01137 0.9621 20	0.56829 0.0089 20	-0.51083 0.0214 20	-0.52513 0.0174 20	-0.53151 0.0159 20	-0.04223 0.8597 20	-0.50553 0.0546 15	-0.48178 0.0315 20	-0.49091 0.0280 20	0.64848 0.0020 20	-0.24092 0.3062 20	-0.38133 0.0971 20
GPX GPX	0.09070 0.6215 32	0.34268 0.0688 29	0.36180 0.0538 29	-0.15999 0.5004 20	1.00000 33	-0.04638 0.7977 33	0.40752 0.0186 33	-0.22041 0.2177 33	0.39864 0.0216 33	0.27771 0.1176 33	0.06867 0.7041 33	0.10136 0.5746 33	0.04823 0.8075 28	-0.05082 0.7935 29	0.23480 0.2202 29	-0.28685 0.1314 29	0.21849 0.2548 29	0.10099 0.5760 33
SOD SOD	0.16588 0.3642 32	0.27796 0.1443 29	0.16162 0.4023 29	0.43972 0.0524 20	-0.04638 0.7977 33	1.00000 33	0.10352 0.5665 33	-0.00391 0.9828 33	0.08109 0.6537 33	0.08769 0.6275 33	-0.02598 0.8859 33	0.12969 0 4719 33	-0.28763 0.1378 28	-0.11081 0.5672 29	0.29516 0.1201 29	0.32193 0.0886 29	0.13638 0.4806 29	-0.14598 0.4176 33
TAS TAS	0.42633 0.0150 32	0.48035 0.0084 29	0.63277 0.0002 29	0.01137 0.9621 20	0.40752 0 0186 33	0.10352 0.5665 33	1.00000 33	0.20151 0.2608 33	0.41948 0.0151 33	0.39314 0.0236 33	0.36536 0.0365 33	0.55064 0 0009 33	0.19057 0.3314 28	0.22094 0.2494 29	0.40077 0.0312 29	0.21102 0.2718 29	0.15793 0.4132 29	0.20661 0.2487 33
CAT CAT	-0.28759 0.1105 32	-0.47941 0.0085 29	-0.12774 0.5090 29	0.56829 0.0089 20	-0.22041 0.2177 33	-0.00391 0.9828 33	0.20151 0.2608 33	1.00000 33	-0.53730 0.0013 33	-0.39327 0.0236 33	-0.45403 0.0080 33	-0.09816 0.5868 33	-0.34925 0.0685 28	-0.29873 0.1154 29	-0.41682 0.0245 29	0.83792 <.0001 29	-0.20243 0.2923 29	-0.41615 0 0160 33
LPO LPO	0.71174 <.0001 32	0.84434 <.0001 29	0.69720 <.0001 29	-0.51083 0.0214 20	0.39864 0.0216 33	0.08109 0.6537 33	0.41948 0.0151 33	-0.53730 0.0013 33	1.00000 34	0.77142 <.0001 34	0.75475 <.0001 33	0.69276 < 0001 33	0.69140 <.0001 28	0.53259 0.0024 30	0.80680 <.0001 29	-0.59089 0.0007 29	0.45146 0.0140 29	0.64852 < 0001 33

Appendix A

PEARSON CORRELATION COEFFICIENTS
PROB > |R| UNDER H0: RHO=0
NUMBER OF OBSERVATIONS

	FE	ALT	AST	O2	GPX	SOD	TAS	CAT	LPO	OHDG_8	FADU	VIT_C	MDA	AMESN	ORAC_L	ORAC_A	IP_8	CU
OHdG_8 OHdG_8	0.62826 0.0001 32	0.77638 <.0001 29	0.83399 <.0001 29	-0.52513 0.0174 20	0.27771 0.1176 33	0.08769 0.6275 33	0.39314 0.0236 33	-0.39327 0.0236 33	0.77142 <.0001 34	1.00000 34	0.84565 <.0001 33	0.65193 <.0001 33	0.72919 <.0001 28	0.72016 <.0001 30	0.83841 <.0001 29	-0.48310 0.0079 29	0.35392 0.0596 29	0.64271 <.0001 33
FADU FADU	0.67818 <.0001 32	0.79023 <.0001 29	0.84237 <.0001 29	-0.53151 0.0159 20	0.06867 0.7041 33	-0.02598 0.8859 33	0.36536 0.0365 33	-0.45403 0.0080 33	0.75475 <.0001 33	0.84565 <.0001 33	1.00000 33	0.73044 <.0001 33	0.77201 <.0001 28	0.82742 <.0001 29	0.74726 <.0001 29	-0.55976 0.0016 29	0.29954 0.1144 29	0.68097 <.0001 33
VIT_C VIT_C	0.78944 <.0001 32	0.73695 <.0001 29	0.75977 <.0001 29	-0.04223 0.8597 20	0.10136 0.5746 33	0.12969 0.4719 33	0.55064 0.0009 33	-0.09816 0.5868 33	0.69276 <.0001 33	0.65193 <.0001 33	0.73044 <.0001 33	1.00000 33	0.66760 0.0001 28	0.56607 0.0014 29	0.59261 0.0007 29	-0.08932 0.6450 29	0.56039 0.0016 29	0.64112 <.0001 33
MDA MDA	0.64160 0.0003 27	0.88994 <.0001 24	0.69187 0.0002 24	-0.50553 0.0546 15	0.04823 0.8075 28	-0.28763 0.1378 28	0.19057 0.3314 28	-0.34925 0.0685 28	0.69140 <.0001 28	0.72919 <.0001 28	0.77201 <.0001 28	0.66760 0.0001 28	1.00000 28	0.83540 <.0001 24	0.47853 0.0180 24	-0.46837 0.0210 24	0.27142 0.1995 24	0.72910 <.0001 28
AMESN	0.38743 0.0417 28	0.46237 0.0200 25	0.76824 <.0001 25	-0.48178 0.0315 20	-0.05082 0.7935 29	-0.11081 0.5672 29	0.22094 0.2494 29	-0.29873 0.1154 29	0.53259 0.0024 30	0.72016 <.0001 30	0.82742 <.0001 29	0.56607 0.0014 29	0.83540 <.0001 24	1.00000 30	0.60486 0.0005 29	-0.46974 0.0101 29	0.08646 0.6556 29	0.63178 0.0002 29
ORAC_L ORAC_L	0.56901 0.0016 28	0.85932 <.0001 25	0.85868 <.0001 25	-0.49091 0.0280 20	0.23480 0.2202 29	0.29516 0.1201 29	0.40077 0.0312 29	-0.41682 0.0245 29	0.80680 <.0001 29	0.83841 <.0001 29	0.74726 <.0001 29	0.59261 0.0007 29	0.47853 0.0180 24	0.60486 0.0005 29	1.00000 29	-0.41956 0.0235 29	0.34089 0.0704 29	0.51018 0.0047 29
ORAC_A ORAC_A	-0.27197 0.1615 28	-0.41433 0.0395 25	-0.25809 0.2129 25	0.64848 0.0020 20	-0.28685 0.1314 29	0.32193 0.0886 29	0.21102 0.2718 29	0.83792 <.0001 29	-0.59089 0.0007 29	-0.48310 0.0079 29	-0.55976 0.0016 29	-0.08932 0.6450 29	-0.46837 0.0210 24	-0.46974 0.0101 29	-0.41956 0.0235 29	1.00000 29	-0.12666 0.5127 29	-0.52557 0.0034 29
IP_8 IP_8	0.17861 0.3632 28	0.46650 0.0187 25	0.34878 0.0875 25	-0.24092 0.3062 20	0.21849 0.2548 29	0.13638 0.4806 29	0.15793 0.4132 29	-0.20243 0.2923 29	0.45146 0.0140 29	0.35392 0.0596 29	0.29954 0.1144 29	0.56039 0.0016 29	0.27142 0.1995 24	0.08646 0.6556 29	0.34089 0.0704 29	-0.12666 0.5127 29	1.00000 29	0.32212 0.0884 29
Cu Cu	0.67507 <.0001 32	0.62941 0.0003 29	0.59329 0.0007 29	-0.38133 0.0971 20	0.10099 0.5760 33	-0.14598 0.4176 33	0.20661 0.2487 33	-0.41615 0.0160 33	0.64852 <.0001 33	0.64271 <.0001 33	0.68097 <.0001 33	0.64112 <.0001 33	0.72910 <.0001 28	0.63178 0.0002 29	0.51018 0.0047 29	-0.52557 0.0034 29	0.32212 0.0884 29	1.00000 33

Appendix A

Table 20x

Correlation Analysis

Treatment=C

PEARSON CORRELATION COEFFICIENTS
PROB > |R| UNDER H0: RHO=0
NUMBER OF OBSERVATIONS

	FE	ALT	AST	O2	GPX	SOD	TAS	CAT	LPO	OHDG_8	FADU	VIT_C	MDA	AMESN	ORAC_L	ORAC_A	IP_8	CU
FE FE	1.00000 35	-0.26903 0.1582 29	0.00520 0.9786 29	-0.01703 0.9432 20	-0.07321 0.6807 34	0.25655 0.1430 34	0.05276 0.7670 34	0.15260 0.3889 34	0.00444 0.9801 34	-0.11214 0.5213 35	0.04019 0.8187 35	-0.12210 0.4915 34	0.11597 0.5491 29	0.15345 0.4182 30	-0.07045 0.7165 29	0.00578 0.9763 29	-0.13622 0.4810 29	-0.17230 0.3299 34
ALT ALT	-0.26903 0.1582 29	1.00000 29	0.52877 0.0032 29	-0.41938 0.0739 19	0.24566 0.1990 29	-0.00232 0.9905 29	0.57130 0.0012 29	-0.01014 0.9584 29	0.63932 0.0002 29	-0.09895 0.6096 29	0.51720 0.0041 29	0.53375 0.0029 29	0.26126 0.2175 24	-0.33285 0.1120 24	0.36872 0.0762 24	-0.25272 0.2335 24	0.49381 0.0142 24	0.32085 0.0897 29
AST AST	0.00520 0.9786 29	0.52877 0.0032 29	1.00000 29	-0.02390 0.9226 19	0.23307 0.2237 29	0.18242 0.3436 29	0.55825 0.0016 29	-0.04176 0.8297 29	0.59157 0.0007 29	-0.34494 0.0669 29	0.30425 0.1086 29	0.25521 0.1815 29	0.37322 0.0724 24	-0.25812 0.2233 24	0.46366 0.0225 24	-0.26498 0.2108 24	0.24056 0.2575 24	0.13353 0.4898 29
O2 O2	-0.01703 0.9432 20	-0.41938 0.0739 19	-0.02390 0.9226 19	1.00000 20	0.14048 0.5547 20	0.01721 0.9426 20	-0.44441 0.0496 20	-0.18282 0.4404 20	-0.26941 0.2507 20	-0.16020 0.4999 20	-0.45363 0.0445 20	-0.42835 0.0595 20	-0.02802 0.9210 15	-0.00239 0.9920 20	-0.36725 0.1112 20	0.12067 0.6123 20	-0.30811 0.1863 20	-0.29677 0.2039 20
GPX GPX	-0.07321 0.6807 34	0.24566 0.1990 29	0.23307 0.2237 29	0.14048 0.5547 20	1.00000 34	-0.06893 0.6985 34	0.24493 0.1627 34	-0.44581 0.0082 34	0.45494 0.0069 34	0.02875 0.8718 34	0.08529 0.6315 34	0.11770 0.5074 34	0.23628 0.2172 29	-0.13392 0.4886 29	0.10850 0.5753 29	-0.31871 0.0920 29	0.04028 0.8356 29	0.20816 0.2375 34
SOD SOD	0.25655 0.1430 34	-0.00232 0.9905 29	0.18242 0.3436 29	0.01721 0.9426 20	-0.06893 0.6985 34	1.00000 34	0.18744 0.2885 34	0.08487 0.6332 34	-0.00156 0.9930 34	0.03416 0.8479 34	-0.02664 0.8811 34	0.05682 0.7496 34	0.15147 0.4328 29	0.00764 0.9686 29	0.15030 0.4364 29	0.35210 0.0610 29	-0.19278 0.3164 29	0.20968 0.2340 34
TAS TAS	0.05276 0.7670 34	0.57130 0.0012 29	0.55825 0.0016 29	-0.44441 0.0496 20	0.24493 0.1627 34	0.18744 0.2885 34	1.00000 34	0.04955 0.7808 34	0.66744 <.0001 34	0.13846 0.4348 34	0.60008 0.0002 34	0.75613 <.0001 34	0.72912 < 0001 29	-0.15350 0.4266 29	0.76966 <.0001 29	-0.14455 0.4544 29	0.38269 0.0405 29	0.49640 0.0028 34
CAT CAT	0.15260 0.3889 34	-0.01014 0.9584 29	-0.04176 0.8297 29	-0.18282 0.4404 20	-0.44581 0.0082 34	0.08487 0.6332 34	0.04955 0.7808 34	1.00000 34	-0.34023 0.0490 34	-0.29569 0.0895 34	-0.18943 0.2833 34	0.00405 0.9819 34	-0.16452 0.3938 29	0.01323 0.9457 29	-0.08131 0.6750 29	0.55425 0.0018 29	-0.16109 0.4038 29	-0.22020 0.2108 34
LPO LPO	0.00444 0.9801 34	0.63932 0.0002 29	0.59157 0.0007 29	-0.26941 0.2507 20	0.45494 0 0069 34	-0.00156 0.9930 34	0.66744 <.0001 34	-0.34023 0.0490 34	1.00000 34	0.18648 0.2910 34	0.50396 0.0024 34	0.64641 <.0001 34	0.68209 <.0001 29	-0.05427 0.7798 29	0.55297 0.0019 29	-0.58984 0.0008 29	0.59425 0.0007 29	0.30286 0.0817 34

Appendix A

PEARSON CORRELATION COEFFICIENTS
PROB > |R| UNDER H0: RHO=0
NUMBER OF OBSERVATIONS

	FE	ALT	AST	O2	GPX	SOD	TAS	CAT	LPO	OHDG_8	FADU	VIT C	MDA	AMESN	ORAC L	ORAC_A	IP_8	CU
OHdG_8 OHdG_8	-0.11214 0.5213 35	-0.09895 0.6096 29	-0.34494 0.0669 29	-0.16020 0.4999 20	0.02875 0.8718 34	0.03416 0.8479 34	0.13846 0.4348 34	-0.29569 0.0895 34	0.18648 0.2910 34	1.00000 35	0.15631 0.3699 35	0.39422 0.0211 34	0.34257 0.0689 29	0.14187 0.4546 30	-0.05393 0.7811 29	0.05611 0.7725 29	0.18441 0.3382 29	0.48284 0.0038 34
FADU FADU	0.04019 0.8187 35	0.51720 0.0041 29	0.30425 0.1086 29	-0.45363 0.0445 20	0.08529 0.6315 34	-0.02664 0.8811 34	0.60008 0.0002 34	-0.18943 0.2833 34	0.50396 0.0024 34	0.15631 0.3699 35	1.00000 35	0.54121 0.0009 34	0.69465 <.0001 29	-0.01134 0.9526 30	0.63903 0.0002 29	-0.38690 0.0381 29	0.64893 0.0001 29	0.46952 0.0051 34
VIT_C VIT_C	-0.12210 0.4915 34	0.53375 0.0029 29	0.25521 0.1815 29	-0.42835 0.0595 20	0.11770 0.5074 34	0.05682 0.7496 34	0.75613 <.0001 34	0.00405 0.9819 34	0.64641 <.0001 34	0.39422 0.0211 34	0.54121 0.0009 34	1.00000 34	0.69796 <.0001 29	-0.19544 0.3096 29	0.51684 0.0041 29	-0.08184 0.6730 29	0.56322 0.0015 29	0.37261 0.0300 34
MDA MDA	0.11597 0.5491 29	0.26126 0.2175 24	0.37322 0.0724 24	-0.02802 0.9210 15	0.23628 0.2172 29	0.15147 0.4328 29	0.72912 <.0001 29	-0.16452 0.3938 29	0.68209 <.0001 29	0.34257 0.0689 29	0.69465 <.0001 29	0.69796 <.0001 29	1.00000 29	-0.02542 0.9061 24	0.61991 0.0012 24	-0.22951 0.2807 24	0.65595 0.0005 24	0.47827 0.0087 29
AMESN	0.15345 0.4182 30	-0.33285 0.1120 24	-0.25812 0.2233 24	-0.00239 0.9920 20	-0.13392 0.4886 29	0.00764 0.9686 29	-0.15350 0.4266 29	0.01323 0.9457 29	-0.05427 0.7798 29	0.14187 0.4546 30	-0.01134 0.9526 30	-0.19544 0.3096 29	-0.02542 0.9061 24	1.00000 30	0.01116 0.9542 29	0.15598 0.4191 29	-0.06595 0.7339 29	0.31759 0.0932 29
ORAC_L ORAC_L	-0.07045 0.7165 29	0.36872 0.0762 24	0.46366 0.0225 24	-0.36725 0.1112 20	0.10850 0.5753 29	0.15030 0.4364 29	0.76966 <.0001 29	-0.08131 0.6750 29	0.55297 0.0019 29	-0.05393 0.7811 29	0.63903 0.0002 29	0.51684 0.0041 29	0.61991 0.0012 24	0.01116 0.9542 29	1.00000 29	-0.38510 0.0391 29	0.38145 0.0412 29	0.18418 0.3389 29
ORAC_A ORAC_A	0.00578 0.9763 29	-0.25272 0.2335 24	-0.26498 0.2108 24	0.12067 0.6123 20	-0.31871 0.0920 29	0.35210 0.0610 29	-0.14455 0.4544 29	0.55425 0.0018 29	-0.58984 0.0008 29	0.05611 0.7725 29	-0.38690 0.0381 29	-0.08184 0.6730 29	-0.22951 0.2807 24	0.15598 0.4191 29	-0.38510 0.0391 29	1.00000 29	-0.43595 0.0181 29	0.13303 0.4915 29
IP_8 IP_8	-0.13622 0.4810 29	0.49381 0.0142 24	0.24056 0.2575 24	-0.30811 0.1863 20	0.04028 0.8356 29	-0.19278 0.3164 29	0.38269 0.0405 29	-0.16109 0.4038 29	0.59425 0.0007 29	0.18441 0.3382 29	0.64893 0.0001 29	0.56322 0.0015 29	0.65595 0.0005 24	-0.06595 0.7339 29	0.38145 0.0412 29	-0.43595 0.0181 29	1.00000 29	0.17179 0.3729 29
Cu Cu	-0.17230 0.3299 34	0.32085 0.0897 29	0.13353 0.4898 29	-0.29677 0.2039 20	0.20816 0.2375 34	0.20968 0.2340 34	0.49640 0.0028 34	-0.22020 0.2108 34	0.30286 0.0817 34	0.48284 0.0038 34	0.46952 0.0051 34	0.37261 0.0300 34	0.47827 0.0087 29	0.31759 0.0932 29	0.18418 0.3389 29	0.13303 0.4915 29	0.17179 0.3729 29	1.00000 34

Appendix A

Table 21x

Correlation Analysis

Treatment=Cu

PEARSON CORRELATION COEFFICIENTS
PROB > |R| UNDER H0: RHO=0
NUMBER OF OBSERVATIONS

	FE	ALT	AST	O2	GPX	SOD	TAS	CAT	LPO	OHDG_8	FADU	VIT_C	MDA	AMESN	ORAC_L	ORAC_A	IP_8	CU
FE FE	1.00000 33	0.56529 0.0014 29	0.47885 0.0086 29	-0.45734 0.0490 19	0.21311 0.2416 32	0.10196 0.5723 33	0.49167 0.0037 33	-0.16242 0.3665 33	0.61738 0.0001 33	0.53025 0.0015 33	0.67976 <.0001 33	0.61503 0.0001 33	0.56000 0.0019 28	0.63089 0.0003 28	0.65731 0.0001 28	-0.08957 0.6503 28	0.51998 0.0046 28	0.46960 0.0058 33
ALT ALT	0.56529 0.0014 29	1.00000 30	0.83737 <.0001 30	-0.30755 0.1871 20	0.23544 0.2189 29	-0.00059 0.9975 30	0.56329 0.0012 30	-0.24003 0.2014 30	0.85796 <.0001 30	0.70079 <.0001 30	0.83194 <.0001 30	0.76771 <.0001 30	0.91930 <.0001 25	0.55167 0.0043 25	0.91000 <.0001 25	-0.39119 0.0532 25	0.56076 0.0035 25	0.48894 0.0061 30
AST AST	0.47885 0.0086 29	0.83737 <.0001 30	1.00000 30	-0.37411 0.1042 20	0.20695 0.2814 29	-0.22535 0.2312 30	0.54529 0.0018 30	-0.30457 0.1017 30	0.65267 <.0001 30	0.61950 0.0003 30	0.65908 <.0001 30	0.54021 0.0021 30	0.57518 0.0026 25	0.56331 0.0034 25	0.84217 <.0001 25	-0.44988 0.0240 25	0.27891 0.1770 25	0.42418 0.0195 30
O2 O2	-0.45734 0.0490 19	-0.30755 0.1871 20	-0.37411 0.1042 20	1.00000 20	0.63291 0.0036 19	-0.26122 0.2660 20	-0.60327 0.0049 20	-0.18335 0.4391 20	-0.10496 0.6597 20	0.12587 0.5969 20	-0.15699 0.5086 20	-0.51467 0.0202 20	-0.01121 0.9684 15	-0.53430 0.0152 20	-0.36430 0.1143 20	-0.35916 0.1199 20	-0.49325 0.0271 20	-0.05648 0.8130 20
GPX GPX	0.21311 0.2416 32	0.23544 0.2189 29	0.20695 0.2814 29	0.63291 0.0036 19	1.00000 33	-0.34405 0.0499 33	0.19304 0.2818 33	-0.34495 0.0493 33	0.34499 0.0493 33	0.47436 0.0053 33	0.15713 0.3825 33	0.03183 0.8604 33	0.11448 0.5619 28	-0.13419 0.4960 28	0.16311 0.4069 28	-0.48133 0.0095 28	-0.16714 0.3953 28	0.37866 0.0298 33
SOD SOD	0.10196 0.5723 33	-0.00059 0.9975 30	-0.22535 0.2312 30	-0.26122 0.2660 20	-0.34405 0.0499 33	1.00000 34	-0.10582 0.5514 34	0.39725 0.0200 34	-0.13324 0.4525 34	-0.25822 0.1404 34	-0.11781 0.5070 34	-0.15236 0.3897 34	-0.23154 0.2268 29	0.13486 0.4855 29	0.07476 0.6999 29	0.51358 0.0044 29	0.59128 0.0007 29	-0.16843 0.3410 34
TAS TAS	0.49167 0.0037 33	0.56329 0.0012 30	0.54529 0.0018 30	-0.60327 0.0049 20	0.19304 0.2818 33	-0.10582 0.5514 34	1.00000 34	0.06502 0.7149 34	0.53172 0.0012 34	0.42311 0.0127 34	0.49139 0.0032 34	0.55279 0.0007 34	0.29832 0.1160 29	0.41362 0.0257 29	0.66638 <.0001 29	0.02324 0.9047 29	0.37804 0.0432 29	0.55700 0.0006 34
CAT CAT	-0.16242 0.3665 33	-0.24003 0.2014 30	-0.30457 0.1017 30	-0.18335 0.4391 20	-0.34495 0.0493 33	0.39725 0.0200 34	0.06502 0.7149 34	1.00000 34	-0.35483 0.0395 34	-0.37365 0.0295 34	-0.36626 0.0331 34	-0.23091 0.1889 34	-0.49671 0.0061 29	-0.16552 0.3908 29	-0.30589 0.1066 29	0.79740 < 0001 29	0.19555 0.3094 29	-0.22854 0 1936 34
LPO LPO	0.61738 0.0001 33	0.85796 <.0001 30	0.65267 <.0001 30	-0.10496 0.6597 20	0.34499 0.0493 33	-0.13324 0.4525 34	0.53172 0.0012 34	-0.35483 0.0395 34	1.00000 35	0.86910 < 0001 35	0.81834 < 0001 34	0.74588 <.0001 34	0.80913 <.0001 29	0.45534 0.0115 30	0.81455 <.0001 29	-0.56833 0.0013 29	0.39528 0.0338 29	0.64384 <.0001 34

Appendix A

PEARSON CORRELATION COEFFICIENTS
PROB > |R| UNDER H0: RHO=0
NUMBER OF OBSERVATIONS

	FE	ALT	AST	O2	GPX	SOD	TAS	CAT	LPO	OHDG_8	FADU	VIT_C	MDA	AMESN	ORAC_L	ORAC_A	IP_8	CU
OHdG_8 OHdG_8	0.53025 0.0015 33	0.70079 <.0001 30	0.61950 0.0003 30	0.12587 0.5969 20	0.47436 0.0053 33	-0.25822 0.1404 34	0.42311 0.0127 34	-0.37365 0.0295 34	0.86910 <.0001 35	1.00000 35	0.70297 <.0001 34	0.62014 <.0001 34	0.79031 <.0001 29	0.33719 0.0684 30	0.67521 <.0001 29	-0.68944 <.0001 29	0.11560 0.5504 29	0.64018 <.0001 34
FADU FADU	0.67976 <.0001 33	0.83194 <.0001 30	0.65908 <.0001 30	-0.15699 0.5086 20	0.15713 0.3825 33	-0.11781 0.5070 34	0.49139 0.0032 34	-0.36626 0.0331 34	0.81834 <.0001 34	0.70297 <.0001 34	1.00000 34	0.76306 <.0001 34	0.87225 <.0001 29	0.68983 <.0001 29	0.72537 <.0001 29	-0.48537 0.0076 29	0.34226 0.0692 29	0.68113 <.0001 34
VIT_C VIT_C	0.61503 0.0001 33	0.76771 <.0001 30	0.54021 0.0021 30	-0.51467 0.0202 20	0.03183 0.8604 33	-0.15236 0.3897 34	0.55279 0.0007 34	-0.23091 0.1889 34	0.74588 <.0001 34	0.62014 <.0001 34	0.76306 <.0001 34	1.00000 34	0.81382 <.0001 29	0.57879 0.0010 29	0.57654 0.0011 29	-0.27219 0.1532 29	0.45255 0.0137 29	0.52579 0.0014 34
MDA MDA	0.56000 0.0019 28	0.91930 <.0001 25	0.57518 0.0026 25	-0.01121 0.9684 15	0.11448 0.5619 28	-0.23154 0.2268 29	0.29832 0.1160 29	-0.49671 0.0061 29	0.80913 <.0001 29	0.79031 <.0001 29	0.87225 <.0001 29	0.81382 <.0001 29	1.00000 29	0.54469 0.0059 24	0.54443 0.0059 24	-0.61515 0.0014 24	0.17683 0.4085 24	0.54283 0.0023 29
AMESN	0.63089 0.0003 28	0.55167 0.0043 25	0.56331 0.0034 25	-0.53430 0.0152 20	-0.13419 0.4960 28	0.13486 0.4855 29	0.41362 0.0257 29	-0.16552 0.3908 29	0.45534 0.0115 30	0.33719 0.0684 30	0.68983 <.0001 29	0.57879 0.0010 29	0.54469 0.0059 24	1.00000 30	0.58380 0.0009 29	-0.09112 0.6383 29	0.39800 0.0325 29	0.38931 0.0368 29
ORAC_L ORAC_L	0.65731 0.0001 28	0.91000 <.0001 25	0.84217 <.0001 25	-0.36430 0.1143 20	0.16311 0.4069 28	0.07476 0.6999 29	0.66638 <.0001 29	-0.30589 0.1066 29	0.81455 <.0001 29	0.67521 <.0001 29	0.72537 <.0001 29	0.57654 0.0011 29	0.54443 0.0059 24	0.58380 0.0009 29	1.00000 29	-0.35313 0.0602 29	0.51522 0.0042 29	0.59373 0.0007 29
ORAC_A ORAC_A	-0.08957 0.6503 28	-0.39119 0.0532 25	-0.44988 0.0240 25	-0.35916 0.1199 20	-0.48133 0.0095 28	0.51358 0.0044 29	0.02324 0.9047 29	0.79740 <.0001 29	-0.56833 0.0013 29	-0.68944 <.0001 29	-0.48537 0.0076 29	-0.27219 0.1532 29	-0.61515 0.0014 24	-0.09112 0.6383 29	-0.35313 0.0602 29	1.00000 29	0.21703 0.2581 29	-0.40993 0.0272 29
IP_8 IP_8	0.51998 0.0046 28	0.56076 0.0035 25	0.27891 0.1770 25	-0.49325 0.0271 20	-0.16714 0.3953 28	0.59128 0.0007 29	0.37804 0.0432 29	0.19555 0.3094 29	0.39528 0.0338 29	0.11560 0.5504 29	0.34226 0.0692 29	0.45255 0.0137 29	0.17683 0.4085 24	0.39800 0.0325 29	0.51522 0.0042 29	0.21703 0.2581 29	1.00000 29	0.25962 0.1738 29
Cu Cu	0.46960 0.0058 33	0.48894 0.0061 30	0.42418 0.0195 30	-0.05648 0.8130 20	0.37866 0.0298 33	-0.16843 0.3410 34	0.55700 0.0006 34	-0.22854 0.1936 34	0.64384 <.0001 34	0.64018 <.0001 34	0.68113 <.0001 34	0.52579 0.0014 34	0.54283 0.0023 29	0.38931 0.0368 29	0.59373 0.0007 29	-0.40993 0.0272 29	0.25962 0.1738 29	1.00000 34

Appendix A

Table 22x

Correlation Analysis

Treatment=F

PEARSON CORRELATION COEFFICIENTS
PROB > |R| UNDER H0: RHO=0
NUMBER OF OBSERVATIONS

	FE	ALT	AST	O2	GPX	SOD	TAS	CAT	LPO	OHDG_8	FADU	VIT_C	MDA	AMESN	ORAC_L	ORAC_A	IP_8	CU
FE FE	1.00000 34	0.55576 0.0014 30	0.76025 <.0001 30	-0.15583 0.5118 20	0.43601 0.0099 34	0.40404 0.0178 34	0.32952 0.0570 34	-0.23354 0.1837 34	0.78358 <.0001 34	0.61866 <.0001 34	0.61312 0.0001 34	0.69145 <.0001 34	0.61646 0.0005 28	0.55257 0.0023 28	0.71746 <.0001 29	-0.20113 0.2955 29	0.47021 0.0101 29	0.68672 <.0001 34
ALT ALT	0.55576 0.0014 30	1.00000 30	0.75276 <.0001 30	-0.27485 0.2409 20	0.43680 0.0158 30	0.57656 0.0009 30	0.36401 0.0480 30	-0.43801 0.0155 30	0.63131 0.0002 30	0.35599 0.0535 30	0.52349 0.0030 30	0.57333 0.0009 30	0.84504 <.0001 24	0.14805 0.4900 24	0.61117 0.0012 25	-0.26264 0.2047 25	0.19658 0.3463 25	0.53313 0.0024 30
AST AST	0.76025 <.0001 30	0.75276 <.0001 30	1.00000 30	-0.35632 0.1231 20	0.45623 0.0113 30	0.50769 0.0042 30	0.41422 0.0229 30	-0.32858 0.0763 30	0.71308 <.0001 30	0.40809 0.0252 30	0.70264 <.0001 30	0.61628 0.0003 30	0.86183 <.0001 24	0.49146 0.0147 24	0.83479 <.0001 25	-0.32342 0.1148 25	0.35767 0.0792 25	0.52103 0.0032 30
O2 O2	-0.15583 0.5118 20	-0.27485 0.2409 20	-0.35632 0.1231 20	1.00000 20	-0.44585 0.0488 20	0.14672 0.5371 20	0.04482 0.8512 20	0.40743 0.0746 20	-0.45346 0.0446 20	0.25203 0.2837 20	-0.34711 0.1338 20	-0.38366 0.0949 20	-0.39021 0.1505 15	-0.27388 0.2565 19	-0.42005 0.0652 20	0.49158 0.0277 20	-0.28813 0.2180 20	-0.09882 0.6785 20
GPX GPX	0.43601 0.0099 34	0.43680 0.0158 30	0.45623 0.0113 30	-0.44585 0.0488 20	1.00000 34	0.13784 0.4369 34	0.11664 0.5112 34	-0.72538 <.0001 34	0.49349 0.0030 34	0.47451 0.0046 34	0.44062 0.0091 34	0.30696 0.0774 34	0.19524 0.3194 28	0.38523 0.0429 28	0.49119 0.0068 29	-0.41762 0.0242 29	0.01345 0.9448 29	0.56688 0.0005 34
SOD SOD	0.40404 0.0178 34	0.57656 0.0009 30	0.50769 0.0042 30	0.14672 0.5371 20	0.13784 0.4369 34	1.00000 34	0.29396 0.0915 34	-0.26474 0.1303 34	0.28262 0.1053 34	0.24779 0.1577 34	0.27864 0.1105 34	0.19693 0.2643 34	-0.02527 0.8984 28	0.16005 0.4159 28	0.56977 0.0013 29	0.26799 0.1599 29	0.02478 0.8985 29	0.43933 0.0093 34
TAS TAS	0.32952 0.0570 34	0.36401 0.0480 30	0.41422 0.0229 30	0.04482 0.8512 20	0.11664 0.5112 34	0.29396 0.0915 34	1.00000 34	-0.00989 0.9557 34	0.21710 0.2175 34	0.26713 0.1267 34	0.46317 0.0058 34	0.42829 0.0115 34	-0.03090 0.8760 28	-0.11788 0.5502 28	0.35823 0.0564 29	0.38316 0.0402 29	-0.16743 0.3853 29	0.35219 0.0411 34
CAT CAT	-0.23354 0.1837 34	-0.43801 0.0155 30	-0.32858 0.0763 30	0.40743 0.0746 20	-0.72538 <.0001 34	-0.26474 0.1303 34	-0.00989 0.9557 34	1.00000 34	-0.46198 0.0059 34	-0.32200 0.0633 34	-0.40390 0.0178 34	-0.16499 0.3511 34	-0.12470 0.5272 28	-0.25278 0.1943 28	-0.50856 0.0048 29	0.48429 0.0078 29	0.05317 0.7841 29	-0.49437 0.0030 34
LPO LPO	0.78358 <.0001 34	0.63131 0.0002 30	0.71308 <.0001 30	-0.45346 0.0446 20	0.49349 0.0030 34	0.28262 0.1053 34	0.21710 0.2175 34	-0.46198 0.0059 34	1.00000 34	0.54703 0.0008 34	0.57085 0.0004 34	0.71237 <.0001 34	0.55105 0.0024 28	0.46802 0.0120 28	0.78805 <.0001 29	-0.50409 0.0053 29	0.49570 0.0062 29	0.62858 <.0001 34

Appendix A

PEARSON CORRELATION COEFFICIENTS
PROB > |R| UNDER H0: RHO=0
NUMBER OF OBSERVATIONS

	FE	ALT	AST	O2	GPX	SOD	TAS	CAT	LPO	OHDG 8	FADU	VIT_C	MDA	AMESN	ORAC_L	ORAC_A	IP_8	CU
OHdG_8	0.61866	0.35599	0.40809	0.25203	0.47451	0.24779	0.26713	-0.32200	0.54703	1.00000	0.54789	0.43634	0.48529	0.51867	0.45365	-0.23583	0.23311	0.63009
OHdG_8	< 0001	0.0535	0.0252	0.2837	0.0046	0.1577	0.1267	0.0633	0.0008		0.0007	0.0099	0.0089	0.0039	0.0134	0.2181	0.2236	<.0001
	34	30	30	20	34	34	34	34	34	35	35	34	28	29	29	29	29	34
FADU	0.61312	0.52349	0.70264	-0.34711	0.44062	0.27864	0.46317	-0.40390	0.57085	0.54789	1.00000	0.71490	0.61513	0.63883	0.75331	-0.39778	0.20653	0.64275
FADU	0.0001	0.0030	< 0001	0.1338	0.0091	0.1105	0.0058	0.0178	0.0004	0.0007		< 0001	0.0005	0.0002	<.0001	0.0326	0.2824	<.0001
	34	30	30	20	34	34	34	34	34	35	35	34	28	29	29	29	29	34
VIT_C	0.69145	0.57333	0.61628	-0.38366	0.30696	0.19693	0.42829	-0.16499	0.71237	0.43634	0.71490	1.00000	0.64286	0.44007	0.59955	-0.27319	0.44740	0.66827
VIT_C	<.0001	0.0009	0.0003	0.0949	0.0774	0.2643	0.0115	0.3511	<.0001	0.0099	<.0001		0.0002	0.0191	0.0006	0.1516	0.0150	< 0001
	34	30	30	20	34	34	34	34	34	34	34	34	28	28	29	29	29	34
MDA	0.61646	0.84504	0.86183	-0.39021	0.19524	-0.02527	-0.03090	-0.12470	0.55105	0.48529	0.61513	0.64286	1.00000	0.67255	0.43967	-0.41385	0.63941	0.53990
MDA	0.0005	< 0001	<.0001	0.1505	0.3194	0.8984	0.8760	0.5272	0.0024	0.0089	0.0005	0.0002		0.0004	0.0316	0.0444	0.0008	0.0030
	28	24	24	15	28	28	28	28	28	28	28	28	28	23	24	24	24	28
AMESN	0.55257	0.14805	0.49146	-0.27388	0.38523	0.16005	-0.11788	-0.25278	0.46802	0.51867	0.63883	0.44007	0.67255	1.00000	0.62719	-0.50870	0.30856	0.40494
	0.0023	0.4900	0.0147	0.2565	0.0429	0.4159	0.5502	0.1943	0.0120	0.0039	0.0002	0.0191	0.0004		0.0004	0.0057	0.1101	0.0326
	28	24	24	19	28	28	28	28	28	29	29	28	23	29	28	28	28	28
ORAC_L	0.71746	0.61117	0.83479	-0.42005	0.49119	0.56977	0.35823	-0.50856	0.78805	0.45365	0.75331	0.59955	0.43967	0.62719	1.00000	-0.32552	0.25502	0.59543
ORAC_L	< 0001	0.0012	< 0001	0.0652	0.0068	0.0013	0.0564	0.0048	<.0001	0.0134	< 0001	0.0006	0.0316	0.0004		0.0849	0.1818	0.0007
	29	25	25	20	29	29	29	29	29	29	29	29	24	28	29	29	29	29
ORAC_A	-0.20113	-0.26264	-0.32342	0.49158	-0.41762	0.26799	0.38316	0.48429	-0.50409	-0.23583	-0.39778	-0.27319	-0.41385	-0.50870	-0.32552	1.00000	-0.39337	-0.24843
ORAC_A	0.2955	0.2047	0.1148	0.0277	0.0242	0.1599	0.0402	0.0078	0.0053	0.2181	0.0326	0.1516	0.0444	0.0057	0.0849		0.0348	0.1938
	29	25	25	20	29	29	29	29	29	29	29	29	24	28	29	29	29	29
IP_8	0.47021	0.19658	0.35767	-0.28813	0.01345	0.02478	-0.16743	0.05317	0.49570	0.23311	0.20653	0.44740	0.63941	0.30856	0.25502	-0.39337	1.00000	0.31531
IP_8	0.0101	0.3463	0.0792	0.2180	0.9448	0.8985	0.3853	0.7841	0.0062	0.2236	0.2824	0.0150	0.0008	0.1101	0.1818	0.0348		0.0957
	29	25	25	20	29	29	29	29	29	29	29	29	24	28	29	29	29	29
Cu	0.68672	0.53313	0.52103	-0.09882	0.56688	0.43933	0.35219	-0.49437	0.62858	0.63009	0.64275	0.66827	0.53990	0.40494	0.59543	-0.24843	0.31531	1.00000
Cu	< 0001	0.0024	0.0032	0.6785	0.0005	0.0093	0.0411	0.0030	< 0001	<.0001	<.0001	<.0001	0.0030	0.0326	0.0007	0.1938	0.0957	
	34	30	30	20	34	34	34	34	34	34	34	34	28	28	29	29	29	34

Appendix A

Table 23x

Correlation Analysis

Treatment=N

PEARSON CORRELATION COEFFICIENTS
PROB > |R| UNDER H0: RHO=0
NUMBER OF OBSERVATIONS

	FE	ALT	AST	O2	GPX	SOD	TAS	CAT	LPO	OHDG_8	FADU	VIT_C	MDA	AMESN	ORAC_L	ORAC_A	IP_8	CU
FE FE	1.00000 35	0.88531 <.0001 29	0.84678 <.0001 29	-0.35588 0.1236 20	0.09896 0.5776 34	0.51734 0.0017 34	0.49194 0.0031 34	-0.33748 0.0510 34	0.77508 <.0001 34	0.71784 <.0001 35	0.74886 <.0001 34	0.75927 <.0001 34	0.67580 <.0001 29	0.39213 0.0321 30	0.81372 <.0001 29	-0.06655 0.7316 29	0.31746 0.0933 29	0.78967 <.0001 34
ALT ALT	0.88531 <.0001 29	1.00000 29	0.83631 <.0001 29	-0.55911 0.0128 19	0.05159 0.7904 29	0.71627 <.0001 29	0.56748 0.0013 29	-0.39930 0.0319 29	0.87072 <.0001 29	0.79751 <.0001 29	0.71620 <.0001 29	0.73930 <.0001 29	0.95679 <.0001 24	0.38133 0.0660 24	0.80554 <.0001 24	0.04296 0.8420 24	0.04370 0.8393 24	0.84029 <.0001 29
AST AST	0.84678 <.0001 29	0.83631 <.0001 29	1.00000 29	-0.35281 0.1384 19	0.03835 0.8434 29	0.67394 <.0001 29	0.64416 0.0002 29	-0.29136 0.1252 29	0.71481 <.0001 29	0.73591 <.0001 29	0.65238 0.0001 29	0.76126 <.0001 29	0.81393 <.0001 24	0.51969 0.0092 24	0.88040 <.0001 24	-0.01469 0.9457 24	0.15069 0.4822 24	0.74846 <.0001 29
O2 O2	-0.35588 0.1236 20	-0.55911 0.0128 19	-0.35281 0.1384 19	1.00000 20	-0.33313 0.1512 20	0.14915 0.5303 20	-0.11807 0.6201 20	0.68499 0.0009 20	-0.63951 0.0024 20	-0.66016 0.0015 20	-0.47341 0.0350 20	-0.18020 0.4471 20	-0.37280 0.1711 15	-0.44936 0.0468 20	-0.56391 0.0096 20	0.59623 0.0055 20	-0.21345 0.3662 20	-0.73695 0.0002 20
GPX GPX	0.09896 0.5776 34	0.05159 0.7904 29	0.03835 0.8434 29	-0.33313 0.1512 20	1.00000 34	-0.14069 0.4274 34	-0.13834 0.4352 34	-0.35556 0.0390 34	0.18849 0.2857 34	0.14527 0.4124 34	0.15187 0.3912 34	0.03190 0.8579 34	0.22221 0.2466 29	0.21728 0.2576 29	0.04803 0.8046 29	-0.40820 0.0279 29	0.02557 0.8953 29	0.23613 0.1788 34
SOD SOD	0.51734 0.0017 34	0.71627 <.0001 29	0.67394 <.0001 29	0.14915 0.5303 20	-0.14069 0.4274 34	1.00000 34	0.46208 0.0059 34	-0.07567 0.6706 34	0.34328 0.0469 34	0.32432 0.0613 34	0.33053 0.0562 34	0.39482 0.0208 34	0.16275 0.3989 29	0.03491 0.8573 29	0.49400 0.0065 29	0.38624 0.0385 29	-0.28114 0.1396 29	0.35401 0.0400 34
TAS TAS	0.49194 0.0031 34	0.56748 0.0013 29	0.64416 0.0002 29	-0.11807 0.6201 20	-0.13834 0.4352 34	0.46208 0.0059 34	1.00000 34	0.08595 0.6289 34	0.35646 0.0385 34	0.44127 0.0090 34	0.29799 0.0870 34	0.56861 0.0005 34	-0.00362 0.9851 29	-0.05799 0.7651 29	0.54135 0.0024 29	0.47544 0.0091 29	-0.27063 0.1556 29	0.34017 0.0490 34
CAT CAT	-0.33748 0.0510 34	-0.39930 0.0319 29	-0.29136 0.1252 29	0.68499 0.0009 20	-0.35556 0.0390 34	-0.07567 0.6706 34	0.08595 0.6289 34	1.00000 34	-0.54048 0.0010 34	-0.45555 0.0068 34	-0.40457 0.0176 34	-0.16547 0.3497 34	-0.16409 0.3950 29	-0.08044 0.6783 29	-0.42503 0.0215 29	0.44636 0.0152 29	-0.09134 0.6375 29	-0.55035 0.0007 34
LPO LPO	0.77508 <.0001 34	0.87072 <.0001 29	0.71481 <.0001 29	-0.63951 0.0024 20	0.18849 0.2857 34	0.34328 0.0469 34	0.35646 0.0385 34	-0.54048 0.0010 34	1.00000 34	0.78152 <.0001 34	0.76751 <.0001 34	0.68854 <.0001 34	0.59167 0.0007 29	0.37542 0.0448 29	0.78946 <.0001 29	-0.29252 0.1236 29	0.16258 0.3994 29	0.84285 <.0001 34

Appendix A

PEARSON CORRELATION COEFFICIENTS
PROB > |R| UNDER H0: RHO=0
NUMBER OF OBSERVATIONS

	FE	ALT	AST	O2	GPX	SOD	TAS	CAT	LPO	OHDG_8	FADU	VIT_C	MDA	AMESN	ORAC_L	ORAC_A	IP_8	CU
OHdG_8 OHdG_8	0.71784 <.0001 35	0.79751 < 0001 29	0.73591 < 0001 29	-0.66016 0 0015 20	0.14527 0.4124 34	0.32432 0.0613 34	0.44127 0.0090 34	-0.45555 0.0068 34	0.78152 <.0001 34	1.00000 35	0 58884 0.0002 34	0.56938 0.0004 34	0.50718 0.0050 29	0.52563 0.0029 30	0.75546 <0001 29	-0.17942 0.3517 29	0.24224 0.2055 29	0.72398 < 0001 34
FADU FADU	0.74886 < 0001 34	0.71620 < 0001 29	0.65238 0.0001 29	-0.47341 0.0350 20	0.15187 0.3912 34	0.33053 0.0562 34	0.29799 0 0870 34	-0.40457 0.0176 34	0.76751 <.0001 34	0.58884 0.0002 34	1.00000 34	0.74868 < 0001 34	0.62961 0.0003 29	0.52024 0.0038 29	0.77696 <.0001 29	-0.29546 0.1197 29	0.51526 0.0042 29	0.75639 <.0001 34
VIT_C VIT_C	0.75927 <.0001 34	0.73930 <.0001 29	0.76126 < 0001 29	-0.18020 0 4471 20	0.03190 0.8579 34	0.39482 0.0208 34	0.56861 0.0005 34	-0.16547 0.3497 34	0.68854 <.0001 34	0.56938 0.0004 34	0.74868 <.0001 34	1.00000 34	0.58971 0.0008 29	0.47940 0.0085 29	0.64173 0.0002 29	-0.05650 0.7709 29	0.40267 0.0303 29	0.72720 <.0001 34
MDA MDA	0.67580 <.0001 29	0.95679 <.0001 24	0.81393 <.0001 24	-0.37280 0.1711 15	0.22221 0.2466 29	0.16275 0.3989 29	-0.00362 0.9851 29	-0.16409 0.3950 29	0.59167 0.0007 29	0.50718 0.0050 29	0.62961 0.0003 29	0.58971 0.0008 29	1.00000 29	0.73749 <.0001 24	0.54233 0.0062 24	-0.34097 0.1030 24	0.31422 0.1348 24	0.69517 <.0001 29
AMESN	0.39213 0.0321 30	0.38133 0.0660 24	0.51969 0.0092 24	-0.44936 0.0468 20	0.21728 0.2576 29	0.03491 0.8573 29	-0.05799 0.7651 29	-0.08044 0.6783 29	0.37542 0.0448 29	0.52563 0.0029 30	0.52024 0.0038 29	0.47940 0.0085 29	0.73749 <.0001 24	1.00000 30	0.52186 0.0037 29	-0.50676 0.0050 29	0.57146 0.0012 29	0.53918 0.0025 29
ORAC_L ORAC_L	0.81372 <.0001 29	0.80554 <.0001 24	0.88040 < 0001 24	-0.56391 0.0096 20	0.04803 0.8046 29	0.49400 0.0065 29	0.54135 0.0024 29	-0.42503 0.0215 29	0.78946 <.0001 29	0.75546 < 0001 29	0.77696 < 0001 29	0.64173 0.0002 29	0.54233 0.0062 24	0.52186 0.0037 29	1.00000 29	-0.17849 0.3542 29	0.22468 0.2413 29	0.76123 < 0001 29
ORAC_A ORAC_A	-0.06655 0.7316 29	0.04296 0.8420 24	-0.01469 0.9457 24	0.59623 0.0055 20	-0.40820 0.0279 29	0.38624 0.0385 29	0.47544 0.0091 29	0.44636 0.0152 29	-0.29252 0.1236 29	-0.17942 0.3517 29	-0.29546 0.1197 29	-0.05650 0.7709 29	-0.34097 0.1030 24	-0.50676 0.0050 29	-0.17849 0.3542 29	1.00000 29	-0.50443 0.0053 29	-0.50785 0.0049 29
IP_8 IP_8	0.31746 0.0933 29	0.04370 0.8393 24	0.15069 0.4822 24	-0.21345 0.3662 20	0.02557 0.8953 29	-0.28114 0.1396 29	-0.27063 0.1556 29	-0.09134 0.6375 29	0.16258 0.3994 29	0.24224 0.2055 29	0.51526 0.0042 29	0.40267 0.0303 29	0.31422 0.1348 24	0.57146 0.0012 29	0.22468 0.2413 29	-0.50443 0.0053 29	1.00000 29	0.35937 0.0555 29
Cu Cu	0.78967 < 0001 34	0.84029 <.0001 29	0.74846 <0001 29	-0.73695 0.0002 20	0.23613 0.1788 34	0.35401 0.0400 34	0.34017 0.0490 34	-0.55035 0.0007 34	0.84285 <.0001 34	0.72398 < 0001 34	0.75639 < 0001 34	0.72720 < 0001 34	0.69517 <.0001 29	0.53918 0.0025 29	0 76123 < 0001 29	-0.50785 0.0049 29	0.35937 0.0555 29	1.00000 34

Appendix A

Table 24x

Correlation Analysis

Treatment=V

PEARSON CORRELATION COEFFICIENTS
PROB > |R| UNDER H0: RHO=0
NUMBER OF OBSERVATIONS

	FE	ALT	AST	O2	GPX	SOD	TAS	CAT	LPO	OHDG_8	FADU	VIT_C	MDA	AMESN	ORAC_L	ORAC_A	IP_8	CU
FE FE	1.00000 30	0.61478 0.0008 26	0.60510 0.0011 26	-0.14083 0.5653 19	0.43250 0.0191 29	0.16174 0.3932 30	0.48426 0.0067 30	-0.27255 0.1451 30	0.65575 <.0001 30	0.71900 <.0001 30	0.65703 <.0001 30	0.59885 0.0005 30	0.64406 0.0005 25	0.43501 0.0207 28	0.55934 0.0020 28	-0.10282 0.6026 28	0.36832 0.0538 28	0.56613 0.0011 30
ALT ALT	0.61478 0.0008 26	1.00000 27	0.60651 0.0008 27	-0.18228 0.4418 20	0.69462 < 0001 26	0.23551 0.2370 27	0.52117 0.0053 27	-0.48025 0.0112 27	0.82016 <.0001 27	0.66759 0.0001 27	0.48392 0.0105 27	0.72459 <.0001 27	0.84883 < 0001 22	0.26624 0.1983 25	0.70160 <.0001 25	0.11269 0.5917 25	0.59063 0.0019 25	0.61222 0.0007 27
AST AST	0.60510 0.0011 26	0.60651 0.0008 27	1.00000 27	-0.14931 0.5298 20	0.60789 0.0010 26	0.20632 0.3018 27	0.75262 <.0001 27	-0.28956 0.1429 27	0.57531 0.0017 27	0.56097 0.0023 27	0.70791 <.0001 27	0.63791 0.0003 27	0.71154 0.0002 22	0.71695 <.0001 25	0.76987 <.0001 25	-0.04066 0 8470 25	0.51925 0.0078 25	0.42506 0.0271 27
O2 O2	-0.14083 0.5653 19	-0.18228 0.4418 20	-0.14931 0.5298 20	1.00000 20	0.00715 0.9768 19	0.38924 0.0898 20	0.09751 0.6826 20	0.09034 0.7049 20	-0.23772 0.3129 20	0.01112 0.9629 20	-0.22032 0.3506 20	-0.22982 0.3297 20	-0.27730 0.3170 15	-0.10871 0.6482 20	-0.16382 0.4901 20	0.35527 0.1243 20	-0.01110 0.9629 20	-0.08847 0.7107 20
GPX GPX	0.43250 0.0191 29	0.69462 < 0001 26	0.60789 0.0010 26	0.00715 0.9768 19	1.00000 30	0.14494 0.4448 30	0.56540 0.0011 30	-0.51775 0.0034 30	0.65156 <.0001 30	0.48486 0.0066 30	0.35094 0.0572 30	0.37533 0.0410 30	0.37775 0.0626 25	0.21926 0.2623 28	0.63804 0.0003 28	-0.13879 0.4812 28	0.44234 0.0184 28	0.46988 0.0088 30
SOD SOD	0.16174 0.3932 30	0.23551 0.2370 27	0.20632 0.3018 27	0.38924 0.0898 20	0.14494 0.4448 30	1.00000 31	0.18617 0.3160 31	-0.10476 0.5749 31	0.05029 0.7882 31	-0.05728 0.7596 31	-0.12167 0.5144 31	-0.09729 0.6026 31	-0.14190 0.4893 26	-0.15743 0.4147 29	0.18635 0.3331 29	0.41872 0.0238 29	0.39082 0.0361 29	0.16770 0.3672 31
TAS TAS	0.48426 0.0067 30	0.52117 0.0053 27	0.75262 <.0001 27	0.09751 0.6826 20	0.56540 0.0011 30	0.18617 0.3160 31	1.00000 31	-0.03136 0.8670 31	0.35123 0.0527 31	0.35979 0.0468 31	0.34787 0.0552 31	0.36256 0.0450 31	0.11972 0.5602 26	0.28454 0.1347 29	0.62731 0.0003 29	0.18167 0.3456 29	0.51057 0.0047 29	0.08322 0.6563 31
CAT CAT	-0.27255 0.1451 30	-0.48025 0.0112 27	-0.28956 0.1429 27	0.09034 0.7049 20	-0.51775 0.0034 30	-0.10476 0.5749 31	-0.03136 0.8670 31	1.00000 31	-0.63801 0.0001 31	-0.51328 0.0031 31	-0.39180 0.0293 31	-0.37120 0.0398 31	-0.38121 0.0547 26	-0.31866 0.0920 29	-0.52287 0.0036 29	0.20307 0.2907 29	-0.32403 0.0864 29	-0.44397 0.0124 31
LPO LPO	0.65575 <.0001 30	0.82016 <.0001 27	0.57531 0.0017 27	-0.23772 0.3129 20	0.65156 <.0001 30	0.05029 0.7882 31	0.35123 0.0527 31	-0.63801 0.0001 31	1.00000 31	0.78663 < 0001 31	0.55777 0.0011 31	0.53257 0.0020 31	0.70943 <.0001 26	0.33155 0.0789 29	0.72107 <.0001 29	-0.27666 0.1463 29	0.29041 0.1264 29	0.70404 < 0001 31

Appendix A

PEARSON CORRELATION COEFFICIENTS
PROB > |R| UNDER H0: RHO=0
NUMBER OF OBSERVATIONS

	FE	ALT	AST	O2	GPX	SOD	TAS	CAT	LPO	OHDG_8	FADU	VIT_C	MDA	AMESN	ORAC_L	ORAC_A	IP_8	CU
OHdG_8 OHdG_8	0.71900 < 0001 30	0.66759 0.0001 27	0.56097 0.0023 27	0.01112 0.9629 20	0.48486 0.0066 30	-0.05728 0.7596 31	0.35979 0.0468 31	-0.51328 0.0031 31	0.78663 <.0001 31	1.00000 32	0.74971 < 0001 31	0.59772 0.0004 31	0.89268 <.0001 26	0.69679 <.0001 30	0.76902 < 0001 29	-0.30764 0.1045 29	0.39865 0.0322 29	0.68596 <.0001 31
FADU FADU	0.65703 <.0001 30	0.48392 0.0105 27	0.70791 <.0001 27	-0.22032 0.3506 20	0.35094 0.0572 30	-0.12167 0.5144 31	0.34787 0.0552 31	-0.39180 0.0293 31	0.55777 0.0011 31	0.74971 < 0001 31	1.00000 31	0.63378 0.0001 31	0.84774 <.0001 26	0.78360 < 0001 29	0.69771 <.0001 29	-0.32552 0.0849 29	0.20046 0.2971 29	0.57748 0.0007 31
VIT_C VIT_C	0.59885 0.0005 30	0.72459 < 0001 27	0.63791 0.0003 27	-0.22982 0.3297 20	0.37533 0.0410 30	-0.09729 0.6026 31	0.36256 0.0450 31	-0.37120 0.0398 31	0.53257 0.0020 31	0.59772 0.0004 31	0.63378 0.0001 31	1.00000 31	0.69996 <.0001 26	0.57013 0.0012 29	0.52462 0.0035 29	0.07335 0.7053 29	0.34846 0.0639 29	0.40410 0.0242 31
MDA MDA	0.64406 0.0005 25	0.84883 < 0001 22	0.71154 0.0002 22	-0.27730 0.3170 15	0.37775 0.0626 25	-0.14190 0.4893 26	0.11972 0.5602 26	-0.38121 0.0547 26	0.70943 <.0001 26	0.89268 <.0001 26	0.84774 <.0001 26	0.69996 <.0001 26	1.00000 26	0.74844 <.0001 24	0.66648 0.0004 24	-0.34238 0.1015 24	0.12352 0.5653 24	0.74128 <.0001 26
AMESN	0.43501 0.0207 28	0.26624 0.1983 25	0.71695 <.0001 25	-0.10871 0.6482 20	0.21926 0.2623 28	-0.15743 0.4147 29	0.28454 0.1347 29	-0.31866 0.0920 29	0.33155 0.0789 29	0.69679 <.0001 30	0.78360 < 0001 29	0.57013 0.0012 29	0.74844 < 0001 24	1.00000 30	0.59208 0.0007 29	-0.38845 0.0373 29	0.41755 0.0242 29	0.43927 0.0171 29
ORAC_L ORAC_L	0.55934 0.0020 28	0.70160 <.0001 25	0.76987 <.0001 25	-0.16382 0.4901 20	0.63804 0.0003 28	0.18635 0.3331 29	0.62731 0.0003 29	-0.52287 0.0036 29	0.72107 <.0001 29	0.76902 <.0001 29	0.69771 <.0001 29	0.52462 0.0035 29	0.66648 0.0004 24	0.59208 0.0007 29	1.00000 29	-0.11085 0.5670 29	0.55330 0.0019 29	0.60897 0.0005 29
ORAC_A ORAC_A	-0.10282 0.6026 28	0.11269 0.5917 25	-0.04066 0.8470 25	0.35527 0.1243 20	-0.13879 0.4812 28	0.41872 0.0238 29	0.18167 0.3456 29	0.20307 0.2907 29	-0.27666 0.1463 29	-0.30764 0.1045 29	-0.32552 0.0849 29	0.07335 0.7053 29	-0.34238 0.1015 24	-0.38845 0.0373 29	-0.11085 0.5670 29	1.00000 29	0.12456 0.5197 29	-0.30265 0.1105 29
IP_8 IP_8	0.36832 0.0538 28	0.59063 0.0019 25	0.51925 0.0078 25	-0.01110 0.9629 20	0.44234 0.0184 28	0.39082 0.0361 29	0.51057 0.0047 29	-0.32403 0.0864 29	0.29041 0.1264 29	0.39865 0.0322 29	0.20046 0.2971 29	0.34846 0.0639 29	0.12352 0.5653 24	0.41755 0.0242 29	0.55330 0.0019 29	0.12456 0.5197 29	1.00000 29	0.31752 0.0933 29
Cu Cu	0.56613 0.0011 30	0.61222 0.0007 27	0.42506 0.0271 27	-0.08847 0.7107 20	0.46988 0.0088 30	0.16770 0.3672 31	0.08322 0.6563 31	-0.44397 0.0124 31	0.70404 <.0001 31	0.68596 < 0001 31	0.57748 0.0007 31	0.40410 0.0242 31	0.74128 <.0001 26	0.43927 0.0171 29	0.60897 0.0005 29	-0.30265 0.1105 29	0.31752 0.0933 29	1.00000 31

Analysis of Variance Results

Table 25x

Dependent Variable: FE

SOURCE	DF	TYPE III SS	MEAN SQUARE	F VALUE	PR > F
Months	6	94954.71061	15825.78510	54.01	<.0001
Treatment	5	53707.91749	10741.58350	36.66	<.0001
Months*Treatment	30	30860.63798	1028.68793	3.51	<.0001

Dependent Variable: ALT

SOURCE	DF	TYPE III SS	MEAN SQUARE	F VALUE	PR > F
Months	5	821754.8630	164350.9726	127.04	<.0001
Treatment	5	70603.7380	14120.7476	10.91	<.0001
Months*Treatment	25	152106.8267	6084.2731	4.70	<.0001

Dependent Variable: AST

SOURCE	DF	TYPE III SS	MEAN SQUARE	F VALUE	PR > F
Months	5	1192774.273	238554.855	80.96	<.0001
Treatment	5	171635.876	34327.175	11.65	<.0001
Months*Treatment	25	440670.644	17626.826	5.98	<.0001

Dependent Variable: O2

SOURCE	DF	TYPE III SS	MEAN SQUARE	F VALUE	PR > F
Months	3	5.32961583	1.77653861	14.07	<.0001
Treatment	5	0.63335417	0.12667083	1.00	0.4203
Months*Treatment	15	5.38284917	0.35885661	2.84	0.0011

Dependent Variable: GPX

SOURCE	DF	TYPE III SS	MEAN SQUARE	F VALUE	PR > F
Months	6	120910.0009	20151.6668	21.52	<.0001
Treatment	5	35485.2804	7097.0561	7.58	<.0001
Months*Treatment	30	59957.7072	1998.5902	2.13	0.0015

Dependent Variable: SOD

SOURCE	DF	TYPE III SS	MEAN SQUARE	F VALUE	PR > F
Months	6	23391187.87	3898531.31	35.29	<.0001
Treatment	5	8970044.11	1794008.82	16.24	<.0001
Months*Treatment	30	3463755.40	115458.51	1.05	0.4125

Table 25x Cont...

Dependent Variable: TAS

SOURCE	DF	TYPE III SS	MEAN SQUARE	F VALUE	PR > F
Months	6	3.09100936	0.51516823	88.03	<.0001
Treatment	5	0.33444396	0.06688879	11.43	<.0001
Months*Treatment	30	0.42650571	0.01421686	2.43	0.0002

Dependent Variable: CAT

SOURCE	DF	TYPE III SS	MEAN SQUARE	F VALUE	PR > F
Months	6	11591.95340	1931.99223	37.06	<.0001
Treatment	5	5673.71244	1134.74249	21.77	<.0001
Months*Treatment	30	2622.27457	87.40915	1.68	0.0228

Dependent Variable: VIT_C

SOURCE	DF	TYPE III SS	MEAN SQUARE	F VALUE	PR > F
Months	6	618.2096865	103.0349477	104.89	<.0001
Treatment	5	14.0678464	2.8135693	2.86	0.0167
Months*Treatment	30	17.0814600	0.5693820	0.58	0.9598

Dependent Variable: Cu

SOURCE	DF	TYPE III SS	MEAN SQUARE	F VALUE	PR > F
Months	6	10979.87564	1829.97927	41.66	<.0001
Treatment	5	1599.01457	319.80291	7.28	<.0001
Months*Treatment	30	3267.56519	108.91884	2.48	0.0002

Dependent Variable: LPO

SOURCE	DF	TYPE III SS	MEAN SQUARE	F VALUE	PR > F
Months	6	232005.5763	38667.5960	141.67	<.0001
Treatment	5	33262.6909	6652.5382	24.37	<.0001
Months*Treatment	30	33529.4094	1117.6470	4.09	<.0001

Table 26x

Table 2a: Bonferroni (Dunn) Multiple comparison t Tests for FE

COMPARISONS SIGNIFICANT AT THE 0.05 LEVEL ARE INDICATED BY ***.				
MONTHS COMPARISON	DIFFERENCE BETWEEN MEANS	SIMULTANEOUS 95% CONFIDENCE LIMITS		
20 - 16	0.140	-13.510	13.790	
20 - 24	1.533	-12.633	15.698	
20 - 12	15.269	1.502	29.037	***
20 - 4	44.176	30.284	58.068	***
20 - 8	46.367	32.716	60.017	***
20 - 2	51.010	36.844	65.175	***
16 - 24	1.393	-12.773	15.558	
16 - 12	15.129	1.362	28.897	***
16 - 4	44.036	30.144	57.928	***
16 - 8	46.227	32.576	59.877	***
16 - 2	50.870	36.704	65.035	***
24 - 12	13.737	-0.542	28.015	
24 - 4	42.643	28.245	57.042	***
24 - 8	44.834	30.668	58.999	***
24 - 2	49.477	34.814	64.140	***
12 - 4	28.907	14.900	42.914	***
12 - 8	31.097	17.330	44.865	***
12 - 2	35.740	21.462	50.019	***
4 - 8	2.191	-11.701	16.083	
4 - 2	6.834	-7.565	21.232	
8 - 2	4.643	-9.522	18.809	

Table 26x Cont...

Table 2b: Bonferroni (Dunn) Multiple comparison t Tests for FE

COMPARISONS SIGNIFICANT AT THE 0.05 LEVEL ARE INDICATED BY ***.				
TREATMENT COMPARISON	DIFFERENCE BETWEEN MEANS	SIMULTANEOUS 95% CONFIDENCE LIMITS		
N - A	0.182	-12.298	12.662	
N - V	2.040	-10.656	14.736	
N - F	5.704	-6.583	17.991	
N - Cu	6.345	-6.036	18.726	
N - C	46.206	34.008	58.403	***
A - V	1.858	-11.109	14.826	
A - F	5.522	-7.045	18.090	
A - Cu	6.163	-6.497	18.823	
A - C	46.024	33.544	58.504	***
V - F	3.664	-9.117	16.446	
V - Cu	4.305	-8.567	17.177	
V - C	44.166	31.470	56.861	***
F - Cu	0.641	-11.828	13.110	
F - C	40.502	28.215	52.789	***
Cu - C	39.861	27.480	52.242	***

Table 27x

Bonferroni (Dunn) Multiple comparison t Tests for ALT

COMPARISONS SIGNIFICANT AT THE 0.05 LEVEL ARE INDICATED BY ***.				
MONTHS COMPARISON	DIFFERENCE BETWEEN MEANS	SIMULTANEOUS 95% CONFIDENCE LIMITS		
16 - 20	52.433	24.692	80.175	***
16 - 12	160.383	132.151	188.616	***
16 - 8	162.000	134.258	189.742	***
16 - 2	165.749	136.960	194.537	***
16 - 4	179.433	151.692	207.175	***
20 - 12	107.950	79.717	136.183	***
20 - 8	109.567	81.825	137.308	***
20 - 2	113.315	84.527	142.104	***
20 - 4	127.000	99.258	154.742	***
12 - 8	1.617	-26.616	29.849	
12 - 2	5.365	-23.897	34.628	
12 - 4	19.050	-9.183	47.283	
8 - 2	3.749	-25.040	32.537	
8 - 4	17.433	-10.308	45.175	
2 - 4	13.685	-15.104	42.473	

Table 27x Cont.....

Bonferroni (Dunn) Multiple comparison t Tests for ALT

COMPARISONS SIGNIFICANT AT THE 0.05 LEVEL ARE INDICATED BY ***.				
TREATMENT COMPARISON	DIFFERENCE BETWEEN MEANS	SIMULTANEOUS 95% CONFIDENCE LIMITS		
N - A	1.369	-26.847	29.585	
N - Cu	6.515	-21.464	34.495	
N - F	18.669	-9.311	46.648	
N - V	24.007	-4.727	52.741	
N - C	59.462	31.246	87.678	***
A - Cu	5.146	-22.833	33.126	
A - F	17.300	-10.680	45.279	
A - V	22.638	-6.095	51.372	
A - C	58.093	29.877	86.309	***
Cu - F	12.153	-15.588	39.895	
Cu - V	17.492	-11.010	45.994	
Cu - C	52.947	24.967	80.927	***
F - V	5.339	-23.163	33.840	
F - C	40.794	12.814	68.773	***
V - C	35.455	6.721	64.189	***

Table 28x

Bonferroni (Dunn) Multiple comparison t Tests for AST

COMPARISONS SIGNIFICANT AT THE 0.05 LEVEL ARE INDICATED BY ***				
MONTHS COMPARISON	DIFFERENCE BETWEEN MEANS	SIMULTANEOUS 95% CONFIDENCE LIMITS		
20 - 16	95.53	53.67	137.40	***
20 - 12	182.01	139.40	224.62	***
20 - 8	204.73	162.87	246.60	***
20 - 4	221.83	179.97	263.70	***
20 - 2	228.44	185.00	271.89	***
16 - 12	86.48	43.87	129.09	***
16 - 8	109.20	67.33	151.07	***
16 - 4	126.30	84.43	168.17	***
16 - 2	132.91	89.46	176.36	***
12 - 8	22.72	-19.89	65.33	
12 - 4	39.82	-2.79	82.43	
12 - 2	46.43	2.27	90.60	***
8 - 4	17.10	-24.77	58.97	
8 - 2	23.71	-19.74	67.16	
4 - 2	6.61	-36.84	50.06	

Table 28x Cont.....

Bonferroni (Dunn) Multiple comparison t Tests for AST

COMPARISONS SIGNIFICANT AT THE 0.05 LEVEL ARE INDICATED BY ***				
TREATMENT COMPARISON	DIFFERENCE BETWEEN MEANS	SIMULTANEOUS 95% CONFIDENCE LIMITS		
Cu - A	20.89	-21.34	63.12	
Cu - N	25.89	-16.34	68.12	
Cu - V	43.65	0.64	86.67	***
Cu - F	46.00	4.13	87.87	***
Cu - C	100.24	58.01	142.46	***
A - N	5.00	-37.58	47.58	
A - V	22.76	-20.61	66.12	
A - F	25.11	-17.12	67.34	
A - C	79.34	36.76	121.93	***
N - V	17.76	-25.61	61.12	
N - F	20.11	-22.12	62.34	
N - C	74.34	31.76	116.93	***
V - F	2.35	-40.67	45.36	
V - C	56.58	13.22	99.95	***
F - C	54.24	12.01	96.46	***

Table 29x

Dependent Variable: O2

SOURCE	DF	TYPE III SS	MEAN SQUARE	F VALUE	PR > F
Months	3	5.32961583	1.77653861	14.07	<.0001
Treatment	5	0.63335417	0.12667083	1.00	0.4203
Months*Treatment	15	5.38284917	0.35885661	2.84	0.0011

Table 29x Cont.....

Bonferroni (Dunn) Multiple comparison t Tests for O2

COMPARISONS SIGNIFICANT AT THE 0.05 LEVEL ARE INDICATED BY ***				
MONTHS COMPARISON	DIFFERENCE BETWEEN MEANS	SIMULTANEOUS 95% CONFIDENCE LIMITS		
12 - 4	0.26300	0.01579	0.51021	***
12 - 16	0.47967	0.23246	0.72687	***
12 - 20	0.53567	0.28846	0.78287	***
4 - 16	0.21667	-0.03054	0.46387	
4 - 20	0.27267	0.02546	0.51987	***
16 - 20	0.05600	-0.19121	0.30321	

Table 29x Cont.....

Bonferroni (Dunn) t Tests for O2

COMPARISONS SIGNIFICANT AT THE 0.05 LEVEL ARE INDICATED BY ***				
MONTHS COMPARISON	DIFFERENCE BETWEEN MEANS	SIMULTANEOUS 95% CONFIDENCE LIMITS		
12 - 4	0.26300	0.01579	0.51021	***
12 - 16	0.47967	0.23246	0.72687	***
12 - 20	0.53567	0.28846	0.78287	***
4 - 16	0.21667	-0.03054	0.46387	
4 - 20	0.27267	0.02546	0.51987	***
16 - 20	0.05600	-0.19121	0.30321	

Table 29x Cont.....

Bonferroni (Dunn) t Tests for O2

COMPARISONS SIGNIFICANT AT THE 0.05 LEVEL ARE INDICATED BY ***.				
TREATMENT COMPARISON	DIFFERENCE BETWEEN MEANS	SIMULTANEOUS 95% CONFIDENCE LIMITS		
A - N	0.0815	-0.2568	0.4198	
A - V	0.1295	-0.2088	0.4678	
A - Cu	0.1430	-0.1953	0.4813	
A - F	0.1535	-0.1848	0.4918	
A - C	0.2390	-0.0993	0.5773	
N - V	0.0480	-0.2903	0.3863	
N - Cu	0.0615	-0.2768	0.3998	
N - F	0.0720	-0.2663	0.4103	
N - C	0.1575	-0.1808	0.4958	
V - Cu	0.0135	-0.3248	0.3518	
V - F	0.0240	-0.3143	0.3623	
V - C	0.1095	-0.2288	0.4478	
Cu - F	0.0105	-0.3278	0.3488	
Cu - C	0.0960	-0.2423	0.4343	
F - C	0.0855	-0.2528	0.4238	

Table 30x

Bonferroni (Dunn) Multiple comparison t Tests for GPX

COMPARISONS SIGNIFICANT AT THE 0.05 LEVEL ARE INDICATED BY ***.				
MONTHS COMPARISON	DIFFERENCE BETWEEN MEANS	SIMULTANEOUS 95% CONFIDENCE LIMITS		
4 - 16	2.224	-22.615	27.062	
4 - 20	7.440	-17.398	32.278	
4 - 24	23.508	-2.787	49.802	
4 - 12	46.824	21.985	71.662	***
4 - 8	50.937	26.099	75.775	***
4 - 2	63.265	37.521	89.009	***
16 - 20	5.217	-19.190	29.623	
16 - 24	21.284	-4.602	47.171	
16 - 12	44.600	20.194	69.006	***
16 - 8	48.713	24.307	73.120	***
16 - 2	61.042	35.714	86.369	***
20 - 24	16.067	-9.819	41.954	
20 - 12	39.383	14.977	63.790	***
20 - 8	43.497	19.090	67.903	***
20 - 2	55.825	30.497	81.152	***
24 - 12	23.316	-2.571	49.202	
24 - 8	27.429	1.543	53.316	***
24 - 2	39.757	13.000	66.514	***
12 - 8	4.113	-20.293	28.520	
12 - 2	16.442	-8.886	41.769	
8 - 2	12.328	-12.999	37.656	

Table 30x Cont.....

Bonferroni (Dunn) Multiple comparison t Tests for GPX

COMPARISONS SIGNIFICANT AT THE 0.05 LEVEL ARE INDICATED BY ***				
TREATMENT COMPARISON	DIFFERENCE BETWEEN MEANS	SIMULTANEOUS 95% CONFIDENCE LIMITS		
C - V	12.219	-10.633	35.072	
C - Cu	19.451	-2.844	41.745	
C - A	20.014	-2.280	42.308	
C - F	32.559	10.432	54.686	***
C - N	44.488	22.361	66.615	***
V - Cu	7.231	-15.783	30.246	
V - A	7.795	-15.220	30.809	
V - F	20.339	-2.513	43.192	
V - N	32.269	9.416	55.122	***
Cu - A	0.564	-21.896	23.024	
Cu - F	13.108	-9.186	35.402	
Cu - N	25.038	2.743	47.332	***
A - F	12.545	-9.750	34.839	
A - N	24.474	2.180	46.768	***
F - N	11.929	-10.198	34.057	

Table 31x

Bonferroni (Dunn) Multiple comparison t Tests for SOD

COMPARISONS SIGNIFICANT AT THE 0.05 LEVEL ARE INDICATED BY ***				
MONTHS COMPARISON	DIFFERENCE BETWEEN MEANS	SIMULTANEOUS 95% CONFIDENCE LIMITS		
12 - 16	55.30	-209.70	320.30	
12 - 2	268.30	-6.70	543.31	
12 - 20	418.30	153.30	683.30	***
12 - 4	795.50	530.50	1060.50	***
12 - 8	828.60	563.60	1093.60	***
12 - 24	851.45	570.37	1132.53	***
16 - 2	213.00	-62.00	488.01	
16 - 20	363.00	98.00	628.00	***
16 - 4	740.20	475.20	1005.20	***
16 - 8	773.30	508.30	1038.30	***
16 - 24	796.15	515.07	1077.23	***
2 - 20	150.00	-125.01	425.00	
2 - 4	527.20	252.19	802.20	***
2 - 8	560.30	285.29	835.30	***
2 - 24	583.15	292.62	873.67	***
20 - 4	377.20	112.20	642.20	***
20 - 8	410.30	145.30	675.30	***
20 - 24	433.15	152.07	714.23	***
4 - 8	33.10	-231.90	298.10	
4 - 24	55.95	-225.13	337.03	
8 - 24	22.85	-258.23	303.93	

Table 31x Cont.....

Bonferroni (Dunn) Multiple comparison t Tests for SOD

COMPARISONS SIGNIFICANT AT THE 0.05 LEVEL ARE INDICATED BY ***.				
TREATMENT COMPARISON	DIFFERENCE BETWEEN MEANS	SIMULTANEOUS 95% CONFIDENCE LIMITS		
C - Cu	389.82	149.56	630.08	***
C - V	437.16	191.15	683.16	***
C - A	492.04	249.97	734.11	***
C - F	510.71	270.45	750.96	***
C - N	707.91	467.65	948.17	***
Cu - V	47.33	-198.67	293.34	
Cu - A	102.22	-139.86	344.29	
Cu - F	120.88	-119.38	361.14	
Cu - N	318.09	77.83	558.35	***
V - A	54.88	-192.89	302.66	
V - F	73.55	-172.45	319.55	
V - N	270.75	24.75	516.76	***
A - F	18.67	-223.41	260.74	
A - N	215.87	-26.20	457.94	
F - N	197.21	-43.05	437.46	

Table 32x

Bonferroni (Dunn) Multiple comparison t Tests for TAS

COMPARISONS SIGNIFICANT AT THE 0.05 LEVEL ARE INDICATED BY ***				
MONTHS COMPARISON	DIFFERENCE BETWEEN MEANS	SIMULTANEOUS 95% CONFIDENCE LIMITS		
20 - 16	0.05337	-0.00763	0.11436	
20 - 12	0.09157	0.03057	0.15256	***
20 - 8	0.12697	0.06597	0.18796	***
20 - 24	0.18801	0.12331	0.25270	***
20 - 4	0.27897	0.21797	0.33996	***
20 - 2	0.40809	0.34480	0.47139	***
16 - 12	0.03820	-0.02279	0.09919	
16 - 8	0.07360	0.01261	0.13459	***
16 - 24	0.13464	0.06995	0.19934	***
16 - 4	0.22560	0.16461	0.28659	***
16 - 2	0.35473	0.29143	0.41803	***
12 - 8	0.03540	-0.02559	0.09639	
12 - 24	0.09644	0.03175	0.16114	***
12 - 4	0.18740	0.12641	0.24839	***
12 - 2	0.31653	0.25323	0.37983	***
8 - 24	0.06104	-0.00365	0.12574	
8 - 4	0.15200	0.09101	0.21299	***
8 - 2	0.28113	0.21783	0.34443	***
24 - 4	0.09096	0.02626	0.15565	***
24 - 2	0.22009	0.15322	0.28696	***
4 - 2	0.12913	0.06583	0.19243	***

Table 32x Cont.....

Bonferroni (Dunn) Multiple comparison t Tests for TAS

COMPARISONS SIGNIFICANT AT THE 0.05 LEVEL ARE INDICATED BY ***				
TREATMENT COMPARISON	DIFFERENCE BETWEEN MEANS	SIMULTANEOUS 95% CONFIDENCE LIMITS		
C - V	0.03410	-0.02252	0.09072	
C - A	0.08108	0.02536	0.13680	***
C - F	0.09012	0.03482	0.14542	***
C - N	0.10526	0.04996	0.16056	***
C - Cu	0.11797	0.06267	0.17327	***
V - A	0.04698	-0.01005	0.10401	
V - F	0.05602	-0.00060	0.11264	
V - N	0.07117	0.01454	0.12779	***
V - Cu	0.08387	0.02725	0.14050	***
A - F	0.00904	-0.04668	0.06475	
A - N	0.02418	-0.03153	0.07990	
A - Cu	0.03689	-0.01883	0.09261	
F - N	0.01515	-0.04015	0.07045	
F - Cu	0.02785	-0.02745	0.08315	
N - Cu	0.01271	-0.04259	0.06801	

Table 33x

Bonferroni (Dunn) Multiple comparison t Tests for CAT

COMPARISONS SIGNIFICANT AT THE 0.05 LEVEL ARE INDICATED BY ***				
MONTHS COMPARISON	DIFFERENCE BETWEEN MEANS	SIMULTANEOUS 95% CONFIDENCE LIMITS		
8 - 12	4.013	-1.743	9.770	
8 - 2	14.364	8.390	20.338	***
8 - 24	18.011	11.905	24.117	***
8 - 20	18.763	13.007	24.520	***
8 - 4	19.347	13.590	25.103	***
12 - 8	-4.013	-9.770	1.743	
12 - 2	10.351	4.377	16.325	***
12 - 24	13.997	7.892	20.103	***
12 - 20	14.750	8.993	20.507	***
12 - 4	15.333	9.577	21.090	***
12 - 16	15.537	9.780	21.293	***
2 - 24	3.646	-2.665	9.958	
2 - 20	4.399	-1.575	10.373	
2 - 4	4.982	-0.992	10.956	
2 - 16	5.186	-0.788	11.160	
24 - 2	-3.646	-9.958	2.665	
24 - 20	0.753	-5.353	6.858	
24 - 4	1.336	-4.770	7.442	
24 - 16	1.539	-4.567	7.645	
20 - 4	0.583	-5.173	6.340	
20 - 16	0.787	-4.970	6.543	
4 - 16	0.203	-5.553	5.960	

Table 33x Cont.....

Bonferroni (Dunn) Multiple comparison t Tests for CAT

COMPARISONS SIGNIFICANT AT THE 0.05 LEVEL ARE INDICATED BY ***				
TREATMENT COMPARISON	DIFFERENCE BETWEEN MEANS	SIMULTANEOUS 95% CONFIDENCE LIMITS		
C - V	2.482	-2.862	7.826	
C - F	9.356	4.137	14.575	***
C - A	10.723	5.464	15.981	***
C - N	12.226	7.007	17.446	***
C - Cu	15.035	9.816	20.255	***
V - F	6.874	1.530	12.218	***
V - A	8.241	2.858	13.623	***
V - N	9.745	4.401	15.089	***
V - Cu	12.554	7.210	17.898	***
F - A	1.367	-3.892	6.625	
F - N	2.871	-2.349	8.090	
F - Cu	5.679	0.460	10.899	***
A - N	1.504	-3.755	6.763	
A - Cu	4.313	-0.946	9.571	
N - Cu	2.809	-2.410	8.028	

Table 34x

Bonferroni (Dunn) Multiple comparison t Tests for VIT_C

COMPARISONS SIGNIFICANT AT THE 0.05 LEVEL ARE INDICATED BY ***.				
MONTHS COMPARISON	DIFFERENCE BETWEEN MEANS	SIMULTANEOUS 95% CONFIDENCE LIMITS		
24 - 16	0.8708	0.0327	1.7090	***
24 - 20	1.4608	0.6227	2.2990	***
24 - 12	2.6842	1.8460	3.5223	***
24 - 8	3.0942	2.2560	3.9323	***
24 - 4	4.9342	4.0960	5.7723	***
24 - 2	5.2112	4.3449	6.0776	***
16 - 20	0.5900	-0.2002	1.3802	
16 - 12	1.8133	1.0231	2.6036	***
16 - 8	2.2233	1.4331	3.0136	***
16 - 4	4.0633	3.2731	4.8536	***
16 - 2	4.3404	3.5203	5.1604	***
20 - 12	1.2233	0.4331	2.0136	***
20 - 8	1.6333	0.8431	2.4236	***
20 - 4	3.4733	2.6831	4.2636	***
20 - 2	3.7504	2.9303	4.5704	***
12 - 8	0.4100	-0.3802	1.2002	
12 - 4	2.2500	1.4598	3.0402	***
12 - 2	2.5271	1.7070	3.3471	***
8 - 4	1.8400	1.0498	2.6302	***
8 - 2	2.1171	1.2970	2.9371	***
4 - 2	0.2771	-0.5430	1.0971	

Table 34x Cont.....

Bonferroni (Dunn) Multiple comparison t Tests for VIT_C

COMPARISONS SIGNIFICANT AT THE 0.05 LEVEL ARE INDICATED BY ***				
TREATMENT COMPARISON	DIFFERENCE BETWEEN MEANS	SIMULTANEOUS 95% CONFIDENCE LIMITS		
V - C	0.5076	-0.2260	1.2412	
V - A	0.5754	-0.1634	1.3143	
V - F	0.9429	0.2093	1.6765	***
V - N	0.9988	0.2652	1.7323	***
V - Cu	1.0076	0.2740	1.7412	***
C - A	0.0678	-0.6540	0.7897	
C - F	0.4353	-0.2812	1.1517	
C - N	0.4912	-0.2253	1.2076	
C - Cu	0.5000	-0.2164	1.2164	
A - F	0.3675	-0.3544	1.0893	
A - N	0.4234	-0.2985	1.1452	
A - Cu	0.4322	-0.2897	1.1540	
F - N	0.0559	-0.6606	0.7723	
F - Cu	0.0647	-0.6517	0.7812	
N - Cu	0.0088	-0.7076	0.7253	

Table 35x

Bonferroni (Dunn) Multiple comparison t Tests for Cu

COMPARISONS SIGNIFICANT AT THE 0.05 LEVEL ARE INDICATED BY ***				
MONTHS COMPARISON	DIFFERENCE BETWEEN MEANS	SIMULTANEOUS 95% CONFIDENCE LIMITS		
24 - 16	0.758	-4.847	6.364	
24 - 20	2.272	-3.334	7.877	
24 - 4	13.276	7.670	18.881	***
24 - 12	13.662	8.056	19.267	***
24 - 8	18.315	12.710	23.920	***
24 - 2	18.724	12.930	24.518	***
16 - 20	1.513	-3.771	6.798	
16 - 4	12.517	7.233	17.802	***
16 - 12	12.903	7.619	18.188	***
16 - 8	17.557	12.272	22.841	***
16 - 2	17.966	12.482	23.450	***
20 - 4	11.004	5.719	16.289	***
20 - 12	11.390	6.105	16.675	***
20 - 8	16.043	10.759	21.328	***
20 - 2	16.452	10.968	21.937	***
4 - 12	0.386	-4.899	5.671	
4 - 8	5.039	-0.245	10.324	
4 - 2	5.448	-0.036	10.933	
12 - 8	4.653	-0.631	9.938	
12 - 2	5.062	-0.422	10.547	
8 - 2	0.409	-5.075	5.893	

Table 35x Cont.....

Bonferroni (Dunn) Multiple comparison t Tests for Cu

COMPARISONS SIGNIFICANT AT THE 0.05 LEVEL ARE INDICATED BY ***.				
TREATMENT COMPARISON	DIFFERENCE BETWEEN MEANS	SIMULTANEOUS 95% CONFIDENCE LIMITS		
A - Cu	0.823	-4.004	5.651	
A - F	1.224	-3.603	6.052	
A - V	1.483	-3.458	6.424	
A - C	3.740	-1.087	8.567	
A - N	8.605	3.778	13.433	***
Cu - F	0.401	-4.390	5.192	
Cu - V	0.659	-4.247	5.565	
Cu - C	2.916	-1.875	7.708	
Cu - N	7.782	2.991	12.573	***
F - V	0.258	-4.647	5.164	
F - C	2.516	-2.276	7.307	
F - N	7.381	2.590	12.172	***
V - C	2.257	-2.648	7.163	
V - N	7.123	2.217	12.028	***
C - N	4.865	0.074	9.657	***

Table 36x

Bonferroni (Dunn) Multiple comparison t Tests for LPO

COMPARISONS SIGNIFICANT AT THE 0.05 LEVEL ARE INDICATED BY ***.				
MONTHS COMPARISON	DIFFERENCE BETWEEN MEANS	SIMULTANEOUS 95% CONFIDENCE LIMITS		
16 - 20	9.883	-3.286	23.053	
16 - 24	17.841	4.174	31.507	***
16 - 4	62.723	49.554	75.893	***
16 - 12	74.200	61.030	87.370	***
16 - 8	83.927	70.757	97.096	***
16 - 2	85.194	71.528	98.861	***
20 - 24	7.957	-5.710	21.624	
20 - 4	52.840	39.670	66.010	***
20 - 12	64.317	51.147	77.486	***
20 - 8	74.043	60.874	87.213	***
20 - 2	75.311	61.644	88.978	***
24 - 4	44.883	31.216	58.550	***
24 - 12	56.359	42.693	70.026	***
24 - 8	66.086	52.419	79.753	***
24 - 2	67.354	53.207	81.500	***
4 - 12	11.477	-1.693	24.646	
4 - 8	21.203	8.034	34.373	***
4 - 2	22.471	8.804	36.138	***
12 - 8	9.727	-3.443	22.896	
12 - 2	10.994	-2.672	24.661	
8 - 2	1.268	-12.399	14.935	

Table 36x Cont....

Bonferroni (Dunn) Multiple comparison t Tests for LPO

COMPARISONS SIGNIFICANT AT THE 0.05 LEVEL ARE INDICATED BY ***.				
TREATMENT COMPARISON	DIFFERENCE BETWEEN MEANS	SIMULTANEOUS 95% CONFIDENCE LIMITS		
Cu - A	9.547	-2.307	21.402	
Cu - V	12.223	0.081	24.365	***
Cu - F	16.583	4.728	28.437	***
Cu - N	26.018	14.163	37.872	***
Cu - C	41.491	29.637	53.346	***
A - V	2.676	-9.550	14.902	
A - F	7.035	-4.905	18.976	
A - N	16.471	4.530	28.411	***
A - C	31.944	20.004	43.884	***
V - F	4.359	-7.867	16.585	
V - N	13.794	1.569	26.020	***
V - C	29.268	17.042	41.494	***
F - N	9.435	-2.505	21.376	
F - C	24.909	12.969	36.849	***
N - C	15.474	3.533	27.414	***

Table 37x

Dependent Variable: FADU

SOURCE	DF	TYPE III SS	MEAN SQUARE	F VALUE	PR > F
Months	6	1.06145829	0.17690971	90.27	<.0001
Treatment	5	0.09561937	0.01912387	9.76	<.0001
Months*Treatment	30	0.11786938	0.00392898	2.00	0.0033

Table 37x Cont.....

Bonferroni (Dunn) t Tests for FADU

COMPARISONS SIGNIFICANT AT THE 0.05 LEVEL ARE INDICATED BY ***				
MONTHS COMPARISON	DIFFERENCE BETWEEN MEANS	SIMULTANEOUS 95% CONFIDENCE LIMITS		
24 - 20	0.00315	-0.03347	0.03977	
24 - 16	0.04628	0.00966	0.08291	***
24 - 12	0.14122	0.10460	0.17784	***
24 - 2	0.15481	0.11690	0.19272	***
24 - 8	0.16908	0.13246	0.20571	***
24 - 4	0.17145	0.13483	0.20807	***
20 - 16	0.04313	0.00784	0.07842	***
20 - 12	0.13807	0.10278	0.17336	***
20 - 2	0.15166	0.11503	0.18828	***
20 - 8	0.16593	0.13064	0.20122	***
20 - 4	0.16830	0.13301	0.20359	***
16 - 12	0.09493	0.05964	0.13022	***
16 - 2	0.10852	0.07190	0.14515	***
16 - 8	0.12280	0.08751	0.15809	***
16 - 4	0.12517	0.08988	0.16046	***
12 - 2	0.01359	-0.02303	0.05021	
12 - 8	0.02787	-0.00742	0.06316	
12 - 4	0.03023	-0.00506	0.06552	
2 - 8	0.01428	-0.02235	0.05090	
2 - 4	0.01664	-0.01998	0.05327	
8 - 4	0.00237	-0.03292	0.03766	

Table 37x Cont.....

Bonferroni (Dunn) t Tests for FADU

COMPARISONS SIGNIFICANT AT THE 0.05 LEVEL ARE INDICATED BY ***				
TREATMENT COMPARISON	DIFFERENCE BETWEEN MEANS	SIMULTANEOUS 95% CONFIDENCE LIMITS		
Cu - F	0.01937	-0.01240	0.05114	
Cu - A	0.02452	-0.00772	0.05675	
Cu - N	0.02691	-0.00508	0.05891	
Cu - V	0.03887	0.00611	0.07163	***
Cu - C	0.06663	0.03486	0.09839	***
F - A	0.00515	-0.02686	0.03715	
F - N	0.00754	-0.02422	0.03931	
F - V	0.01950	-0.01303	0.05204	
F - C	0.04726	0.01572	0.07879	***
A - N	0.00240	-0.02984	0.03463	
A - V	0.01436	-0.01864	0.04735	
A - C	0.04211	0.01010	0.07412	***
N - V	0.01196	-0.02080	0.04472	
N - C	0.03972	0.00795	0.07148	***
V - C	0.02775	-0.00478	0.06029	

Figure 38x

Dependent Variable: MDA

SOURCE	DF	TYPE III SS	MEAN SQUARE	F VALUE	PR > F
Months	5	18871.61178	3774.32236	60.21	<.0001
Treatment	5	1907.25573	381.45115	6.09	<.0001
Months*Treatment	25	5011.56480	200.46259	3.20	<.0001

Table 38x

Bonferroni (Dunn) t Tests for MDA

COMPARISONS SIGNIFICANT AT THE 0.05 LEVEL ARE INDICATED BY ***.				
MONTHS COMPARISON	DIFFERENCE BETWEEN MEANS	SIMULTANEOUS 95% CONFIDENCE LIMITS		
24 - 16	18.743	12.261	25.224	***
24 - 12	28.076	21.595	34.557	***
24 - 4	29.386	22.905	35.867	***
24 - 8	30.907	24.425	37.388	***
24 - 2	31.998	25.234	38.761	***
16 - 12	9.333	3.223	15.444	***
16 - 4	10.643	4.533	16.754	***
16 - 8	12.164	6.053	18.275	***
16 - 2	13.255	6.846	19.664	***
12 - 4	1.310	-4.801	7.421	
12 - 8	2.831	-3.280	8.941	
12 - 2	3.922	-2.487	10.331	
4 - 8	1.521	-4.590	7.631	
4 - 2	2.612	-3.797	9.021	
8 - 2	1.091	-5.318	7.500	

Table 38x Cont.....

Bonferroni (Dunn) t Tests for MDA

COMPARISONS SIGNIFICANT AT THE 0.05 LEVEL ARE INDICATED BY ***.				
TREATMENT COMPARISON	DIFFERENCE BETWEEN MEANS	SIMULTANEOUS 95% CONFIDENCE LIMITS		
F - A	1.166	-5.159	7.491	
F - Cu	1.238	-5.032	7.508	
F - N	3.760	-2.511	10.030	
F - V	3.870	-2.575	10.316	
F - C	9.153	2.883	15.423	***
A - Cu	0.071	-6.199	6.342	
A - N	2.593	-3.677	8.863	
A - V	2.704	-3.742	9.149	
A - C	7.987	1.716	14.257	***
Cu - N	2.522	-3.693	8.737	
Cu - V	2.632	-3.760	9.024	
Cu - C	7.915	1.700	14.130	***
N - V	0.110	-6.281	6.502	
N - C	5.393	-0.822	11.609	
V - C	5.283	-1.109	11.675	

Table 39x

Dependent Variable: AMES

SOURCE	DF	TYPE III SS	MEAN SQUARE	F VALUE	PR > F
Months	5	722241.6012	144448.3202	42.51	<.0001
Treatment	5	197469.3319	39493.8664	11.62	<.0001
Months*Treatment	25	247372.1407	9894.8856	2.91	<.0001

Table 39x Cont.....

Bonferroni (Dunn) t Tests for AMES

COMPARISONS SIGNIFICANT AT THE 0.05 LEVEL ARE INDICATED BY ***.				
MONTHS COMPARISON	DIFFERENCE BETWEEN MEANS	SIMULTANEOUS 95% CONFIDENCE LIMITS		
20 - 24	7.47	-37.47	52.40	
20 - 16	111.53	66.60	156.47	***
20 - 12	128.10	83.17	173.03	***
20 - 8	148.90	103.97	193.83	***
20 - 4	153.54	108.22	198.85	***
24 - 16	104.07	59.13	149.00	***
24 - 12	120.63	75.70	165.57	***
24 - 8	141.43	96.50	186.37	***
24 - 4	146.07	100.75	191.39	***
16 - 12	16.57	-28.37	61.50	
16 - 8	37.37	-7.57	82.30	
16 - 4	42.00	-3.31	87.32	
12 - 8	20.80	-24.13	65.73	
12 - 4	25.44	-19.88	70.75	
8 - 4	4.64	-40.68	49.95	

Table 39x Cont.....

Bonferroni (Dunn) t Tests for AMES

COMPARISONS SIGNIFICANT AT THE 0.05 LEVEL ARE INDICATED BY ***.				
TREATMENT COMPARISON	DIFFERENCE BETWEEN MEANS	SIMULTANEOUS 95% CONFIDENCE LIMITS		
Cu - N	1.63	-43.30	46.57	
Cu - F	4.31	-41.01	49.63	
Cu - V	29.40	-15.53	74.33	
Cu - A	34.63	-10.30	79.57	
Cu - C	95.90	50.97	140.83	***
N - F	2.68	-42.64	48.00	
N - V	27.77	-17.17	72.70	
N - A	33.00	-11.93	77.93	
N - C	94.27	49.33	139.20	***
F - V	25.09	-20.23	70.41	
F - A	30.32	-15.00	75.64	
F - C	91.59	46.27	136.91	***
V - A	5.23	-39.70	50.17	
V - C	66.50	21.57	111.43	***
A - C	61.27	16.33	106.20	***

Table 40x

Dependent Variable:_8OHdG_

SOURCE	DF	TYPE III SS	MEAN SQUARE	F VALUE	PR > F
Months	6	2312879.695	385479.949	67.44	<.0001
Treatment	5	1037638.584	207527.717	36.31	<.0001
Months*Treatment	30	944680.110	31489.337	5.51	<.0001

Table 40x Cont.....

Bonferroni (Dunn) t Tests for 8OHdG_

COMPARISONS SIGNIFICANT AT THE 0.05 LEVEL ARE INDICATED BY ***				
MONTHS COMPARISON	DIFFERENCE BETWEEN MEANS	SIMULTANEOUS 95% CONFIDENCE LIMITS		
20 - 16	30.40	-29.84	90.64	
20 - 24	31.27	-28.98	91.51	
20 - 4	189.20	128.96	249.44	***
20 - 12	197.03	136.79	257.28	***
20 - 2	262.65	200.13	325.16	***
20 - 8	266.73	206.49	326.98	***
16 - 24	0.87	-59.38	61.11	
16 - 4	158.80	98.56	219.04	***
16 - 12	166.63	106.39	226.88	***
16 - 2	232.25	169.73	294.76	***
16 - 8	236.33	176.09	296.58	***
24 - 4	157.93	97.69	218.18	***
24 - 12	165.77	105.52	226.01	***
24 - 2	231.38	168.86	293.90	***
24 - 8	235.47	175.22	295.71	***
4 - 12	7.83	-52.41	68.08	
4 - 2	73.45	10.93	135.96	***
4 - 8	77.53	17.29	137.78	***
12 - 2	65.61	3.10	128.13	***
12 - 8	69.70	9.46	129.94	***
2 - 8	4.09	-58.43	66.60	

Table 40x Cont.....

Bonferroni (Dunn) t Tests for 8OHdG_

COMPARISONS SIGNIFICANT AT THE 0.05 LEVEL ARE INDICATED BY ***				
TREATMENT COMPARISON	DIFFERENCE BETWEEN MEANS	SIMULTANEOUS 95% CONFIDENCE LIMITS		
Cu - N	58.71	4.88	112.55	***
Cu - A	87.48	33.26	141.71	***
Cu - F	138.69	84.85	192.52	***
Cu - V	145.26	90.18	200.34	***
Cu - C	220.43	166.59	274.26	***
N - A	28.77	-25.46	83.00	
N - F	79.97	26.14	133.81	***
N - V	86.54	31.46	141.63	***
N - C	161.71	107.88	215.55	***
A - F	51.20	-3.03	105.43	
A - V	57.78	2.31	113.24	***
A - C	132.95	78.72	187.17	***
F - V	6.57	-48.51	61.65	
F - C	81.74	27.91	135.58	***
V - C	75.17	20.09	130.25	***

Table 41x

Dependent Variable: ORAC_L

SOURCE	DF	TYPE III SS	MEAN SQUARE	F VALUE	PR > F
Months	5	208.3671008	41.6734202	2901.76	<.0001
Treatment	5	2.4351503	0.4870301	33.91	<.0001
Months*Treatment	25	3.5464330	0.1418573	9.88	<.0001

Table 41x Cont.....

Bonferroni (Dunn) t Tests for ORAC_L

COMPARISONS SIGNIFICANT AT THE 0.05 LEVEL ARE INDICATED BY ***				
MONTHS COMPARISON	DIFFERENCE BETWEEN MEANS	SIMULTANEOUS 95% CONFIDENCE LIMITS		
20 - 16	1.06733	0.97490	1.15976	***
20 - 24	1.85950	1.76146	1.95754	***
20 - 12	2.54533	2.45290	2.63776	***
20 - 8	2.87500	2.78257	2.96743	***
20 - 4	3.02867	2.93624	3.12110	***
16 - 24	0.79217	0.69413	0.89020	***
16 - 12	1.47800	1.38557	1.57043	***
16 - 8	1.80767	1.71524	1.90010	***
16 - 4	1.96133	1.86890	2.05376	***
24 - 12	0.68583	0.58780	0.78387	***
24 - 8	1.01550	0.91746	1.11354	***
24 - 4	1.16917	1.07113	1.26720	***
12 - 8	0.32967	0.23724	0.42210	***
12 - 4	0.48333	0.39090	0.57576	***
8 - 4	0.15367	0.06124	0.24610	***

COMPARISONS SIGNIFICANT AT THE 0.05 LEVEL ARE INDICATED BY ***.			
MONTHS COMPARISON	DIFFERENCE BETWEEN MEANS	SIMULTANEOUS 95% CONFIDENCE LIMITS	

Table 41x Cont.....

Bonferroni (Dunn) t Tests for ORAC_L

COMPARISONS SIGNIFICANT AT THE 0.05 LEVEL ARE INDICATED BY ***				
TREATMENT COMPARISON	DIFFERENCE BETWEEN MEANS	SIMULTANEOUS 95% CONFIDENCE LIMITS		
A - F	0.05069	-0.04332	0.14470	
A - V	0.07103	-0.02298	0.16504	
A - Cu	0.07690	-0.01711	0.17091	
A - N	0.11759	0.02358	0.21160	***
A - C	0.37379	0.27978	0.46780	***
F - V	0.02034	-0.07367	0.11435	
F - Cu	0.02621	-0.06780	0.12022	
F - N	0.06690	-0.02711	0.16091	
F - C	0.32310	0.22909	0.41711	***
V - Cu	0.00586	-0.08815	0.09987	
V - N	0.04655	-0.04746	0.14056	
V - C	0.30276	0.20875	0.39677	***
Cu - N	0.04069	-0.05332	0.13470	
Cu - C	0.29690	0.20289	0.39091	***
N - C	0.25621	0.16220	0.35022	***

Table 42x

Dependent Variable: ORAC_A

SOURCE	DF	TYPE III SS	MEAN SQUARE	F VALUE	PR > F
Months	5	1426.637379	285.327476	311.56	<.0001
Treatment	5	57.653857	11.530771	12.59	<.0001
Months*Treatment	25	135.403568	5.416143	5.91	<.0001

Table 42x Cont.....

Bonferroni (Dunn) t Tests for ORAC_A

COMPARISONS SIGNIFICANT AT THE 0.05 LEVEL ARE INDICATED BY ***				
MONTHS COMPARISON	DIFFERENCE BETWEEN MEANS	SIMULTANEOUS 95% CONFIDENCE LIMITS		
12 - 8	3.1713	2.4332	3.9094	***
12 - 16	5.2343	4.4962	5.9724	***
12 - 20	6.9247	6.1866	7.6628	***
12 - 4	7.4400	6.7019	8.1781	***
12 - 24	8.4545	7.6716	9.2374	***
8 - 16	2.0630	1.3249	2.8011	***
8 - 20	3.7533	3.0152	4.4914	***
8 - 4	4.2687	3.5306	5.0068	***
8 - 24	5.2832	4.5003	6.0660	***
16 - 20	1.6903	0.9522	2.4284	***
16 - 4	2.2057	1.4676	2.9438	***
16 - 24	3.2202	2.4373	4.0030	***
20 - 4	0.5153	-0.2228	1.2534	
20 - 24	1.5298	0.7470	2.3127	***
4 - 24	1.0145	0.2316	1.7974	***

Table 42x Cont.....

Bonferroni (Dunn) t Tests for ORAC_A

COMPARISONS SIGNIFICANT AT THE 0.05 LEVEL ARE INDICATED BY ***.				
TREATMENT COMPARISON	DIFFERENCE BETWEEN MEANS	SIMULTANEOUS 95% CONFIDENCE LIMITS		
A - Cu	0.0879	-0.6628	0.8387	
A - N	0.3155	-0.4352	1.0662	
A - F	0.4200	-0.3307	1.1707	
A - V	1.2783	0.5276	2.0290	***
A - C	1.5317	0.7810	2.2824	***
Cu - N	0.2276	-0.5231	0.9783	
Cu - F	0.3321	-0.4187	1.0828	
Cu - V	1.1903	0.4396	1.9411	***
Cu - C	1.4438	0.6931	2.1945	***
N - F	0.1045	-0.6462	0.8552	
N - V	0.9628	0.2120	1.7135	***
N - C	1.2162	0.4655	1.9669	***
F - V	0.8583	0.1076	1.6090	***
F - C	1.1117	0.3610	1.8624	***
V - C	0.2534	-0.4973	1.0042	

Table 43x

Dependent Variable: IP_8 IP_8

SOURCE	DF	TYPE III SS	MEAN SQUARE	F VALUE	PR > F
Months	5	105371614.5	21074322.9	10.08	<.0001
Treatment	5	968270990.2	193654198.0	92.65	<.0001
Months*Treatment	25	253163238.6	10126529.5	4.85	<.0001

Table 43x Cont.....

Bonferroni (Dunn) t Tests for IP_8

COMPARISONS SIGNIFICANT AT THE 0.05 LEVEL ARE INDICATED BY ***.				
MONTHS COMPARISON	DIFFERENCE BETWEEN MEANS	SIMULTANEOUS 95% CONFIDENCE LIMITS		
16 - 20	784.4	-330.7	1899.4	
16 - 24	902.4	-280.3	2085.1	
16 - 12	1141.2	26.1	2256.3	***
16 - 8	1795.3	680.3	2910.4	***
16 - 4	2413.6	1298.5	3528.6	***
20 - 24	118.0	-1064.7	1300.7	
20 - 12	356.8	-758.2	1471.9	
20 - 8	1011.0	-104.1	2126.0	
20 - 4	1629.2	514.1	2744.3	***
24 - 12	238.8	-943.9	1421.5	
24 - 8	893.0	-289.7	2075.6	
24 - 4	1511.2	328.5	2693.9	***
12 - 8	654.1	-460.9	1769.2	
12 - 4	1272.4	157.3	2387.4	***
8 - 4	618.2	-496.8	1733.3	

Table 43x Cont.....

Bonferroni (Dunn) t Tests for IP_8

COMPARISONS SIGNIFICANT AT THE 0.05 LEVEL ARE INDICATED BY ***				
TREATMENT COMPARISON	DIFFERENCE BETWEEN MEANS	SIMULTANEOUS 95% CONFIDENCE LIMITS		
Cu - A	5396.8	4262.7	6530.9	***
Cu - V	5856.7	4722.5	6990.8	***
Cu - F	5976.8	4842.7	7110.9	***
Cu - N	6115.3	4981.2	7249.4	***
Cu - C	7545.7	6411.6	8679.8	***
A - V	459.8	-674.3	1593.9	
A - F	580.0	-554.1	1714.1	
A - N	718.4	-415.7	1852.6	
A - C	2148.9	1014.7	3283.0	***
V - F	120.2	-1013.9	1254.3	
V - N	258.6	-875.5	1392.7	
V - C	1689.0	554.9	2823.1	***
F - N	138.4	-995.7	1272.6	
F - C	1568.9	434.7	2703.0	***
N - C	1430.4	296.3	2564.5	***

Table 44x REGRESSION ANALYSIS

Group	Parameter A	Significantly affecting Parameter B	*p* Value	Remarks
Fe	Fe	LPO	0.0000	The influence of Fe and $^{\bullet-}O_2$ significantly affected lipid and DNA destruction with adducts (MDA, 8-IP, 8OHdG) formed which significantly contributed to liver damage.
	$^{\bullet-}O_2$	LPO	0.0035	
	Fe	MDA	0.0007	
	$^{\bullet-}O_2$	MDA	0.0334	
	Fe	8-IP	0.0084	
	GPx	8OHdG	0.0121	
	ORAC_L	AST	0.0000	
	MDA	AST	0.0002	
Fe + V	$^{\bullet-}O_2$	LPO	0.0083	$^{\bullet-}O_2$ and Cu significantly influenced lipid destruction. Lipid-soluble antioxidants and MDA affected DNA adducts formation. 8-IP influenced the formation of mutagenic compounds. Lipid-soluble antioxidants and DNA adducts affected liver damage.
	Cu	LPO	0.0001	
	Cu	MDA	0.0003	
	TAS	8OHdG	0.0430	
	ORAC_L	8OHdG	0.0000	
	MDA	8OHdG	0.0006	
	8-IP	AMES	0.0292	
	ORAC_L	ALT	0.0000	
	8OHdG	ALT	0.0000	
Fe - V	Cu	$^{\bullet-}O_2$	0.0002	Cu significantly influenced $^{\bullet-}O_2$ production. However, Cu and Fe affected LPO and MDA production respectively. Lipid peroxidation and the level of lipid-soluble antioxidants significantly influenced 8OHdG production.
	Cu	LPO	0.0002	
	Fe	MDA	0.0026	
	Cu	MDA	0.0213	
	LPO	8OHdG	0.0000	
	ORAC_L	8OHdG	0.0000	
Fe + ASA	$^{\bullet-}O_2$	LPO	0.0180	Cu and $^{\bullet-}O_2$ significantly influenced lipid peroxidation, while Fe and $^{\bullet-}O_2$ influenced MDA production. MDA and ORAC_L significantly influenced 8OHdG formation. This adduct affected mutagenesis significantly.
	Cu	LPO	0.0046	
	$^{\bullet-}O_2$	MDA	0.0010	
	Fe	MDA	0.0013	
	MDA	8OHdG	0.0000	
	ORAC_L	8OHdG	0.0000	
	8OHdG	AMES	0.0000	
Fe + Cu	Fe	$^{\bullet-}O_2$	0.0490	Fe influenced $^{\bullet-}O_2$ production. Fe and $^{\bullet-}O_2$ significantly influenced DNA destruction with the formation of the DNA adduct 8OHdG. Water-soluble antioxidants and lipid peroxidation influenced 8OHdG production. Mutagenesis was significantly influenced by GPx and FADU. Liver damage determined by ALT levels was predictable by Cu, ORAC_L and MDA levels.
	Fe	8OHdG	0.0000	
	$^{\bullet-}O_2$	8OHdG	0.0000	
	TAS	8OHdG	0.0390	
	ORAC_A	8OHdG	0.0024	
	LPO	8OHdG	0.0000	
	8-IP	8OHdG	0.0111	
	GPx	AMES	0.0002	
	FADU	AMES	0.0006	
	ORAC_L	ALT	0.0009	
	MDA	ALT	0.0065	
	Cu	ALT	0.0030	

Table 45x

Months	Treatment	Variable	Label	Mean	Std Dev	Minimum	Maximum
2	A	ALT	ALT	54.150000	5.269092	48.800000	59.300000
		AMESN					
		AST	AST	61.750000	9.979145	51.000000	74.000000
		CAT	CAT	39.000000	7.317103	28.900000	46.000000
		Cu	Cu	17.757500	7.149538	11.740000	27.200000
		FADU	FADU	0.042500	0.007594	0.033000	0.050000
		FE	FE	54.150000	5.269092	48.800000	59.300000
		GPX	GPX	117.700000	5.986652	111.300000	125.700000
		IP_8	IP_8				
		MDA	MDA	1.002500	0.131498	0.830000	1.110000
		O2	O2				
		OHdG_8	OHdG_8	97.500000	5.322907	92.000000	103.000000
		ORAC_A	ORAC_A				
		ORAC_L	ORAC_L				
		SOD	SOD	1250.000000	331.691620	810.000000	1615.000000
		TAS	TAS	0.352500	0.079320	0.260000	0.450000
	C	ALT	ALT	45.980000	7.421725	37.000000	55.000000
		AMESN					
		AST	AST	83.200000	4.641659	77.000000	89.000000
		CAT	CAT	52.340000	9.023192	42.400000	67.000000
		Cu	Cu	17.526000	2.034952	15.450000	19.760000
		FADU	FADU	0.024200	0.001643	0.023000	0.027000
		FE	FE	51.580000	9.128362	40.900000	66.000000
		GPX	GPX	153.900000	16.143575	127.100000	166.800000
		IP_8	IP_8				
		MDA	MDA	0.700000	0.103441	0.550000	0.820000
		O2	O2				
		OHdG_8	OHdG_8	95.800000	4.324350	90.000000	102.000000
		ORAC_A	ORAC_A				
		ORAC_L	ORAC_L				
		SOD	SOD	1923.000000	235.646980	1714.000000	2229.000000
		TAS	TAS	0.378000	0.038987	0.320000	0.420000
	Cu	ALT	ALT	61.440000	6.957945	52.600000	70.100000
		AMESN					
		AST	AST	117.400000	73.755000	70.000000	248.000000
		CAT	CAT	32.640000	7.527483	25.700000	45.400000
		Cu	Cu	16.318000	3.686512	12.720000	20.930000
		FADU	FADU	0.038600	0.007021	0.033000	0.050000
		FE	FE	61.440000	6.957945	52.600000	70.100000
		GPX	GPX	120.620000	30.035762	84.300000	160.300000
		IP_8	IP_8				
		MDA	MDA	0.944000	0.103586	0.780000	1.040000
		O2	O2				
		OHdG_8	OHdG_8	133.400000	21.766947	112.000000	170.000000
		ORAC_A	ORAC_A				
		ORAC_L	ORAC_L				
		SOD	SOD	1514.800000	550.832280	655.000000	2105.000000
		TAS	TAS	0.274000	0.036469	0.230000	0.320000

Table 45x Cont.....

2 months	F	ALT	ALT	67.920000	8.235108	59.200000	80.200000
		AMESN					
		AST	AST	75.600000	18.676188	57.000000	103.000000
		CAT	CAT	39.340000	4.540154	33.200000	43.300000
		Cu	Cu	16.512000	4.853630	9.190000	20.540000
		FADU	FADU	0.035800	0.008044	0.023000	0.043000
		FE	FE	67.920000	8.235108	59.200000	80.200000
		GPX	GPX	126.140000	39.912567	59.700000	167.000000
		IP_8	IP_8				
		MDA	MDA	0.817500	0.191202	0.680000	1.100000
		O2	O2				
		OHdG_8	OHdG_8	126.200000	21.170735	100.000000	155.000000
		ORAC_A	ORAC_A				
		ORAC_L	ORAC_L				
		SOD	SOD	1252.600000	365.581450	968.000000	1878.000000
		TAS	TAS	0.332000	0.085849	0.200000	0.440000
	N	ALT	ALT	62.460000	4.989289	57.300000	70.400000
		AMESN					
		AST	AST	102.800000	19.418419	82.000000	129.500000
		CAT	CAT	37.860000	5.071785	32.100000	45.700000
		Cu	Cu	5.046000	3.731545	0.780000	9.780000
		FADU	FADU	0.052800	0.009731	0.047000	0.070000
		FE	FE	62.460000	4.989289	57.300000	70.400000
		GPX	GPX	124.740000	26.074183	88.200000	150.200000
		IP_8	IP_8				
		MDA	MDA	0.998000	0.295076	0.610000	1.370000
		O2	O2				
		OHdG_8	OHdG_8	139.400000	19.112823	109.000000	159.000000
		ORAC_A	ORAC_A				
		ORAC_L	ORAC_L				
		SOD	SOD	739.200000	384.287910	391.000000	1258.000000
		TAS	TAS	0.308000	0.069785	0.210000	0.400000
	V	ALT	ALT	49.700000	13.859293	39.900000	59.500000
		AMESN					
		AST	AST	59.000000	0.000000	59.000000	59.000000
		CAT	CAT	48.150000	6.717514	43.400000	52.900000
		Cu	Cu	21.425000	0.134350	21.330000	21.520000
		FADU	FADU	0.025000	0.011314	0.017000	0.033000
		FE	FE	49.900000	14.142136	39.900000	59.900000
		GPX	GPX	72.700000	84.711392	12.800000	132.600000
		IP_8	IP_8				
		MDA	MDA	0.775000	0.360625	0.520000	1.030000
		O2	O2				
		OHdG_8	OHdG_8	104.000000	5.656854	100.000000	108.000000
		ORAC_A	ORAC_A				
		ORAC_L	ORAC_L				
		SOD	SOD	1498.500000	655.487990	1035.000000	1962.000000
		TAS	TAS	0.375000	0.049498	0.340000	0.410000

Table 45x Cont....

4 months	A	ALT	ALT	41.600000	8.018728	33.000000	52.000000
		AMESN		302.000000	48.036445	256.000000	363.000000
		AST	AST	88.400000	12.876335	71.000000	107.000000
		CAT	CAT	34.000000	2.721213	30.600000	36.200000
		Cu	Cu	23.100000	10.738715	17.200000	42.000000
		FADU	FADU	0.023200	0.006419	0.013000	0.030000
		FE	FE	75.400000	5.948109	69.200000	82.300000
		GPX	GPX	182.380000	32.705305	139.900000	212.500000
		IP_8	IP_8	1870.000000	326.802690	1475.000000	2375.000000
		MDA	MDA	4.300000	0.784219	3.300000	5.500000
		O2	O2	0.556000	0.212321	0.200000	0.770000
		OHdG_8	OHdG_8	126.000000	10.049876	110.000000	137.000000
		ORAC_A	ORAC_A	13.424000	0.533132	12.580000	13.870000
		ORAC_L	ORAC_L	3.654000	0.050299	3.600000	3.730000
		SOD	SOD	833.600000	169.305350	560.000000	1000.000000
		TAS	TAS	0.496000	0.028810	0.460000	0.540000
	C	ALT	ALT	45.400000	6.268971	41.000000	56.000000
		AMESN		316.200000	19.395876	282.000000	330.000000
		AST	AST	89.000000	17.102631	67.000000	110.000000
		CAT	CAT	35.580000	4.785603	29.800000	40.600000
		Cu	Cu	19.580000	2.320991	16.600000	22.300000
		FADU	FADU	0.019400	0.006427	0.013000	0.030000
		FE	FE	55.080000	13.116859	41.500000	71.200000
		GPX	GPX	214.360000	11.975517	201.600000	227.300000
		IP_8	IP_8	100.000000	20.615528	75.000000	125.000000
		MDA	MDA	2.440000	0.531977	2.000000	3.200000
		O2	O2	0.500000	0.216564	0.270000	0.820000
		OHdG_8	OHdG_8	143.200000	22.906331	109.000000	173.000000
		ORAC_A	ORAC_A	12.448000	0.611613	11.810000	13.100000
		ORAC_L	ORAC_L	3.510000	0.066708	3.410000	3.580000
		SOD	SOD	1248.600000	256.074790	915.000000	1596.000000
		TAS	TAS	0.452000	0.082280	0.380000	0.560000
	Cu	ALT	ALT	39.600000	16.440803	16.000000	61.000000
		AMESN		321.800000	24.923884	300.000000	355.000000
		AST	AST	98.600000	45.954325	52.000000	174.000000
		CAT	CAT	33.320000	9.371073	19.700000	42.300000
		Cu	Cu	24.160000	3.660328	20.900000	29.500000
		FADU	FADU	0.020200	0.004087	0.017000	0.027000
		FE	FE	63.880000	19.322189	34.300000	81.900000
		GPX	GPX	233.825000	39.572750	176.300000	266.800000
		IP_8	IP_8	2996.600000	555.518050	2485.000000	3700.000000
		MDA	MDA	4.740000	0.559464	4.300000	5.400000
		O2	O2	0.938000	0.482514	0.440000	1.580000
		OHdG_8	OHdG_8	375.800000	70.254537	285.000000	482.000000
		ORAC_A	ORAC_A	13.722000	1.643585	12.130000	16.470000
		ORAC_L	ORAC_L	3.624000	0.048270	3.570000	3.680000
		SOD	SOD	848.200000	430.129860	269.000000	1273.000000
		TAS	TAS	0.432000	0.056303	0.360000	0.510000

Table 45x Cont.....

4 months	F	ALT	ALT	42.000000	9.027735	30.000000	51.000000
		AMESN		344.250000	33.757715	301.000000	380.000000
		AST	AST	84.600000	25.274493	56.000000	124.000000
		CAT	CAT	33.280000	3.080097	28.800000	36.500000
		Cu	Cu	20.980000	3.603054	17.800000	26.600000
		FADU	FADU	0.020000	0.013583	0.010000	0.043000
		FE	FE	69.180000	4.365432	65.000000	75.500000
		GPX	GPX	171.840000	22.390913	133.700000	187.600000
		IP_8	IP_8	1530.000000	47.827816	1475.000000	1580.000000
		MDA	MDA	2.700000	0.845577	2.200000	4.200000
		O2	O2	0.478000	0.113886	0.300000	0.570000
		OHdG_8	OHdG_8	179.800000	114.521610	77.000000	366.000000
		ORAC_A	ORAC_A	12.742000	0.606069	11.830000	13.390000
		ORAC_L	ORAC_L	3.564000	0.039115	3.520000	3.610000
		SOD	SOD	523.600000	149.894300	373.000000	692.000000
		TAS	TAS	0.436000	0.081425	0.310000	0.510000
	N	ALT	ALT	45.800000	18.033303	23.000000	73.000000
		AMESN		346.800000	28.437651	309.000000	382.000000
		AST	AST	74.800000	18.267457	50.000000	96.000000
		CAT	CAT	34.200000	3.551056	30.300000	39.800000
		Cu	Cu	12.916000	7.945645	0.780000	19.800000
		FADU	FADU	0.031400	0.018133	0.017000	0.063000
		FE	FE	66.580000	11.654484	48.200000	79.000000
		GPX	GPX	164.260000	51.983536	75.700000	211.100000
		IP_8	IP_8	1610.000000	45.961941	1570.000000	1665.000000
		MDA	MDA	2.940000	0.896103	2.100000	4.200000
		O2	O2	0.496000	0.132590	0.350000	0.670000
		OHdG_8	OHdG_8	227.800000	62.515598	138.000000	314.000000
		ORAC_A	ORAC_A	13.200000	0.256027	12.780000	13.470000
		ORAC_L	ORAC_L	3.554000	0.036469	3.490000	3.580000
		SOD	SOD	506.400000	200.158190	234.000000	692.000000
		TAS	TAS	0.456000	0.018166	0.440000	0.480000
	V	ALT	ALT	50.800000	27.160633	18.000000	87.000000
		AMESN		304.800000	41.227418	263.000000	372.000000
		AST	AST	125.800000	71.754442	42.000000	233.000000
		CAT	CAT	45.080000	18.781959	31.500000	74.500000
		Cu	Cu	22.160000	5.905337	13.500000	28.400000
		FADU	FADU	0.011400	0.003131	0.010000	0.017000
		FE	FE	66.875000	21.265367	38.100000	86.800000
		GPX	GPX	166.150000	22.208182	142.400000	190.800000
		IP_8	IP_8	1550.000000	56.899033	1480.000000	1615.000000
		MDA	MDA	3.840000	0.716240	3.200000	5.000000
		O2	O2	0.336000	0.208279	0.110000	0.600000
		OHdG_8	OHdG_8	97.000000	21.342446	64.000000	123.000000
		ORAC_A	ORAC_A	12.716000	0.615085	11.740000	13.390000
		ORAC_L	ORAC_L	3.554000	0.032863	3.520000	3.590000
		SOD	SOD	986.800000	501.359850	595.000000	1857.000000
		TAS	TAS	0.492000	0.118195	0.410000	0.700000

Table 45x Cont.....

8 months	A	ALT	ALT	71.800000	28.287807	44.000000	118.000000
		AMESN		315.600000	47.930158	266.000000	366.000000
		AST	AST	130.000000	23.632605	89.000000	146.000000
		CAT	CAT	49.460000	3.907429	46.100000	54.900000
		Cu	Cu	15.680000	7.920354	1.600000	20.200000
		FADU	FADU	0.023400	0.010359	0.007000	0.033000
		FE	FE	65.320000	12.524656	52.200000	84.700000
		GPX	GPX	169.120000	14.871180	152.900000	192.900000
		IP_8	IP_8	2110.000000	427.434210	1500.000000	2700.000000
		MDA	MDA	1.980000	0.511859	1.400000	2.600000
		O2	O2				
		OHdG_8	OHdG_8	72.600000	16.133815	48.000000	89.000000
		ORAC_A	ORAC_A	18.400000	0.322955	18.080000	18.730000
		ORAC_L	ORAC_L	3.818000	0.028636	3.770000	3.840000
		SOD	SOD	716.400000	222.779710	462.000000	1060.000000
		TAS	TAS	0.640000	0.055227	0.570000	0.710000
	C	ALT	ALT	59.400000	13.088163	45.000000	75.000000
		AMESN		319.200000	36.175959	255.000000	343.000000
		AST	AST	96.200000	29.760712	70.000000	132.000000
		CAT	CAT	66.900000	7.869244	58.700000	76.100000
		Cu	Cu	18.580000	2.920959	16.000000	23.100000
		FADU	FADU	0.021400	0.003782	0.017000	0.027000
		FE	FE	56.840000	13.979020	39.700000	74.800000
		GPX	GPX	154.800000	49.803614	103.500000	210.200000
		IP_8	IP_8	140.000000	82.764727	30.000000	250.000000
		MDA	MDA	1.996000	0.859698	0.580000	2.700000
		O2	O2				
		OHdG_8	OHdG_8	99.000000	78.962016	24.000000	218.000000
		ORAC_A	ORAC_A	17.240000	0.970593	16.220000	18.770000
		ORAC_L	ORAC_L	3.668000	0.071903	3.580000	3.780000
		SOD	SOD	1237.600000	296.450330	753.000000	1515.000000
		TAS	TAS	0.566000	0.051769	0.490000	0.630000
	Cu	ALT	ALT	62.400000	19.730687	44.000000	88.000000
		AMESN		344.800000	66.522177	287.000000	458.000000
		AST	AST	132.600000	74.217922	93.000000	265.000000
		CAT	CAT	41.060000	4.417352	36.600000	46.800000
		Cu	Cu	22.340000	6.337823	12.700000	30.500000
		FADU	FADU	0.023400	0.004775	0.020000	0.030000
		FE	FE	57.680000	4.137874	50.500000	60.400000
		GPX	GPX	144.800000	29.942194	96.300000	175.400000
		IP_8	IP_8	5752.000000	1724.590000	3000.000000	7490.000000
		MDA	MDA	1.560000	0.650385	0.600000	2.200000
		O2	O2				
		OHdG_8	OHdG_8	157.600000	109.814840	25.000000	315.000000
		ORAC_A	ORAC_A	18.260000	0.308788	17.920000	18.750000
		ORAC_L	ORAC_L	3.880000	0.029155	3.860000	3.930000
		SOD	SOD	938.800000	105.630010	818.000000	1040.000000
		TAS	TAS	0.590000	0.027386	0.550000	0.620000

Table 45x Cont.....

8 months	F	ALT	ALT	46.400000	6.228965	40.000000	54.000000
		AMESN		316.800000	40.616499	267.000000	360.000000
		AST	AST	75.000000	13.453624	64.000000	96.000000
		CAT	CAT	61.020000	3.663605	56.300000	65.000000
		Cu	Cu	15.240000	9.956556	0.200000	25.800000
		FADU	FADU	0.023400	0.005225	0.017000	0.030000
		FE	FE	67.500000	15.113736	48.900000	89.700000
		GPX	GPX	92.300000	41.497229	32.500000	128.300000
		IP_8	IP_8	1958.000000	726.546630	1170.000000	2650.000000
		MDA	MDA	2.140000	0.181659	1.900000	2.300000
		O2	O2				
		OHdG_8	OHdG_8	96.600000	106.514320	11.000000	282.000000
		ORAC_A	ORAC_A	17.216000	0.425359	16.780000	17.770000
		ORAC_L	ORAC_L	3.690000	0.070000	3.580000	3.760000
		SOD	SOD	541.600000	277.244120	190.000000	939.000000
		TAS	TAS	0.610000	0.060415	0.550000	0.680000
	N	ALT	ALT	65.600000	11.392980	53.000000	83.000000
		AMESN		365.800000	69.553577	246.000000	411.000000
		AST	AST	119.800000	26.957374	77.000000	152.000000
		CAT	CAT	47.920000	4.910397	41.400000	54.500000
		Cu	Cu	9.000000	7.650163	0.400000	17.000000
		FADU	FADU	0.027600	0.007197	0.017000	0.037000
		FE	FE	67.060000	11.000591	54.500000	82.700000
		GPX	GPX	120.380000	40.338654	72.400000	176.700000
		IP_8	IP_8	1766.000000	290.224050	1350.000000	2040.000000
		MDA	MDA	2.200000	0.784219	1.000000	3.000000
		O2	O2				
		OHdG_8	OHdG_8	171.400000	145.692480	14.000000	347.000000
		ORAC_A	ORAC_A	16.838000	0.610672	15.820000	17.260000
		ORAC_L	ORAC_L	3.620000	0.159687	3.350000	3.740000
		SOD	SOD	603.000000	306.823240	217.000000	921.000000
		TAS	TAS	0.628000	0.047645	0.570000	0.700000
	V	ALT	ALT	64.200000	12.397580	52.000000	85.000000
		AMESN		297.000000	35.121219	247.000000	339.000000
		AST	AST	110.200000	29.337689	85.000000	161.000000
		CAT	CAT	65.180000	10.663583	47.800000	74.800000
		Cu	Cu	11.820000	10.860341	0.200000	23.100000
		FADU	FADU	0.020600	0.006427	0.013000	0.030000
		FE	FE	67.320000	7.410601	56.500000	75.900000
		GPX	GPX	141.000000	31.862360	87.800000	174.100000
		IP_8	IP_8	1640.000000	90.277350	1500.000000	1710.000000
		MDA	MDA	1.960000	0.151658	1.800000	2.100000
		O2	O2				
		OHdG_8	OHdG_8	87.200000	31.586390	44.000000	126.000000
		ORAC_A	ORAC_A	15.910000	0.980663	14.670000	16.840000
		ORAC_L	ORAC_L	3.706000	0.023022	3.680000	3.740000
		SOD	SOD	711.200000	479.226150	248.000000	1423.000000
		TAS	TAS	0.642000	0.041473	0.600000	0.710000

Table 45x Cont.....

12 months	A	ALT	ALT	59.000000	11.022704	46.000000	71.000000
		AMESN		320.400000	24.704251	303.000000	364.000000
		AST	AST	177.400000	35.111252	129.000000	224.000000
		CAT	CAT	51.300000	2.223736	49.300000	55.000000
		Cu	Cu	21.460000	10.056490	8.800000	30.300000
		FADU	FADU	0.039000	0.014612	0.022000	0.057000
		FE	FE	108.920000	15.727110	91.300000	131.100000
		GPX	GPX	141.800000	32.909117	112.200000	195.300000
		IP_8	IP_8	2192.000000	1068.420000	1180.000000	3900.000000
		MDA	MDA	4.660000	2.619733	2.500000	9.100000
		O2	O2	1.234000	0.648174	0.510000	2.260000
		OHdG_8	OHdG_8	166.200000	17.838161	144.000000	186.000000
		ORAC_A	ORAC_A	21.810000	0.953756	20.750000	22.880000
		ORAC_L	ORAC_L	4.088000	0.023875	4.050000	4.110000
		SOD	SOD	1546.400000	441.692540	1083.000000	2143.000000
		TAS	TAS	0.617000	0.085974	0.533000	0.760000
	C	ALT	ALT	56.000000	15.979153	34.000000	72.000000
		AMESN		326.600000	25.637863	299.000000	354.000000
		AST	AST	86.250000	32.294220	63.000000	134.000000
		CAT	CAT	55.520000	6.361368	47.800000	63.700000
		Cu	Cu	30.420000	3.431035	26.100000	33.100000
		FADU	FADU	0.049600	0.010262	0.039000	0.066000
		FE	FE	50.420000	7.113157	38.500000	56.600000
		GPX	GPX	180.100000	19.896608	156.500000	203.400000
		IP_8	IP_8	302.800000	94.481215	189.000000	450.000000
		MDA	MDA	4.220000	1.523811	2.600000	6.400000
		O2	O2	0.400000	0.257002	0.080000	0.730000
		OHdG_8	OHdG_8	170.000000	64.826692	80.000000	247.000000
		ORAC_A	ORAC_A	19.370000	1.876633	16.490000	21.410000
		ORAC_L	ORAC_L	4.020000	0.041833	3.950000	4.060000
		SOD	SOD	2164.600000	444.781740	1605.000000	2839.000000
		TAS	TAS	0.740400	0.074504	0.663000	0.828000
	Cu	ALT	ALT	74.000000	8.972179	60.000000	84.000000
		AMESN		429.400000	88.810472	286.000000	499.000000
		AST	AST	108.600000	8.820431	96.000000	118.000000
		CAT	CAT	48.760000	4.795623	45.500000	57.100000
		Cu	Cu	20.580000	4.033237	16.000000	25.700000
		FADU	FADU	0.066600	0.029399	0.018000	0.093000
		FE	FE	114.050000	19.416917	91.400000	138.600000
		GPX	GPX	131.900000	17.600000	104.800000	153.000000
		IP_8	IP_8	9950.000000	1350.460000	8850.000000	12000.000000
		MDA	MDA	4.880000	2.017920	1.900000	6.900000
		O2	O2	0.210000	0.213190	0.040000	0.490000
		OHdG_8	OHdG_8	191.000000	46.059744	138.000000	259.000000
		ORAC_A	ORAC_A	21.608000	1.978287	20.170000	24.640000
		ORAC_L	ORAC_L	4.040000	0.114673	3.840000	4.120000
		SOD	SOD	1747.200000	162.011420	1614.000000	2003.000000
		TAS	TAS	0.584000	0.060324	0.533000	0.669000

Table 45x Cont.....

12 months	F	ALT	ALT	57.800000	15.514509	44.000000	84.000000
		AMESN		337.000000	58.809013	257.000000	422.000000
		AST	AST	107.400000	49.902906	75.000000	195.000000
		CAT	CAT	47.740000	6.165468	40.200000	57.100000
		Cu	Cu	25.180000	13.326928	14.000000	41.700000
		FADU	FADU	0.051000	0.020940	0.036000	0.086000
		FE	FE	94.780000	13.411637	72.900000	106.600000
		GPX	GPX	139.860000	25.727087	99.300000	165.100000
		IP_8	IP_8	1278.000000	234.882950	1050.000000	1650.000000
		MDA	MDA	5.040000	0.918150	3.500000	5.900000
		O2	O2	0.944000	0.878140	0.090000	2.000000
		OHdG_8	OHdG_8	224.600000	137.607410	136.000000	464.000000
		ORAC_A	ORAC_A	22.684000	0.551162	21.890000	23.210000
		ORAC_L	ORAC_L	4.084000	0.032094	4.040000	4.110000
		SOD	SOD	1412.200000	316.294480	1054.000000	1892.000000
		TAS	TAS	0.677000	0.058664	0.590000	0.731000
	N	ALT	ALT	83.750000	44.252119	44.000000	147.000000
		AMESN		345.600000	32.577600	310.000000	385.000000
		AST	AST	171.500000	87.743946	83.000000	270.000000
		CAT	CAT	48.740000	4.443310	43.700000	54.400000
		Cu	Cu	5.120000	1.188276	4.000000	6.600000
		FADU	FADU	0.052200	0.012029	0.041000	0.070000
		FE	FE	96.380000	11.770811	78.500000	106.600000
		GPX	GPX	108.800000	35.935846	78.500000	170.300000
		IP_8	IP_8	1368.000000	511.341370	660.000000	2100.000000
		MDA	MDA	5.720000	1.321741	3.700000	7.400000
		O2	O2	1.216000	0.474479	0.600000	1.770000
		OHdG_8	OHdG_8	203.400000	31.887302	151.000000	230.000000
		ORAC_A	ORAC_A	20.308000	0.600808	19.710000	21.060000
		ORAC_L	ORAC_L	4.066000	0.025100	4.050000	4.110000
		SOD	SOD	1223.800000	556.790540	655.000000	2052.000000
		TAS	TAS	0.623800	0.061626	0.556000	0.697000
	V	ALT	ALT	51.600000	16.164777	32.000000	77.000000
		AMESN		325.000000	35.853870	275.000000	364.000000
		AST	AST	147.200000	39.175247	110.000000	212.000000
		CAT	CAT	55.400000	7.858753	47.100000	66.100000
		Cu	Cu	17.820000	8.445531	8.200000	28.700000
		FADU	FADU	0.048600	0.006656	0.040000	0.057000
		FE	FE	107.620000	16.400671	91.600000	131.800000
		GPX	GPX	144.620000	38.092939	91.400000	193.300000
		IP_8	IP_8	2200.000000	720.243010	1050.000000	2850.000000
		MDA	MDA	4.300000	1.500000	2.800000	6.400000
		O2	O2	0.878000	0.732646	0.100000	1.990000
		OHdG_8	OHdG_8	147.400000	20.403431	129.000000	178.000000
		ORAC_A	ORAC_A	17.112000	3.127630	12.680000	19.500000
		ORAC_L	ORAC_L	4.062000	0.092033	3.910000	4.150000
		SOD	SOD	1626.000000	198.855480	1425.000000	1880.000000
		TAS	TAS	0.646200	0.025548	0.612000	0.675000

Table 45x Cont.....

16 months	A	ALT	ALT	257.200000	42.233873	207.000000	321.000000
		AMESN		358.000000	35.163902	319.000000	412.000000
		AST	AST	236.000000	55.619241	174.000000	325.000000
		CAT	CAT	32.960000	6.083009	26.700000	40.000000
		Cu	Cu	33.660000	2.751000	30.100000	36.100000
		FADU	FADU	0.142800	0.027472	0.120000	0.187000
		FE	FE	120.920000	10.719702	106.900000	134.800000
		GPX	GPX	189.220000	30.783551	138.800000	212.900000
		IP_8	IP_8	4102.000000	2464.550000	1100.000000	7500.000000
		MDA	MDA	16.900000	3.116890	11.900000	19.800000
		O2	O2	0.402000	0.191102	0.140000	0.660000
		OHdG_8	OHdG_8	444.200000	33.899853	399.000000	490.000000
		ORAC_A	ORAC_A	15.004000	0.354655	14.570000	15.450000
		ORAC_L	ORAC_L	5.830000	0.076812	5.760000	5.950000
		SOD	SOD	1506.000000	184.885100	1332.000000	1796.000000
		TAS	TAS	0.620200	0.025646	0.589000	0.656000
	C	ALT	ALT	110.000000	21.130547	78.000000	137.000000
		AMESN		301.600000	29.534725	254.000000	332.000000
		AST	AST	130.600000	38.181147	92.000000	182.000000
		CAT	CAT	46.300000	12.620420	31.800000	62.700000
		Cu	Cu	25.920000	11.240641	8.200000	37.700000
		FADU	FADU	0.082800	0.012029	0.067000	0.100000
		FE	FE	50.400000	21.904338	21.500000	82.900000
		GPX	GPX	203.000000	18.172232	182.500000	230.900000
		IP_8	IP_8	590.000000	193.649170	390.000000	900.000000
		MDA	MDA	4.260000	2.326586	2.300000	8.200000
		O2	O2	0.318000	0.053572	0.270000	0.390000
		OHdG_8	OHdG_8	128.400000	15.852445	115.000000	154.000000
		ORAC_A	ORAC_A	13.068000	0.316654	12.710000	13.580000
		ORAC_L	ORAC_L	4.838000	0.317285	4.490000	5.260000
		SOD	SOD	1831.200000	740.866860	1357.000000	3140.000000
		TAS	TAS	0.820000	0.113351	0.678000	0.989000
	Cu	ALT	ALT	213.200000	42.044025	141.000000	240.000000
		AMESN		441.200000	50.286181	400.000000	527.000000
		AST	AST	212.400000	58.243455	131.000000	282.000000
		CAT	CAT	35.900000	3.922372	31.700000	40.200000
		Cu	Cu	34.060000	13.889312	13.600000	52.100000
		FADU	FADU	0.225400	0.114238	0.120000	0.393000
		FE	FE	116.940000	16.151563	98.100000	139.200000
		GPX	GPX	185.440000	16.694101	159.600000	203.800000
		IP_8	IP_8	12940.000000	4173.490000	6700.000000	18000.000000
		MDA	MDA	20.700000	3.685784	16.700000	26.300000
		O2	O2	0.520000	0.308545	0.080000	0.860000
		OHdG_8	OHdG_8	522.000000	28.469282	489.000000	558.000000
		ORAC_A	ORAC_A	15.372000	0.372116	14.950000	15.760000
		ORAC_L	ORAC_L	5.712000	0.085849	5.610000	5.830000
		SOD	SOD	1659.000000	454.479370	1242.000000	2167.000000
		TAS	TAS	0.608600	0.070106	0.544000	0.700000

Table 45x Cont.....

16 months	F	ALT	ALT	273.600000	113.810370	123.000000	419.000000
		AMESN		364.600000	73.162832	238.000000	417.000000
		AST	AST	278.200000	132.394110	188.000000	502.000000
		CAT	CAT	31.960000	4.429786	26.800000	36.300000
		Cu	Cu	34.940000	4.609555	27.900000	39.100000
		FADU	FADU	0.174800	0.127300	0.067000	0.393000
		FE	FE	117.000000	24.297634	84.400000	150.600000
		GPX	GPX	176.720000	15.261291	151.100000	189.900000
		IP_8	IP_8	2280.000000	1172.310000	810.000000	3150.000000
		MDA	MDA	14.240000	3.470303	11.500000	19.200000
		O2	O2	0.240000	0.157797	0.080000	0.410000
		OHdG_8	OHdG_8	258.400000	30.394078	207.000000	281.000000
		ORAC_A	ORAC_A	14.542000	0.540759	13.620000	14.900000
		ORAC_L	ORAC_L	5.572000	0.069426	5.510000	5.690000
		SOD	SOD	1584.400000	359.868450	1050.000000	2039.000000
		TAS	TAS	0.726600	0.214610	0.561000	1.100000
	N	ALT	ALT	272.400000	45.169680	243.000000	352.000000
		AMESN		379.400000	42.547620	325.000000	431.000000
		AST	AST	252.800000	57.014910	181.000000	321.000000
		CAT	CAT	27.900000	9.245269	15.500000	39.400000
		Cu	Cu	33.340000	3.995998	27.500000	38.100000
		FADU	FADU	0.156200	0.073135	0.060000	0.240000
		FE	FE	133.620000	14.234360	118.500000	154.800000
		GPX	GPX	131.480000	74.810908	20.200000	206.800000
		IP_8	IP_8	1482.000000	916.498770	600.000000	2940.000000
		MDA	MDA	15.260000	2.673574	13.100000	19.700000
		O2	O2	0.222000	0.120913	0.110000	0.400000
		OHdG_8	OHdG_8	503.600000	25.598828	470.000000	534.000000
		ORAC_A	ORAC_A	17.192000	1.556236	16.310000	19.960000
		ORAC_L	ORAC_L	5.602000	0.048166	5.540000	5.660000
		SOD	SOD	1242.200000	201.302510	987.000000	1472.000000
		TAS	TAS	0.652200	0.044724	0.578000	0.694000
	V	ALT	ALT	215.400000	31.595886	181.000000	263.000000
		AMESN		338.600000	39.437292	291.000000	394.000000
		AST	AST	209.000000	8.336666	199.000000	219.000000
		CAT	CAT	39.220000	6.101393	33.300000	49.000000
		Cu	Cu	36.080000	5.096273	27.300000	39.700000
		FADU	FADU	0.094600	0.075065	0.027000	0.213000
		FE	FE	120.200000	26.266614	91.500000	163.000000
		GPX	GPX	228.820000	17.610565	200.000000	243.600000
		IP_8	IP_8	2744.000000	769.889600	1410.000000	3270.000000
		MDA	MDA	13.460000	2.650094	9.500000	16.000000
		O2	O2	0.302000	0.217761	0.140000	0.620000
		OHdG_8	OHdG_8	245.800000	42.464103	201.000000	297.000000
		ORAC_A	ORAC_A	16.308000	0.231776	16.010000	16.610000
		ORAC_L	ORAC_L	5.674000	0.089610	5.560000	5.810000
		SOD	SOD	1565.600000	240.457480	1279.000000	1865.000000
		TAS	TAS	0.690000	0.049305	0.633000	0.767000

Table 45x Cont.....

20 months	A	ALT	ALT	234.600000	88.624489	112.000000	360.000000
		AMESN		489.800000	81.346174	397.000000	571.000000
		AST	AST	364.200000	96.245519	247.000000	471.000000
		CAT	CAT	36.220000	4.344192	30.900000	41.800000
		Cu	Cu	33.620000	1.706458	30.700000	35.000000
		FADU	FADU	0.206400	0.023287	0.180000	0.240000
		FE	FE	120.700000	35.264642	77.600000	165.300000
		GPX	GPX	179.040000	20.634631	142.900000	194.900000
		IP_8	IP_8	2522.000000	446.998320	2000.000000	3005.000000
		MDA	MDA				
		O2	O2	0.282000	0.225211	0.120000	0.660000
		OHdG_8	OHdG_8	523.400000	208.276980	281.000000	857.000000
		ORAC_A	ORAC_A	13.614000	0.295855	13.300000	14.050000
		ORAC_L	ORAC_L	6.810000	0.062048	6.740000	6.910000
		SOD	SOD	1141.600000	317.692150	738.000000	1604.000000
		TAS	TAS	0.680800	0.042956	0.619000	0.733000
	C	ALT	ALT	65.000000	15.346009	42.000000	81.000000
		AMESN		327.600000	34.136491	288.000000	365.000000
		AST	AST	117.200000	22.409819	93.000000	149.000000
		CAT	CAT	48.280000	6.570921	43.000000	57.800000
		Cu	Cu	24.960000	5.541931	17.600000	31.700000
		FADU	FADU	0.102000	0.057619	0.030000	0.170000
		FE	FE	53.640000	9.189287	44.700000	67.500000
		GPX	GPX	193.140000	20.887030	173.000000	225.600000
		IP_8	IP_8	438.800000	290.907550	120.000000	900.000000
		MDA	MDA				
		O2	O2	0.300000	0.115109	0.140000	0.450000
		OHdG_8	OHdG_8	124.400000	23.308797	91.000000	146.000000
		ORAC_A	ORAC_A	12.728000	0.087864	12.610000	12.810000
		ORAC_L	ORAC_L	6.054000	0.065803	5.960000	6.110000
		SOD	SOD	1554.000000	206.371030	1282.000000	1781.000000
		TAS	TAS	0.871800	0.075692	0.745000	0.945000
	Cu	ALT	ALT	250.400000	72.782553	153.000000	330.000000
		AMESN		486.200000	76.545411	386.000000	588.000000
		AST	AST	537.200000	138.449270	413.000000	757.000000
		CAT	CAT	29.620000	7.550298	21.000000	41.000000
		Cu	Cu	34.040000	5.363115	27.600000	39.800000
		FADU	FADU	0.248000	0.044385	0.190000	0.300000
		FE	FE	129.500000	41.364236	102.900000	202.500000
		GPX	GPX	183.800000	5.027425	177.400000	190.700000
		IP_8	IP_8	9600.000000	4628.710000	4500.000000	16000.000000
		MDA	MDA				
		O2	O2	0.234000	0.350328	0.050000	0.860000
		OHdG_8	OHdG_8	562.200000	180.359920	277.000000	779.000000
		ORAC_A	ORAC_A	13.552000	0.525899	13.070000	14.440000
		ORAC_L	ORAC_L	6.686000	0.198570	6.510000	6.940000
		SOD	SOD	922.800000	169.743040	695.000000	1095.000000
		TAS	TAS	0.729600	0.052176	0.670000	0.773000

Table 45x Cont.....

20 months	F	ALT	ALT	140.400000	22.634045	105.000000	165.000000
		AMESN		539.000000	91.350972	435.000000	662.000000
		AST	AST	310.000000	60.592904	233.000000	402.000000
		CAT	CAT	32.700000	12.002500	18.000000	47.400000
		Cu	Cu	33.920000	5.411747	27.200000	42.300000
		FADU	FADU	0.210200	0.070446	0.105000	0.300000
		FE	FE	118.420000	13.301391	101.200000	133.700000
		GPX	GPX	179.140000	16.067607	154.000000	193.200000
		IP_8	IP_8	2077.000000	630.789190	1500.000000	3150.000000
		MDA	MDA				
		O2	O2	0.198000	0.131415	0.080000	0.410000
		OHdG_8	OHdG_8	273.400000	31.365586	230.000000	312.000000
		ORAC_A	ORAC_A	13.970000	0.243721	13.640000	14.320000
		ORAC_L	ORAC_L	6.746000	0.159781	6.630000	7.020000
		SOD	SOD	1374.000000	409.120400	855.000000	1908.000000
		TAS	TAS	0.671400	0.080108	0.573000	0.756000
	N	ALT	ALT	202.200000	50.529200	130.000000	266.000000
		AMESN		507.800000	118.948310	386.000000	643.000000
		AST	AST	329.000000	48.646685	262.000000	373.000000
		CAT	CAT	34.720000	7.664985	25.900000	46.300000
		Cu	Cu	31.580000	2.809270	29.000000	35.600000
		FADU	FADU	0.190800	0.065945	0.087000	0.270000
		FE	FE	128.660000	17.229132	106.300000	153.500000
		GPX	GPX	145.440000	14.568047	122.200000	158.000000
		IP_8	IP_8	2244.000000	682.590650	1050.000000	2700.000000
		MDA	MDA				
		O2	O2	0.214000	0.128763	0.080000	0.400000
		OHdG_8	OHdG_8	455.000000	150.824400	369.000000	724.000000
		ORAC_A	ORAC_A	13.984000	0.376603	13.490000	14.320000
		ORAC_L	ORAC_L	6.672000	0.128919	6.450000	6.760000
		SOD	SOD	1107.200000	160.769090	996.000000	1391.000000
		TAS	TAS	0.728800	0.052732	0.653000	0.802000
	V	ALT	ALT	134.600000	48.582919	105.000000	221.000000
		AMESN		502.200000	97.276410	417.000000	665.000000
		AST	AST	234.600000	48.283538	184.000000	294.000000
		CAT	CAT	37.420000	8.081893	27.800000	46.800000
		Cu	Cu	30.800000	2.653300	26.500000	33.400000
		FADU	FADU	0.178000	0.057184	0.100000	0.250000
		FE	FE	109.000000	17.258766	97.000000	138.800000
		GPX	GPX	202.820000	19.534892	187.800000	235.200000
		IP_8	IP_8	2550.000000	374.165740	2100.000000	3000.000000
		MDA	MDA				
		O2	O2	0.440000	0.354613	0.050000	0.930000
		OHdG_8	OHdG_8	346.400000	117.402300	229.000000	530.000000
		ORAC_A	ORAC_A	13.496000	0.678292	12.750000	14.390000
		ORAC_L	ORAC_L	6.664000	0.160873	6.450000	6.830000
		SOD	SOD	1110.800000	227.415260	818.000000	1402.000000
		TAS	TAS	0.755400	0.073262	0.682000	0.871000

Table 45x Cont.....

24 months	A	ALT	ALT				
		AMESN		478.200000	77.370537	374.000000	582.000000
		AST	AST				
		CAT	CAT	33.050000	5.385474	26.200000	39.300000
		Cu	Cu	43.600000	7.294290	38.500000	54.200000
		FADU	FADU	0.226250	0.069086	0.155000	0.295000
		FE	FE	134.450000	4.448595	127.800000	137.100000
		GPX	GPX	143.625000	37.420171	95.800000	179.400000
		IP_8	IP_8	2801.250000	294.798660	2415.000000	3060.000000
		MDA	MDA	42.475000	23.465773	20.700000	64.000000
		O2	O2				
		OHdG_8	OHdG_8	385.400000	97.428435	321.000000	558.000000
		ORAC_A	ORAC_A	13.152500	0.246897	12.820000	13.410000
		ORAC_L	ORAC_L	4.717500	0.196532	4.490000	4.970000
		SOD	SOD	634.000000	205.518860	383.000000	818.000000
		TAS	TAS	0.551000	0.166026	0.434000	0.795000
	C	ALT	ALT				
		AMESN		305.200000	19.057807	279.000000	331.000000
		AST	AST				
		CAT	CAT	46.875000	3.533058	42.100000	49.600000
		Cu	Cu	24.425000	2.526361	22.500000	28.100000
		FADU	FADU	0.095000	0.062250	0.020000	0.160000
		FE	FE	45.720000	10.272634	35.000000	56.100000
		GPX	GPX	174.825000	16.220435	154.100000	193.700000
		IP_8	IP_8	1252.500000	381.346300	930.000000	1800.000000
		MDA	MDA	6.150000	1.526434	4.800000	8.200000
		O2	O2				
		OHdG_8	OHdG_8	157.200000	20.885402	139.000000	187.000000
		ORAC_A	ORAC_A	11.295000	0.437607	10.680000	11.650000
		ORAC_L	ORAC_L	4.645000	0.349905	4.290000	5.120000
		SOD	SOD	1072.250000	70.830196	1017.000000	1175.000000
		TAS	TAS	0.768000	0.076981	0.688000	0.855000
	Cu	ALT	ALT				
		AMESN		448.400000	61.893457	369.000000	535.000000
		AST	AST				
		CAT	CAT	23.600000	7.423836	13.900000	31.500000
		Cu	Cu	31.075000	1.894510	28.900000	32.900000
		FADU	FADU	0.267500	0.061847	0.230000	0.360000
		FE	FE	106.625000	31.293916	79.800000	146.800000
		GPX	GPX	150.900000	11.933426	137.300000	164.800000
		IP_8	IP_8	6375.000000	3899.040000	3000.000000	11400.000000
		MDA	MDA	39.525000	1.359841	38.300000	40.800000
		O2	O2				
		OHdG_8	OHdG_8	519.000000	13.656500	501.000000	537.000000
		ORAC_A	ORAC_A	12.187500	0.861834	10.910000	12.760000
		ORAC_L	ORAC_L	4.482500	0.114419	4.340000	4.620000
		SOD	SOD	669.000000	230.526930	444.000000	922.000000
		TAS	TAS	0.527750	0.127280	0.374000	0.648000

Table 45x Cont.....

24 months	F	ALT	ALT				
		AMESN		531.600000	64.477128	462.000000	610.000000
		AST	AST				
		CAT	CAT	40.950000	3.192178	38.200000	44.100000
		Cu	Cu	33.575000	8.578413	24.200000	41.200000
		FADU	FADU	0.210000	0.033354	0.175000	0.265000
		FE	FE	117.375000	19.876850	90.300000	137.100000
		GPX	GPX	164.700000	10.030288	153.800000	177.100000
		IP_8	IP_8	3187.500000	1879.000000	2100.000000	6000.000000
		MDA	MDA	55.475000	39.797603	15.000000	93.100000
		O2	O2				
		OHdG_8	OHdG_8	370.200000	32.010936	292.000000	364.000000
		ORAC_A	ORAC_A	11.480000	0.065828	11.400000	11.560000
		ORAC_L	ORAC_L	5.030000	0.115181	4.880000	5.130000
		SOD	SOD	819.500000	105.244160	709.000000	942.000000
		TAS	TAS	0.471000	0.031177	0.428000	0.494000
	N	ALT	ALT				
		AMESN		516.600000	71.293759	433.000000	609.000000
		AST	AST				
		CAT	CAT	34.925000	9.489073	23.700000	45.300000
		Cu	Cu	33.050000	3.241913	30.600000	37.800000
		FADU	FADU	0.177750	0.027330	0.145000	0.210000
		FE	FE	132.360000	28.108860	106.300000	179.300000
		GPX	GPX	176.925000	24.860192	148.100000	201.400000
		IP_8	IP_8	3000.000000	406.201920	2400.000000	3300.000000
		MDA	MDA	28.375000	21.730068	11.700000	59.900000
		O2	O2				
		OHdG_8	OHdG_8	349.400000	10.968136	335.000000	364.000000
		ORAC_A	ORAC_A	11.777500	0.009574	11.770000	11.790000
		ORAC_L	ORAC_L	4.722500	0.196532	4.490000	4.970000
		SOD	SOD	726.500000	53.319790	651.000000	776.000000
		TAS	TAS	0.412500	0.069773	0.341000	0.508000
	V	ALT	ALT				
		AMESN		527.800000	75.658443	440.000000	615.000000
		AST	AST				
		CAT	CAT	44.075000	2.739069	40.600000	47.200000
		Cu	Cu	36.825000	5.533158	31.700000	44.600000
		FADU	FADU	0.197750	0.071742	0.110000	0.285000
		FE	FE	123.900000	12.016655	106.700000	134.100000
		GPX	GPX	176.000000	33.177101	147.200000	221.400000
		IP_8	IP_8	2107.500000	961.366220	1080.000000	3000.000000
		MDA	MDA	25.275000	7.965499	18.200000	36.000000
		O2	O2				
		OHdG_8	OHdG_8	355.000000	2.915476	351.000000	359.000000
		ORAC_A	ORAC_A	12.272500	1.188988	10.840000	13.750000
		ORAC_L	ORAC_L	4.877500	0.078049	4.780000	4.970000
		SOD	SOD	690.250000	44.850678	645.000000	735.000000
		TAS	TAS	0.579500	0.081913	0.488000	0.681000

Table 45x Cont.....

ANALYSIS VARIABLE : LPO LPO						
MONTHS	TREATMENT	N OBS	MEAN	STD DEV	MINIMUM	MAXIMUM
2	A	5	16.1500000	2.3302360	13.3000000	18.8000000
	C	5	15.2800000	1.3442470	13.3000000	17.0000000
	Cu	5	21.0800000	3.8919147	16.0000000	24.5000000
	F	5	18.6200000	3.4127701	14.5000000	22.3000000
	N	5	20.3800000	9.6998454	11.8000000	35.0000000
	V	5	15.8000000	8.4852814	9.8000000	21.8000000
4	A	5	48.5600000	7.0244573	40.3000000	57.8000000
	C	5	29.3000000	4.9532817	22.6000000	36.3000000
	Cu	5	44.2800000	4.1191018	38.2000000	49.4000000
	F	5	34.2800000	5.6473002	25.6000000	39.8000000
	N	5	30.3200000	3.9751730	25.5000000	35.1000000
	V	5	57.2400000	7.3326666	48.8000000	68.4000000
8	A	5	18.0400000	8.1395946	4.2000000	24.2000000
	C	5	19.3200000	2.7994642	16.3000000	22.4000000
	Cu	5	18.1400000	2.5343638	16.3000000	22.3000000
	F	5	22.6800000	3.1316130	19.6000000	27.3000000
	N	5	16.5800000	6.9481652	10.9000000	25.8000000
	V	5	22.0000000	5.0418251	17.4000000	29.9000000
12	A	5	36.9000000	2.5990383	32.8000000	39.9000000
	C	5	25.0000000	1.8466185	22.6000000	27.5000000
	Cu	5	32.7600000	2.6034592	30.5000000	36.2000000
	F	5	28.1600000	2.1593981	26.1000000	31.7000000
	N	5	19.6000000	3.4777867	15.5000000	25.0000000
	V	5	32.7000000	2.8809721	29.2000000	35.4000000
16	A	5	112.3600000	20.5833185	84.5000000	139.8000000
	C	5	54.6200000	8.3652256	46.0000000	68.5000000
	Cu	5	146.6200000	23.3747086	116.3000000	181.3000000
	F	5	104.6200000	43.9303654	35.5000000	151.5000000

ANALYSIS VARIABLE : LPO LPO						
MONTHS	TREATMENT	N OBS	MEAN	STD DEV	MINIMUM	MAXIMUM
	N	5	98.6200000	20.4542661	80.3000000	123.5000000
16	V	5	103.4800000	16.0036558	90.5000000	130.3000000
20	A	5	113.8800000	36.0806319	76.7000000	159.7000000
	C	5	38.2200000	7.6558474	30.2000000	48.5000000
	Cu	5	133.3200000	33.1897123	103.2000000	180.6000000
	F	5	102.1600000	34.2759828	64.8000000	143.2000000
	N	5	78.2000000	17.9475625	63.4000000	108.8000000
	V	5	95.2400000	40.7010196	68.8000000	166.0000000
24	A	5	92.1800000	25.1335831	57.5000000	118.4000000
	C	5	44.8500000	8.4263476	34.6000000	52.0000000
	Cu	5	118.2600000	13.3175824	104.6000000	132.9000000
	F	5	95.6000000	5.2274914	89.8000000	102.5000000
	N	5	73.9250000	11.7961505	60.8000000	86.7000000
	V	5	78.6250000	13.0361996	70.5000000	97.9000000

RAT LIVER STUDY 2001-2003					Table 46X							*lxviii*
Grading after Scheuer PJ and Lefkowitch JH. Liver biopsy interpretation, 6th Ed (2000). W.B Saunders. London. P274												
Note "iff, IFF, ?IFF" (iron free focus) in COMMENT: do not worry about other comments, they are for me to follow up												
	GRADE	**Hepato**	**(kupffer)**	**(portal)**	**(Bile duct**	**STAGE**	**COMMENT**			**(Up to 4 mo)**		
A1	1	1	0.5	0.5	0	0						
A2	1	1	0.5	0.5	0	0						
A3	1	1	0.5	0.5	0	0						
A4	1	1	0.5	0.5	0	0						
A5	1	1	0.5	0.5	0	0						
A6	1	1	0.5	0.5	0	0						
A7	1	1	0.5	0.5	0	0						
A8	0.5	0.5	0.5	0.5	0	0						
AO1	1	1	0.5	0.5	0	0						
AO2	1	1	0.5	0.5	0	0						
AO3	1	1	1	0.5	0	0						
AO4	1	1	1	0.5	0	0						
ASP1.1	1	1	1	1	0	0						
ASP1.2	1	1	1	0.5	0	0						
ASP1.3	1	1	1	1	0	0						
ASP1.4	1	1	1	1	0	0						
ASP1.5	1	1	2	2	0	0	?Sideronecrosis					
C1.1	-	-	-	-	-	-	Kidney (normal)					
C1.2	0	0	0.5	0	0	0						
C1.3	0	0	0	0	0	0						
C1.4	0	0	0	0	0	0						
C1.5	0	0	0	0	0	0						
CO1	1	1	0.5	0.5	0	0						
CO2	1	1	1	0.5	0	0						
CO3	1	1	0.5	0.5	0	0						
CO4	1	1	0.5	0	0	0						
CO5	1	1	1	1	0	0						
CO6	1	1	1	1	0	0						
CO7	1	1	1	0.5	0	0						
CO8	0.5	0.5	0.5	0.5	0	0						
CO9	1	1	0.5	1	0	0						
CO10	0.5	0.5	0.5	1	0	0						
CO11	1	1	1	1	0	0						
CO12	1	1	1	1	0	0						
CO13	1	1	1	1	0	0						
CU1.1	1	1	1	1	0	0						
CU1.2	1	1	1	1	0	0						
CU1.3	1	1	1	0.5	0	0						
CU1.4	1	1	1	2	0	0						
CU1.5	1	1	1	2	0	0						
CU1	3	3	2	1	0	0						
CU2	1	1	2	1	0	0						
CU3	1	1	0.5	0.5	0	0						
CU4	1	1	0.5	0.5	0	0						
CU5	1	1	0.5	0.5	0	0						
CU6	1	1	2	1	0	0						
CU7	1	1	0.5	0.5	0	0						
CU8	1	1	0.5	0.5	0	0						
FE1.1	1	1	1	1	0	0						
FE1.2	1	1	1	1	0	0	??Sideronecrosis					
FE1.3	1	1	1	0.5	0	0						
FE1.4	1	1	1	0.5	0	0	??Sideronecrosis					
FE1.5	1	1	1	0.5	0	0	??Sideronecrosis					
FO1	1	1	1	1	0	0						
FO2	1	1	0.5	0.5	0	0						
FO3	1	1	0.5	0.5	0							
FO4	1	1	1	1	0	0	??Sideronecrosis					
FO5	1	1	1	0.5	0	0	??Sideronecrosis					
FO6	1	1	0.5	0.5	0	0						
MO1	1	1	0.5	0.5	0	0						
MO2	1	1	0.5	0.5	0	0						
MV1	0.5	0.5	0.5	0	0	0						
MV2	0.5	0.5	0.5	0	0	0						
MV3	0.5	0.5	1	0.5	0	0						
MV4	0.5	0.5	1	0.5	0	0						
MV5	0.5	0.5	1	0.5	0	0						
MV6	0.5	0.5	1	0.5	0	0						
MV7	0.5	0.5	1	0.5	0	0						
MV8	0.5	0.5	2	0.5	0	0						
MV9	1	1	1	0	0	0						
MV10	1	1	1	0.5	0	0						
NM1	1	1	0.5	0.5	0	0						

Table 46X Cont....

	GRADE	Hepato	(kupffer)	(portal)	(Bile duct	STAGE	COMMENT	(Up to 4 mg)
NM2	1	1	0.5	0.5	0	0		
NM3	2	2	2	1	0	0	??Siderenecrosis	
NM4	0.5	0.5	0.5	0	0	0	Iron around larger CVs	
NM5	2	2	1	1	0	0		
NM6	1	1	1	1	0	0		
NM7	2	1	1	0.5	0	0		
NM8	2	2	1	0.5	0	0		
NM9	1	1	1	0.5	0	0		
NO1	0.5	0.5	1	0.5	0	0		
NO2	0.5	0.5	1	0.5	0	0		
NO3	1	1	1	3	0	0	??Siderenecrosis	
NO4	1	1	1	2	0	0		
NO5	1	1	0.5	0.5	0	0		
NO6	1	1	1	0.5	0	0		
NO7	1	1	1	2	0	0		
NO8	1	1	1	1	0	0		
NO9	1	1	2	2	0	0	Siderenec and Kuffer aggregates	
NV1.1	1	1	2	2	0	0	Siderenec and Kuffer aggregates	
NV1.2	1	1	2	2	0	0	Siderenec and Kuffer aggregates	
NV1.3	1	1	2	2	0	0	Siderenec and Kuffer aggregates	
NV1.4	1	1	2	2	0	0	Siderenec and Kuffer aggregates	
NV1.5	1	1	2	2	0	0	Siderenec and Kuffer aggregates	
V1.1	1	1	2	1	0	0	Kupffer cell aggregates	
V1.2	1	1	2	1	0	0	Kupffer cell aggregates	
V1.3	1	1	1	1	0	0		
V1.4	1	1	1	1	0	0		
V1.5	1	1	1	2	0	0	Kupffer cell aggregates	

Table 46X Cont....													lxx
	GRADE	Hepato	(kupffer)	(portal)	(Bile duct	STAGE	COMMENT			(At 8 mo)			
A2.1	1	1	1	2	0	0							
A2.2	1	1	1	1	0	0							
A2.3	1	1	1	1	0	0							
A2.4	1	1	1	1	0	0							
A2.5	1	1	1	1	0	0							
C2.1	0	0	0	0	0	0							
C2.2	0	0	Tr	0	0	0							
C2.3	0	0	Tr	0	0	0							
C2.4	0	0	0	0	0	0							
C2.5	0	0	Tr	0	0	0							
CU2.1	1	2	1	2	0	0							
CU2.2	2	2	2	2	0	0							
CU2.3	2	2	2	2	0	0							
CU2.4	1	2	1	2	0	0							
CU2.5	1	1	1	2	0	0							
F2.1	2	2	2	2	0	0	Perivenular Kupffer aggregates						
F2.2	1	2	1	1	0	0	Perivenular Kupffer aggregates						
F2.3	1	1	1	1	0	0	Perivenular Kupffer aggregates						
F2.4	1	2	1	1	0	0	Perivenular Kupffer aggregates						
F2.5	2	2	2	1	0	0	Perivenular Kupffer aggregates						
N2.1	1	1	1	1	0	0							
N2.2	2	2	2	1	0	0							
N2.3	2	2	2	1	0	0							
N2.4	2	2	2	2	0	0							
N2.5	2	2	2	2	0	0							
V2.1	1	2	1	2	0	0							
V2.2	1	2	1	2	0	0							
V2.3	1	2	1	2	0	0							
V2.4	2	2	2	2	0	0							
V2.5	1	1	1	1	0	0							
	GRADE	Hepato	(kupffer)	(portal)	(Bile duct	STAGE	COMMENT			(At 12 mo)			
A3.1	2	2	1	1	0	0							
A3.2	2	2	1	2	0	0							
A3.3	2	2	2	2	0	0							
A3.4	2	2	1	2	0	0							
A3.5	2	2	1	1	0	0							
C3.1	0	0	Tr	0	0	0							
C3.2	1	1	1	0	0	0							
C3.3	0	Tr	Tr	0	0	0							
C3.4	0	Tr	Tr	0	0	0							
C3.5	0	0	0	0	0	0							
CU3.1	2	2	1	1	0	0							
CU3.2	2	2	1	2	0	0							
CU3.3	2	2	1	3	0	0							
CU3.4	2	2	1	2	0	0							
3	2	2	2	2	0	0							
F3.1	2	2	2	2	0	0							
F3.2	2	2	3	2	0	0							
F3.3	2	2	3	2	0	0							
F3.4	2	2	1	2	0	0							
F3.5	2	2	1	2	0	0	? Solitary early IFF						
N3.1	2	2	2	1	0	0							
N3.2	2	2	2	1	0	0							
N3.3	1	2	2	2	0	0							
N3.4	2	2	2	2	0	0							
N3.5	2	2	2	2	0	0							
V3.1	2	2	2	1	0	0							
V3.2	2	2	1	2	0	0							
V3.3	2	2	2	1	0	0							
V3.4	2	2	2	1	0	0							
V3.5	2	2	2	1	0	0							
V3.6	3	3	3	3	0	0							

Table 46X Cont....													*lxxi*
	GRADE	Hepato	(kupffer)	(portal)	(Bile duct	STAGE	COMMENT			(At 16 mo)			
A4.1	4	4	2	3	0	0							
A4.2	4	4	2	3	0	0							
A4.3	4	4	2	3	0	0							
A4.4	4	4	2	2	0	0							
A4.5	4	4	2	2	0	0							
A4.1.1	3	3	2	2	0	0							
A4.2.1	4	4	3	3	0	0	More pronounced hep iron						
A4.6.1	4	4	2	2	0	0							
C4.1	0	0	Tr	0	0	0							
C4.2	0	0	Tr	Tr	0	0							
C4.3	0	0	Tr	Tr	0	0	Serum blue						
C4.4	0	0	Tr	0	0	0							
C4.5	0	Tr	1	0	0	0							
CU4.1	4	4	2	3	0	0							
CU4.2	4	4	2	2	0	0							
CU4.3	4	4	2	2	0	0	Inflam foci and BD prolif						
CU4.4	4	4	3	3	0	0							
CU4.5	4	4	2	3	0	0							
CU4.1.1	4	4	3	3	0	0							
CU4.3.1	4	4	3	3	0	0							
CU4.4.1	4	4	3	3	0	0							
F4.1	4	4	2	2	0	0							
F4.2	4	4	2	2	0	0							
F4.3	4	4	2	2	0	0							
F4.4	4	4	2	3	0	0							
F4.5	4	4	2	2	0	0	??IFF						
F4.1.1	4	4	3	3	0	0	Neoplasm ? Lymphoma						
N4.1	4	4	2	3	0	0							
N4.2	4	4	2	3	0	0							
N4.3	4	4	2	2	0	0							
N4.4	4	4	2	2	0	0							
N4.5	4	4	2	2	0	0							
V4.1	4	4	2	2	0	0	? Fatty focus ? Significance						
V4.2	4	4	2	2	0	0							
V4.3	4	4	2	2	0	0							
V4.4	4	4	3	3	0	0							
V4.5	4	4	2	2	0	0							
V4.1.1	4	4	2	3	0	0							

Table 46X Cont.....													*lxxii*
	GRADE	Hepato	(kupffer)	(portal)	/Bile duct	STAGE	COMMENT			(At 20 mo)			
A5.1	4	4	3	2	0	0							
A5.2	4	4	3	3									
A5.3	4	4	3	2	0	0							
A5.4	4	4	3	3	0	0							
A5.5	3	4	2	2	0	0							
C5.1	Tr	1	Tr	0	0	0							
C5.2	1	1	1	0	0	0							
C5.3	Tr	1	Tr	0	0	0							
CU5.1	4	4	3	4	0	0							
CU5.2	4	4	3	4	0	0							
CU5.3	4	4	3	4	0	0							
CU5.4	4	4	3	4	0	0							
F5.1	4	4	3	2	0	0							
F5.2	4	4	3	2	0	0							
F5.3	4	4	3	3	0	0	Early IFF with MB						
F5.4	4	4	3	3	0	0	IFF						
F5.5	4	4	4	3	0	0							
F5.6	4	4	3	4	0	0							
N5.1	4	3	2	0	0		IFF						
N5.2	4	4	3	2	0	0							
N5.3	4	4	3	3	0	0							
N5.4	4	4	3	2	0	0	IFF with glob						
N5.5	4	4	3	3	0	0							
N5.6	4	3	4	0	0								
N5.7	4	4	3	4	0	0	Fatty focus						
V5.1	4	4	3	3	0	0	IFF						
V5.1	4	4	3	3	0	0							
V5.3	4	4	3	3	0	0							
V5.4	4	4	3	4	0	0	?Stain artefact repeat						
V5.5	4	4	3	4	0	0							
V5.6	4	4	4	4	0	0							
V5.7	4	4	3	3	0	0	? Early IFF						
V5.8	4	4	3	3	0	0							
Y1.1	4	4	3	3	0	0							
	GRADE	Hepato	(kupffer)	(portal)	/Bile duct	STAGE	COMMENT			(At 24 mo)			
A6.1	4	4	4	4	0	0							
A6.2	4	4	4	4	0	0							
A6.3	4	4	4	4	0	0							
C6.1	0	Trace	Tr	0	0	0	BD prolif						
C6.2	0	1	Tr	Tr	0	0	BD prolif						
C6.3	0	Trace	1	0	0	0	BD prolif						
C6.4	0	Trace	Tr	0	0	0	??Sepsis ??? Leukaemic						
C6.4	0	Trace	Tr	0	0	0							
C6.6	1	1	1	0	0	0	Focal fat						
CU6.1	4	4	3	4	0	0							
CU6.2	4	4	3	4	0	0	BD prolif						
CU6.3	4	4	3	4	0	0	???IFF						
CU6.4	4	4	4	4	0	0							
CU6.5	4	3	4	4	0	0							
CU6.6	4	3	4	4	0	0							
CU6.7	4	3	4	4	0	0	BD prolif						
CU6.8	4	3	4	4	0	0							
F6.1	4	4	4	4	0	0	???IFF	Globules	?Photo				
F6.2	4	3	4	4	0	0	Fat, ???IFF						
F6.3	4	3	4	4	0	0	IFF, fat						
F6.4	4	3	4	4	0	0	IFFs						
N6.1	4	3	4	4	0	0							
N6.2	4	4	4	4	0	0	BD prolif						
N6.3	3	3	3	4	0	0							
N6.4	3	3	3	4	0	0							
N6.5	3	3	3	4	0	0							
N6.6	4	4	3	4	0	0							
N6.7	4	4	3	3	0	0	IFF						
N6.8	4	3	4	4	0	0	?IFF						
N6.9	4	4	3	3	0	0							
N6.10	4	4	3	4	0	0							
N6.11	4	4	3	4	0	0	??IFF early						
N6.12	4	4	4	4	0	0	??IFF early						
V6.1	4	3	4	3	0	0							
V6.2	4	4	3	4	0	0	IFF with globules						
V6.3	4	4	4	0	0		?? Early IFF						
V6.4	4	4	4	4	0	0							
V6.5	4	4	4	4	0	0	Vasc nodules						
V6.6	3	3	3	4	0	0							
V6.7	4	4	3	4	0	0							

Table 46X Cont.....													*lxxiii*
	GRADE	Hepato	(kupffer)	(portal)	(Bile duct	**STAGE**	**COMMENT**			(At 28 mo)		
3A7.1	4	4	4	4	0	0						
3A7.2	4	4	3	3	0	0						
3A7.3	4	4	3	4	0	0						
3A7.4	3	3	3	4	0	0						
3A7.5	4	3	4	4	0	0	iff					
3A7.6	4	4	3	4	0	0	IFF					
3A7.7	4	4	4	4	0	0	? Vasc nodules					
3A7.8	4	4	3	4	0	0	? Vasc nodules					
3A7.9	4	4	4	4	0	0	Sinusoidal infiltrate					
3A7.10	4	4	4	4	0	0	Focal fat + ? Nodule					
3A7.11	4	4	4	5	0	0	Focal fat + ? Nodule					
3A7.12	4	4	4	4	0	0	iff					
3A7.13	0.5	0.5	0.5	0	0	0	von Meyenburg complexes					
3C7.1	0.5	0.5	0.5	1	0	0						
3C7.2	0	0	0	0	0	0						
3C7.3	0.5	0.5	1	0	0	0						
3C7.4	0.5	0.5	0.5	0	0	0						
3C7.5	1	1	1	0.5	0	0						
3C7.6	0	0	0.5	0	0	0						
3C7.7	0	0	0	0	0	0						
3C7.8	0	0	0.5	0	0	0	1+ steatosis, von Meyenburg, angioma					
3C7.9	1	1	1	0.5	0	0						
3CU7.1	4	4	4	4	0	0			Rel nc K vs H			
3CU7.2	4	4	4	4	0	0	Gr 1 Fat + ??iff		Ditto			
3CU7.3	4	4	4	5	0	0			Ditto			
3CU7.4	4	4	4	4	0	0			Ditto			
3CU7.5	4	4	4	4	0	0	iff + fat		Ditto			
3CU7.6	4	4	4	4	0	0	??iff		Ditto			
3F7.1	4	4	4	4	0	0	iff + fat					
3F7.2	4	4	4	4	0	0	?					
3F7.3	4	4	4	4	0	0	Definite IFF + globules					
3F7.4	4	4	4	4	0	0	? iff + fat					
3F7.5	4	4	4	4	0	0	IFF + 'dysplasia' + globules					
3F7.6	4	4	4	4	0	0						
3F7.7	4	4	4	4	0	0	??iff					
3F7.8	4	4	4	4	0	0	Hamartoma					
3F7.9	4	4	4	4	0	0						
3F7.10	4	4	4	4	0	0	Micro steatosis, G-G bodies, ? *Adenoma*					
3F7.11	4	4	4	4	0	0	IFF + fat					
3F7.12	4	4	4	4	0	0						
3N7.1	4	4	4	4	0	0						
3N7.2	4	4	4	4	0	0	IFF (+ ? Abscess)					
3N7.3	4	4	4	4	0	0						
3N7.4	4	4	4	4	0	0						
3N7.5	4	4	4	4	0	0						
3N7.6	4	4	4	4	0	0	('<< less than 7.5)					
3N7.7	4	4	4	4	0	0	von Meyenberg					
3N7.8	4	4	4	4	0	0	IFF + "von Meyenburg"					
3N7.9	4	4	4	4	0	0	STEM CELLS??					
3N7.10	4	4	4	4	0	0	STEM CELLS??					
3N7.11	4	4	4	4	0	0	Large IFF + stem cells					
3V7.1	4	4	4	4	0	0	IFF with Mallory bodies, fat, stem cells					
3V7.2	4	4	4	4	0	0	? Focus of stem cells					
3V7.3	4	4	4	4	0	0	Mitot + ??iff					
3V7.4	4	4	4	4	0	0	IFF + micro steatosis					
3V7.5	4	4	4	4	0	0	Large IFF + EC globules + ? Dysplasia					
3V7.6	4	4	4	4	0	0	Like 3V7.4					
3V7.7	4	4	4	4	0	0	Multiple IFF					
3V7.8	4	4	4	4	0	0						
3V7.9	4	4	4	4	0	0						
3V7.10	4	4	4	4	0	0						
3V7.11	4	3	4	4	0	0						
3V7.12	4	3	4	4	0	0						
Y2	4	4	4	4	0	0						

Table 46X Cont.....												lxxiv
	GRADE	Hepato	(kupffer)	(portal)	Bile duct	STAGE	COMMENT			(At 32 mo)		
A8.1	4	4	3	4	0	0	IFFs					
A8.2	4	4	3	4	0	0	IFFs					
A8.3	4	4	4	4	0	0						
A8.4	4	4	3	4	0	0	IFF					
A8.5	4	4	4	4	Tr	2						
A8.6	4	4	4	4	0	0						
A8.7												
A8.8												
A8.9	4	4	4	4	0	0	IFFs					
A8.10	4	4	4	4	0	0	IFFs					
C8.1	0	Tr	Tr	0	0	0						
C8.2	2	2	1	0	0	0						
C8.3	0	0	0	0	0	0						
C8.4	2	2	2	0	0	1						
C8.5	0	0	Tr	0	0	0	Von Meyenberg					
C8.6	0	1	Tr	0	0	0						
C8.7	2	2	2	0	0	0						
C8.8	2	1	2	0	0	0	??IFF fat BD prolif angioma					
C8.9	2	2	2	0	0	0	Fat BD++ amyloid					
F8.1	4	3	4	3	Tr	0						
F8.2	4	4	4	2	0	0						
F8.3	4	3	4	3	0	0	?emh					
F8.4	4	3	4	4	0	0						
F8.5	4	3	4	4	0	0	?IFF					
F8.6	4	3	4	4	0	1	?IFF BDP Vessels					
F8.7	4	4	4	4	0	0	BDP Vasc focus					
F8.8	4	4	4	4	0	0	IFF					
F8.8/T	4	4	4	4	0		Acinar HCC with iron + IFF					
N8.1	4	4	4	4	0	0						
V8.1	4	4	4	4	0	0	IFF Von M Amyl + Infl					
V8.2	4	4	4	4	0	0	IFF BDP					
V8.3												
V8.4	4	4	4	4	0	0	IFF vasc Globs					
V8.5	4	4	4	4	0	0	Large IFFs ? HCC					
V8.6	3	3	3	4	0	0	Early IFFs					

Table 1y

RAW DATA OF WISTAR RATS @ 2mo

	Fe µmol/l	ALT IU/L	AST IU/L	0_2 mV	GPx IU/L	SOD IU/L	TAS IU/L	CAT U/L	LPO µM	8OHdG ng/g	FADU δf /sec	Vit.C µM	MDA	AMES Colonies	ORAC mM	8-IP ng/g	Cu µM
C1	40.9	55.0	77.0		157.3	1847	0.36	42.4	17.0	95	0.023	1.3	0.65				15.45
C2	66.0	37.0	89.0		166.8	2229	0.32	49.8	15.3	97	0.027	1.5	0.75				15.85
C3	52.3	40.6	83.3		152.4	2111	0.42	50.0	15.8	95	0.024	1.1	0.55				19.57
C4	48.7	51.4	80.7		165.9	1714	0.40	67.0	13.3	102	0.023	1.0	0.73				19.76
C5	50.0	45.9	86.0		127.1	1714	0.39	52.5	15.0	90	0.024	0.8	0.82				17.00
F1	61.7	61.7	57.0		127.9	1248	0.33	35.9	21.8	100	0.033	0.9	0.68				20.54
F2	70.3	70.3	83.0		167.0	1030	0.20	43.3	22.3	134	0.040	1.3	0.76				13.89
F3	59.2	59.2	75.0		138.9	1878	0.35	33.2	14.5	155	0.043	1.3	1.10				19.37
F4	80.2	80.2	103		137.2	968	0.44	41.3	16.2	112	0.023	0.5	0.73				19.57
F5	68.2	68.2	60.0		59.7	1139	0.34	43.0	18.3	130	0.040	0.8					9.19
V1	39.9	39.9	59.0		12.8	1035	0.34	52.9	21.8	100	0.017	1.5	1.03				21.52
V2	59.9	59.5	59.0		132.6	1962	0.41	43.4	9.8	108	0.033	0.5	0.52				21.33
V3																	
V4																	
V5																	
N1	62.1	62.1	91.5		144.3	551	0.29	32.1	14.3	109	0.050	0.5	1.14				4.89
N2	70.4	70.4	129.5		88.2	1035	0.21	36.7	35.0	136	0.050	0.3	0.61				2.15
N3	63.1	63.1	95.0		133.1	1258	0.40	35.6	11.8	159	0.047	0.3	0.81				9.78
N4	57.3	57.3	82.0		150.2	391	0.30	45.7	25.5	151	0.070	0.5	1.37				0.78
N5	59.4	59.4	116.0		107.9	461	0.34	39.2	15.3	142	0.047	1.0	1.06				7.63
A1	59.3	59.3	74.0		116.1	1615	0.45	28.9	13.3	94	0.047	0.75	0.97				12.72
A2	58.0	58.0	65.0		111.3	810	0.37	46.0	15.5	101	0.050	1.5	1.10				27.20
A3	50.5	50.5	57.0		125.7	1273	0.26	42.1	18.8	92	0.033	0.5	0.83				11.74
A4	48.8	48.8	51.0		117.7	1302	0.33	39.0	17.0	103	0.040	1.0	1.11				19.37
A5																	
Cu1	61.5	61.5	248.0		84.3	2105	0.30	32.4	23.8	112	0.037	0.5	0.78				14.67
Cu2	70.1	70.1	99.0		160.3	1863	0.23	30.0	24.5	127	0.050	1.0	0.91				12.72
Cu3	52.6	52.6	70.0		103.3	1446	0.32	45.4	16.0	126	0.053	0.8	1.01				19.57
Cu4	57.0	57.0	88.0		115.0	1505	0.27	25.7	17.8	132	0.040	0.6	0.98				20.93
Cu5	66.0	66.0	82.0		140.2	655	0.25	29.7	23.3	170	0.033	0.6	1.04				13.70

gasare@23/02/2001

Table 2y

RAW DATA OF WISTAR RATS @ 4mo

	Fe µmol/l	ALT IU/L	AST IU/L	0_2 mV	GPx IU/L	SOD IU/L	TAS IU/L	CAT U/L	LPO µM	8OHdG ng/g	FADU δf /min	Vit.C µM	MDA υM	AMES Colonies	ORAC (L) mM	ORAC (A) mM	8-IP ng/g	Cu µM
C1	42.5	56	110	0.41	216.6	1596	0.41	34.8	30.6	173	0.017	1.3	2.0	(L) 322	3.56	12.40	115	20.5
C2	64.3	41	67	0.39	224.0	915	0.38	29.8	27.7	148	0.020	1.8	2.1	(S9) 322	3.58	13.04	125	16.6
C3	41.5	41	79	0.61	201.6	1244	0.39	32.4	29.3	109	0.030	1.8	2.1	(N) 330	3.49	13.10	85	17.8
C4	71.2	43	88	0.27	202.3	1121	0.56	40.6	36.3	140	0.017	1.8	2.8	(C) 325	3.41	11.81	75	22.3
C5	55.9	46	101	0.82	227.3	1367	0.52	40.3	22.6	146	0.013	1.3	3.2	(M) 282	3.51	11.89	100	20.7
F1	69.3	51	124	0.53	185.2	497	0.48	35.7	25.6	170	0.017	0.8	2.5	(L) 380	3.60	12.65	1530	22.5
F2	65.0	51	89	0.57	133.7	692	0.51	36.5	39.8	366	0.010	0.5	2.3	(S9) 359	3.54	12.65	1580	19.2
F3	75.5	30	56	0.43	169.9	666	0.48	33.4	32.6	96	0.010	1.3	2.3	(N) 337	3.55	13.19	1490	18.8
F4	70.9	38	72	0.56	182.8	390	0.40	28.8	38.6	190	0.043	1.3	2.2		3.52	11.83	1475	26.6
F5	65.2	40	82	0.30	187.6	373	0.31	32.0	34.8	77	0.020	1.3	4.2	(M) 301	3.61	13.39	1575	17.8
V1	86.8	40	90	0.47	153.3	768	0.44	33.1	53.4	99	0.010	2.0	5.0	(L) 306	3.58	11.74	1515	25.0
V2	64.5	69	151	0.35		776	0.47	31.5	68.4	95	0.017	2.8	3.2	(S9) 282	3.52	12.73	1540	24.9
V3		40	113	0.11	142.4	595	0.44	74.5	48.8	123	0.010	0.8	3.8	(N) 301	3.52	13.04	1480	28.4
V4	78.1	87	233	0.60	178.1	1857	0.70	53.4	56.4	64	0.010	3.0	3.9	(C) 372	3.59	12.68	1600	13.5
V5	38.1	18	42	0.15	190.8	938	0.41	32.9	59.2	104	0.010	1.0	3.3	(M) 263	3.56	13.39	1615	19.0
N1	67.9	49	87	0.59	178.3	234	0.48	33.5	27.1	220	0.027	1.0	3.5	(L) 344	3.49	13.28	1665	0.78
N2	73.3	41	77	0.47	211.1	638	0.45	30.3	31.1	138	0.027	1.0	4.2	(S9) 309	3.58	12.78	1655	19.8
N3	48.2	23	50	0.67	75.7	613	0.44	39.8	32.8	231	0.017	0.8	2.1	(N) 382	3.56	13.47	1580	17.0
N4	79.0	73	96	0.40	187.9	692	0.47	34.9	35.1	314	0.023	1.0	2.2	(C) 366	3.57	13.28	1580	18.0
N5	64.5	43	64	0.35	168.3	355	0.44	32.5	25.5	236	0.063	1.0	2.7	(M) 333	3.57	13.19	1570	9.0
A1	82.3	52	86	0.63	192.1	560	0.50	35.6	48 6	131	0.027	1.0	3.3	(L) 292	3.62	13.64	1825	17.2
A2	78.2	44	87	0.77	156.6	798	0.49	36.2	57.8	125	0.023	0.8	4.2	(S9) 259	3.67	13.80	1915	21.7
A3	69.2	45	71	0.59	210.8	1000	0.54	31.5	43.4	110	0.030	0.5	4.2	(N) 256	3.65	13.87	1760	17.2
A4	71.9	34	91	0.59	212.5	887	0.46	30.6	52.7	127	0.013	0.5	5.5	(C) 363	3.73	13.23	2375	17.4
A5		33	107	0.20	139.9	923	0.49	36.1	40.3	137	0.023	1.3	4.3	(M) 340	3.60	12.58	1475	42.0
Cu1	71.4	61	174	0.98	245.8	529	0.44	32.2	49.4	376	0.017	0.3	4.3	(L) 300	3.58	12.13	2485	20.9
Cu2	55.2	34	76	1.58		1156	0.36	42.0	46.3	482	0.027	0.3	4.4	(S9) 306	3.57	12.96	3453	20.9
Cu3	76.6	42	101	0.44	246.4	1014	0.45	19.7	43.9	285	0.020	0.5	5.4	(N) 342	3.63	13.35	2500	23 5
Cu4	34.3	16	52	0.49	176.3	1273	0.51	42.3	38.2	361	0.017	0.3	5.3	(C) 355	3.68	13.70	3700	29.5
Cu5	81.9	45	90	1.20	266.8	269	0.40	30.4	43.6	375	0.020	1.0	4.3	(M) 306	3.66	16.47	2845	26.0

gasare@30/02/2001

Table 3y

RAW DATA OF WISTAR RATS @ 8mo

	Fe µmol/l	ALT IU/L	AST IU/L	0_2 mV	GPx IU/L	SOD IU/L	TAS IU/L	CAT U/L	LPO µM	8OHdG ng/g	FADU δf /min	Vit.C µM	MDA υM	AMES Colonies	ORAC (L) mM	ORAC (A) mM	8-IP ng/g	Cu µM
C1	50.4	45	79		103.5	1431	0.49	64.4	16.4	218	0.023	3.5	0.58	(L) 343	3.65	16.22	140	23.1
C2	74.8	68	75		110.9	1515	0.59	58.7	21.0	100	0.027	3.3	2.4	(S9)332	3.58	16.63	30	18.0
C3	52.3	62	125		147.3	753	0.55	74.3	20.5	24	0.020	3.0	1.8	(N) 332	3.66	17.36	250	16.2
C4	67.0	47	70		202.1	1211	0.57	76.1	22.4	122	0.017	3.3	2.7	(C) 334	3.67	18.77	180	19.6
C5	39.7	75	132		210.2	1278	0.63	61.0	16.3	31	0.020	2.8	2.5	(M) 255	3.78	17.22	100	16.0
F1	60.0	52	96		32.5	939	0.55	65.0	24.4	69	0.030	2.8	2.3	(L) 267	3.76	17.23	2400	21.7
F2	71.8	54	80		126.3	654	0.57	62.0	21.3	11	0.020	3.0	2.3	(S9)332	3.68	16.82	2650	25.8
F3	89.7	44	71		128.3	443	0.68	63.6	27.3	282	0.017	3.0	2.0	(N) 344	3.58	17.48	1170	17.0
F4	48.9	42	64		107.3	190	0.67	56.3	19.6	73	0.023	3.3	2.2	(C) 360	3.69	16.78	2400	0.2
F5	67 1	40	64		67.1	482	0.58	58.2	20.8	48	027	2.8	1.9	(M) 281	3.74	17.77	1170	11.5
V1	70.2	59	100		148.1	1423	0.64	70.1	29.9	71	0.020	3.0	2.1	(L) 247	3.69	15.16	1600	23.1
V2	70.2	62	104		147.3	305	0.71	47.8	18.7	106	0.030	3.5	1.8	(S9)339	3.71	16.04	1710	0.2
V3	75.9	63	101		147.7	890	0.64	74.8	17.4	126	0.023	3.0	2.0	(N) 279	3.74	14.67	1680	20.5
V4	63.8	52	85		87.8	690	0.60	70.6	20.1	44	0.017	3.3	2.1	(C) 312	3.71	16.84	1500	14.7
V5	56.5	85	161		174.1	248	0.62	62.6	23.9	89	0.013	3.8	1.8	(M) 308	3.68	16.84	1710	0.6
N1	69.8	64	152		72.4	368	0.57	47.1	25.8	347	0.017	2.3	1.9	(L) 396	3.61	17.26	2040	0.4
N2	54.5	53	77		137.5	217	0.61	54.5	12.3	219	0.027	2.5	1.0	(S9)411	3.35	17.13	2040	1.2
N3	69.5	69	124		176.7	921	0.70	46.1	10.9	250	0.030	3.3	2.4	(N) 411	3.73	16.72	1750	13.3
N4	58.8	59	123		122.1	867	0.62	41.4	11.6	14	0.027	3.8	3.0	(C) 365	3.74	15.82	1350	17.0
N5	82.7	83	123		93.2	642	0.64	50.5	22.3	27	0.037	2.8	2.7	(M) 246	3.67	17.26	1650	13.1
A1	69.9	56	140		192.9	462	0.62	47.1	19 5	67	0.033	2.5	2.4	(L) 277	3.84	18.73	2700	20.2
A2	60.0	75	131		167.9	658	0.62	52.3	4.2	48	0.020	3.0	1.6	(S9)366	3.84	18.37	1500	19.2
A3	59.8	44	89		170.1	778	0.57	46.1	23.8	75	0.027	2.8	1.4	(N) 303	3.82	18.08	2080	1.6
A4	52.2	118	146		161.8	1060	0.71	46.9	24.2	84	0.007	3.0	1.9	(C) 366	3.77	18.73	2200	17.8
A5	84.7	66	144		152.9	624	0.68	54.9	18.5	89	0.030	2.8	2.6	(M) 266	3.82	18.09	2070	19.6
Cu1	57.9	52	97		175.4	1008	0.55	46.8	22.3	315	0.020	3.0	2.2	(L) 287	3.93	18.10	5690	23.1
Cu2	50.5	79	265		156.0	831	0.59	36.6	16.3	136	0.030	2.8	1.3	(S9)458	3.86	18.26	5690	22.3
Cu3	60.4	88	108		96.3	1040	0.58	40.3	16.4	208	0.027	2.5	2.1	(N) 309	3.86	18.75	7490	12.7
Cu4	59.3	49	93		139.5	818	0.61	37.3	16.9	25	0.020	2.5	0.6	(C) 341	3.88	17.92	6890	30.5
Cu5	60.3	44	100		156.8	997	0.62	44.3	18.8	104	0.020	2.3	1.6	(M) 329	3.87	18.27	3000	23.1

gasare@30/06/2001

Table 4y

RAW DATA OF WISTAR RATS @ 12mo

	Fe µmol/l	ALT IU/L	AST IU/L	0_2 mV	GPx IU/L	SOD IU/L	TAS IU/L	CAT U/L	LPO µM	8OHdG ng/g	FADU δf/min	Vit.C µM	MDA υM	AMES Colonies	ORAC (L) mM	ORAC (A) mM	8-IP ng/g	Cu µM
C1	50.1	57.	76.0	0.43	203.4	2839	0.828	51.2	24.1	168	0.046	6.4	5.0	(L) 299	4.06	18.70	270	32.5
C2	56.6	72.0	72.0	0.08	195.8	2019	0.805	63.7	25.9	141	0.066	2.4	4.0	(S9)345	3.95	16.49	450	33.1
C3	52.1	34.0	63.0	0.54	156.5	2151	0.663	55.3	24.9	214	0.039	6.1	6.4	(N) 335	4.02	20.27	189	26.1
C4	54.8	61.0	134.0	0.73	180.1	2209	0.731	59.6	27.5	80	0.052	1.3	3.1	(C) 354	4.04	19.98	300	27.3
C5	38.5	-	-	0.22	164.7	1605	0.675	47.8	22.6	247	0.045	4.7	2.6	(M) 300	4.03	21.41	305	33.1
F1	72.9	57.0	90.0	0.09	148.2	1054	0.731	48.9	28.2	219	0.055	2.4	5.0	(L) 257	4.11	23.21	1140	17.9
F2	98.0	44.	99.0	0.46	155.0	1508	0.675	40.2	28.0	154	0.086	6.4	5.4	(S9)336	4.06	22.42	1200	41.7
F3	104.0	55.0	78 0	2.00	165.1	1370	0.658	45.3	26.8	464	0.036	1.3	3.5	(N) 325	4.11	23.17	1650	37.5
F4	92.4	49.0	75.0	0.39	131.7	1237	0.590	47.2	31.7	136	0.039	1.0	5.9	(C) 422	4.10	22.73	1050	14.8
F5	106.6	84.0	195.0	1.78	99.3	1892	0.731	57.1	26.1	150	0.039	2.4	5.4	(M) 345	4.04	21.89	1350	14.0
V1	91.6	77.0	110.0	1.99	193 3	1880	0.652	47.1	35.4	178	0.040	2.4	2.8	(L) 311	4.10	19.44	2400	28.7
V2	131.8	50.0	152.0	0.36	131.6	1581	0.675	60.3	34.1	157	0.057	1.3	6.4	(S9)320	4.15	12.68	2850	22.3
V3	116.4	51.0	133.0	0.10	91.4	1782	0.629	49.2	29.2	129	0.048	6.7	3.1	(N) 364	3.91	19.50	2700	8.2
V4	101.8	48.0	212.0	1.07	141.6	1425	0.612	54.3	30.0	142	0.053	4.7	5.2	(C) 355	4.10	19.01	2000	19.3
V5	96.5	32.0	129.0	0.87	165.2	1462	0.663	66 1	34.8	131	0.045	1.9	4.0	(M) 275	4.05	14.93	1050	10.6
N1	90.4	69.0	219.0	1.52	97.0	655	0.556	46.4	25.0	228	0.054	4.1	6.0	(L) 310	4.05	21.06	2100	6.2
N2	102.4	147.0	270.0	0.88	170.3	1471	0.618	46.9	15.5	230	0.055	3.6	5.7	(S9)355	4.06	20.84	660	6.6
N3	106.6	75.0	114.0	1.31	107.4	827	0.697	54.4	18.3	151	0.041	3.0	5.8	(N) 385	4.05	19.71	1300	4.0
N4	78.5	44.0	83.0	0.60	90.8	1114	0.573	43.7	19.0	206	0.041	2.7	3.7	(C) 364	4.06	20.00	1350	4.4
N5	104.0	-	-	1.77	78.5	2052	0.675	52.3	20.2	202	0.070	3.3	7.4	(M) 314	4.11	19.93	1430	4.4
A1	111.9	49.0	129.0	0.51	120.7	1083	0.612	55.0	36.9	144	0.045	3.0	9.1	(L) 310	4.08	22.88	2000	12.6
A2	113.8	62.0	166.0	1.16	112.2	2143	0.573	49.3	39.9	174	0.045	4.7	4.6	(S9)311	4.10	20.75	1460	8.8
A3	131.1	46.0	174.0	2.26	195.3	1804	0.607	50.3	38.0	176	0.026	3.6	4.1	(N) 303	4.11	21.02	1180	25.9
A4	96.5	71.	224.0	0.93	131.9	1168	0.533	51.6	32.8	186	0.022	4.1	2.5	(C) 364	4.10	22.67	2420	29.7
A5	91.3	67.0	194.0	1.31	148.9	1534	0.760	50.3	36.9	151	0.057	4.7	3.0	(M) 314	4.05	21.73	3900	30.3
Cu1	110 5	60.0	115.0	0.49	133.4	2003	0.533	46.1	30.5	259	0.065	1.9	6.1	(L) 499	4.07	20.21	9000	20.9
Cu2	91.4	74.0	96.0	0.07	129.3	1614	0.533	57.1	34.9	203	0.086	3.6	1.9	(S9)473	4.06	24.64	12000	23.1
Cu3	115.7	73.0	104.0	0.04	139.0	1630	0.561	45.5	30.9	194	0.018	3.6	3.8	(N) 488	4.11	22.61	9250	17.2
Cu4	138.6	84.0	118.0	0.39	153.0	1808	0.624	48.5	31.3	138	0.093	1.9	5.7	(C) 401	4.12	20.41	8850	16.0
Cu5	91.3.	79.0	110.0	0.06	104.8	1681	0.669	46.6	36.2	161	0.071	2.4	6.9	(M) 286	3.84	20.17	10650	25.7

gasare@30/10/2001

Table 5y

RAW DATA OF WISTAR RATS @ 16mo

	Fe µmol/l	ALT IU/L	AST IU/L	0_2 mV	GPx IU/L	SOD IU/L	TAS IU/L	CAT U/L	LPO µM	8OHdG ng/g	FADU δf/sec	Vit.C µM	MDA υM	AMES Colonies	ORAC (L) mM	ORAC (A) mM	8-IP ng/g	Cu µM
C1	45.3	137	153	0.39	201.0	1574	0.772	54.6	53.8	122	0.067	3.9	3.1	(L) 297	5.26	13.58	390	24.9
C2	21.5	108	96	0.28	207.5	1357	0.678	36.9	53.5	154	0.087	5.3	4.4	(S9)332	4.58	12.71	560	37.7
C3	50.6	115	130	0.29	230.9	1431	0.822	31.8	51.3	133	0.100	6.1	3.3	(N) 317	4.49	12.99	900	33.1
C4	51.7	112	92	0.27	182.5	1654	0.839	62.7	46.0	115	0.080	6.8	2.3	(C) 254	4.83	13.00	620	8.2
C5	82.9	78	182	0.36	193.1	3140	0.989	45.5	68.5	118	0.080	5.3	8.2	(M) 308	5.03	13.06	480	25.7
F1	125.7	341	502	0.08	182.0	1494	0.694	36.3	114.8	207	0.160	5.0	19.2	(L) 238	5.69	14.79	3090	27.9
F2	150.6	123	188	0.09	151.1	1050	0.617	35.1	151.5	269	0.147	5.7	12.0	(S9)382	5.55	13.62	3150	32.7
F3	107.3	419	296	0.39	185.2	2039	0.561	26.8	93.8	256	0.107	4.6	11.9	(N) 374	5.54	14 90	810	37.5
F4	84.4	215	210	0.41	175.4	1630	1.100	27.6	35.5	279	0.393	4.6	11.5	(C) 412	5.57	14.50	1200	39.1
F5	117.0	270	195	0.23	189.9	1709	0.661	34.0	127.5	281	0.067	4.6	16.6	(M) 417	5.51	14.90	3150	37.5
V1	110.7	229	199	0.15	243.6	1473	0.767	40.9	105.8	201	0.033	5.3	15.2	(L) 325	5.67	16.19	2800	39.3
V2	163.0	202	216	0.14	232.2	1451	0.667	36.3	130.3	285	0.213	4.6	14.5	(S9)291	5.68	16.01	1410	37.9
V3	116.6	263	204	0.16	242.0	1279	0.633	33.3	94.8	225	0.093	10.1	9.5	(N) 360	5.65	16.28	3270	27.3
V4	119.2	181	219	0.44	200.0	1760	0.689	49.0	96.0	297	0.027	4.6	12.1	(C) 394	5.81	16.61	3240	39.7
V5	91.5	202	207	0.62	226.3	1865	0.694	36.6	90.5	221	0.107	4.6	16.0	(M) 323	5.56	16.45	3000	36.2
N1	154.8	243	208	0.11	20.2	987	0.678	32.1	80.3	534	0.207	5.3	13.1	(L) 372	5.64	16.67	2940	34.1
N2	140.5	247	274	0.12	194.4	1151	0.578	15.5	83.8	523	0.060	3.1	13.3	(S9)325	5.58	16.66	810	31.7
N3	126.1	262	181	0.20	206.8	1180	0.694	30.3	118.0	490	0.240	4.6	15.5	(N) 357	5.59	19.96	1530	27.5
N4	128.2	352	321	0.28	120.0	1421	0.650	39.4	123.5	470	0.107	5.0	19.7	(C) 412	5.66	16.31	600	35.3
N5	118.5	258	280	0.40	116.0	1472	0.661	22.2	87.5	501	0.167	5.0	14.7	(M) 431	5.54	16.36	1530	38.1
A1	121.7	270	174	0.43	209.3	1533	0 617	31.6	107.5	430	0.120	3.5	19.8	(L) 356	5.95	15.45	1100	36.1
A2	106.9	321	325	0.46	212.9	1359	0.633	27.9	123.0	442	0.120	6.1	17.4	(S9)319	5.78	15.02	5500	31.3
A3	126.5	207	213	0.14	181.1	1332	0.589	26.7	107.0	490	0.147	4.6	16.3	(N) 366	5.80	14.57	3500	35.3
A4	134.8	240	228	0.66	138.8	1796	0.656	38.6	84.5	460	0.187	5.3	11.9	(C) 412	5.76	14.75	2910	30.1
A5	114.7	248	240	0.32	204.0	1510	0.606	40.0	139.8	399	0.140	6.8	19.1	(M) 337	5.86	15.23	7500	35.5
Cu1	98.1	211	207	0.66	195.5	2134	0.544	31.9	140.5	558	0.120	3.5	18.4	(L) 400	5.61	15.76	13000	32.9
Cu2	139.2	236	190	0.66	203.8	2167	0.544	31.7	116.3	504	0.280	6.1	21.9	(S9)412	5.76	15.04	18000	32.7
Cu3	125.1	141	131	0.34	185.8	1441	0.700	38.8	144.0	489	0.207	5.7	16.7	(N) 440	5.83	15.71	15000	52.1
Cu4	116.6	238	282	0.08	159.6	1242	0.594	40.2	181.3	544	0.127	6.8	20.2	(C) 427	5.66	14.95	12000	13.6
Cu5	105.7	240	252	0.86	182.5	1311	0.661	36.9	151.0	515	0.393	3.5	26.3	(M) 527	5.70	15.40	6700	39.0

gasare@12/02/2002

Table 6y

RAW DATA OF WISTAR RATS @ 20mo

	Fe µmol/l	ALT IU/L	AST IU/L	0_2 mV	GPx IU/L	SOD IU/L	TAS IU/L	CAT U/L	LPO µM	8OHdG ng/g	FADU δf/sec	Vit.C µM	MDA υM	AMES Colonies	ORAC (L) mM	ORAC (A) mM	8-IP ng/g	Cu µM
C1	47.2	63	149	0.28	187.9	1731	0.899	57.8	43.0	110	0.030	5.5		(L) 298	6.10	12.66	294	17.6
C2	57.8	42	93	0.45	225.6	1282	0.745	44.6	48.5	146	0.070	3.8		(S9)365	5.96	12.81	900	21.8
C3	67.5	77	101	0.14	200.4	1781	0.899	52.5	37.6	142	0.170	5.3		(N) 331	6.01	12.77	400	31.7
C4	44.7	81	129	0.27	178.8	1537	0.945	43.5	31.8	133	0.090	4.6		(C) 356	6.11	12.79	120	28.6
C5	51.0	62	114	0.36	173.0	1439	0 871	43.0	30.2	91	0.150	3.6		(M) 288	6.09	12.61	480	25.1
F1	126.1	105	312	0 16	154.0	1908	0.613	41.8	120.2	263	0.105	3.2		(L) 578	6.75	13.64	3150	32.7
F2	133.7	140	402	0.11	172.8	1540	0.573	47.4	68.3	312	0.300	4.0		(S9)662	6.63	14.32	1950	33.4
F3	122.7	154	310	0.08	193.2	855	0.745	31.3	64.8	230	0.211	4.2		(N) 556	6.65	14.00	1500	27.2
F4	108.4	165	233	0.41	185.5	1472	0.756	18.0	114.3	294	0.200	5.1		(C) 435	6.68	13.90	2000	42.3
F5	101.2	138	293	0.23	190.2	1095	0.670	25.0	143.2	268	0.235	5.1		(M) 464	7.02	13.99	1785	34.0
V1	98.7	112	193	0.93	235.2	1402	0.682	27.8	93.4	384	0.100	4.4		(L) 506	6.45	13.14	3000	33.4
V2	97.0	119	294	0.16	195.8	1251	0.768	46.8	68.8	274	0.250	5.5		(S9)665	6.75	14.39	2850	30.9
V3	108.8	105	229	0.05	189.0	1101	0.705	35.9	71.3	315	0.210	5.3		(N) 481	6.83	14.01	2100	32.5
V4	101.7	116	273	0.44	206.3	818	0.871	44.5	76.7	229	0.180	4.8		(C) 442	6.75	12.75	2500	26.5
V5	138.8	221	184	0.62	187.8	982	0.751	32.1	166.0	530	0.150	5.5		(M) 417	6.54	13.19	2300	30.7
N1	121.1	182	262	0.19	158.0	1067	0.653	34.5	63.4	369	0.270	4.8		(L) 618	6.67	13.68	2670	29.0
N2	131.6	224	373	0.08	156.2	1048	0.733	36.6	67.4	724	0.087	3.6		(S9)643	6.76	14.29	2400	31.3
N3	130.8	266	360	0.12	122.2	1391	0.728	46.3	74.3	394	0.207	4.6		(N) 489	6.73	14.32	2400	35.6
N4	106.3	130	293	0.28	141.2	996	0.802	30.3	108.8	388	0.190	5.3		(C) 403	6.75	13.49	1050	29.0
N5	153.5	209	357	0.40	149.6	1034	0.728	25.9	77.1	400	0.200	4.2		(M) 386	6.45	14.14	2700	33.0
A1	99.1	231	289	0.16	194.9	1604	0.665	34.6	76.7	510	0.207	4.4		(L) 561	6.74	14.05	2820	35 0
A2	77.6	112	443	0.15	187.9	1103	0.705	39.4	134.3	496	0.240	4.2		(S9)571	6.81	13.30	2000	30.7
A3	115.6	217	471	0.12	183.8	738	0.619	41.8	78.3	857	0.215	4.4		(N) 507	6.79	13.72	3005	34.4
A4	165.3	253	371	0.66	185.7	1244	0.733	34.4	120.4	281	0.180	5.9		(C) 397	6.91	13.39	2685	33.6
A5	145.9	360	247	0.32	142.9	1019	0.682	30.9	159.7	473	0.190	4.8		(M) 413	6.80	13.61	2100	34.4
Cu1	102.9	315	586	0.09	180.8	958	0.676	32.5	104.3	277	0.250	4.4		(L) 530	6.51	13.52	16000	27.6
Cu2	202.5	153	457	0.09	190.7	1060	0.773	26.9	126.0	578	0.300	4.4		(S9)588	6.86	13.45	12000	39.8
Cu3	106.3	330	757	0.05	184.6	806	0.670	41.0	152.5	779	0.220	4.6		(N) 470	6.94	14.44	9500	39.4
Cu4	117.7	220	473	0.08	185.5	1095	0.773	21.0	103.2	597	0.190	4.4		(C) 457	6.55	13.28	4500	31.1
Cu5	118.1	234	413	0.86	177.4	695	0.756	26.7	180.6	580	0.280	4.4		(M) 386	6.57	13.07	6000	32.3

gasare@12/06/2002

Table 7y

RAW DATA OF WISTAR RATS @ 24mo

	Fe µmol/l	ALT IU/L	AST IU/L	0_2 mV	GPx IU/L	SOD IU/L	TAS IU/L	CAT U/L	LPO µM	8OHdG ng/g	FADU δf/sec	Vit.C µM	MDA υM	AMES Colonies	ORAC (L) mM	ORAC (A) mM	8-IP ng/g	Cu µM
C1	55.3				154.1	1036	0.721	49.6	34.6	142	0.155	4.2	6.4	(L) 304	4.29	10.68	1080	28.1
C2	56.1				174.8	1061	0.808	42.1	41.3	187	0.090	4.9	5.2	(S9)279	4.52	11.65	1200	24.0
C3	46.8				176.7	1175	0.688	46.3	52.0	171	0.160	7.0	8.2	(N) 331	5.12	11.56	1800	22.5
C4	35.4				193.7	1017	0.855	49.5	51.5	139	0.020	6.0	4.8	(C) 313	4.65	11.29	930	23.1
C5	35.0									147	0.050			(M) 299				
F1	125.3				160.2	709	0.468	38.2	102.5	349	0.265	6.7	93.1	(L) 573	4.88	11.4	2400	40.5
F2	90.3				167.7	868	0.428	43.3	89.8	349	0.175	5.6	15.0	(S9)610	5.13	11.47	2250	24.2
F3	137.1				153.8	942	0.494	44.1	94.8	364	0.200	6.3	86.0	(N) 543	5.00	11.56	6000	41.2
F4	116.8				177.1	759	0.494	38.2	95.3	302	0.200	4.9	27.8	(C) 470	5.11	11.49	2100	28.4
F5										292	0.210			(M) 462				
V1	125.3				221.4	659	0.681	43.7	70.8	355	0.190	6.0	18.2	(L) 615	4.78	10.84	3000	34.6
V2	134.1				156.0	722	0.601	47.2	70.5	356	0.206	5.6	20.4	(S9)580	4.97	12.30	2850	31.7
V3	129.5				147.2	735	0.488	40.6	97.9	354	0.285	9.5	36.0	(N) 544	4.89	12.20	1080	44.6
V4	106.7				179.4	645	0.548	44.8	75.3	359	0.110	6.7	26.5	(C) 460	4.87	13.75	1500	36.4
V5										351				(M) 440				
N1	129.9				164.7	744	0.394	39.6	67.7	355	0.170	4.9	59.9	(L) 609	4.70	11.77	2400	37.8
N2	130.3				193.5	651	0.407	45.3	80.5	364	0.145	4.6	25.1	(S9)567	4.97	11.79	3300	30.6
N3	116.0				201.4	776	0.341	31.1	60.8	349	0.210	5.6	16.8	(N) 471	4.49	11.78	3150	31.5
N4	106.3				148.1	735	0.508	23.7	86.7	344	0.186	6.7	11.7	(C) 503	4.73	11.77	3150	32.3
N5	179.3									335				(M) 433				
A1	136.7				166.4	550	0.795	39.3	118.4	558	0.295	6.7	61.5	(L) 582	4.71	13.15	3000	42.6
A2	127.8				132.9	383	0.434	32.7	94.6	350	0.155	6.3	64.0	(S9)512	4.97	12.82	3060	54.2
A3	136.2				95.8	818	0.461	26.2	57.5	321	0.275	5.6	20.7	(N) 444	4.49	13.23	2730	38.5
A4	137.1				179.4	785	0.514	34.0	112.7	341	0.180	6.3	23.7	(C) 479	4.70	13.41	2415	39.1
A5									77.7	357				(M) 374				
Cu1	116.0				137.3	804	0.474	31.5	104.6	526	0.360	7.0	38.3	(L) 535	4.49	12.44	3000	32.9
Cu2	83.9				164.8	922	0.648	26.4	132.9	512	0.240	5.9	40.8	(S9)467	4.34	12.64	11400	28.9
Cu3	146.8				145.8	506	0.374	22.6	112.0	519	0.240	6.3	40.6	(N) 415	4.62	12.76	7500	32.4
Cu4	79.8				155.7	444	0.615	13.9	109.6	537	0.230	7.0	38.4	(C) 456	4.48	10.91	3600	30.1
Cu5									132.2	501				(M) 369				

gasare@12/10/2002

Table 8y SPOTTED DATA

Srl	Date	Histo No	LIC	Histo	Ames	FADU	8-IP	8OHdG	AST	ALT	AFP
C1	14/02/2003	C.8.3	625		355	0.070	0.6	254			
C2	11/03/2003	C.8.6	347		392	0.010	0.6	120			
C3	02/05/2003	C.8.7	532		361	0.040	0.9	124			
C4	16/02/2003	C.8.4	972		328	0.040	0.3	137			
C5	08/05/2003	C.8.8	509		367	0.080		123			
F1	25/12/2002	F.7.8	11551	hamatoma	728	0.100		321			
F2	22/02/2003	F.8.8	21481	HCC	755	0.060	2.9	448			
F3	18/02/2003	F.8.6	19792	? IFF BDP ?	691	0.090	6.9	448			
F4	10/01/2003	F.7.10	16412	Adenoma	565	0.250	8.1	332			
F5	21/01/2003	F.7.11	25903	IFF	548	0.090		264			
F6	20/12/2002	F.7.12	10995					458			
3F10	09/03/2003	F.8.7	16157								
3F11	06/04/2003	F.8.5	23611								
V1	07/03/2003	V.8.2	32222	IFF BDP	556	0.040	7.2	255			
V2	16/01/2003	V.7.11	20162		533	0.080	10.5	244			
V3	14/02/2003	V.8.1	27361	IFF	570	0.110	3.3	230			
V4	31/01/2003	V.7.5	20486	Large IFF	412	0.060	3	321			
V5	05/02/2003	V.7.8	18055		519	0.050	6.9	536			
V6	05/01/2003	V.7.10	11435					484			
V7	22/01/2003	V.7.4	25370	IFF							
3V8	03/06/2003	V.8.5	12245								
3V9	25/04/2003	V.8.4	29722								
3V10	03/06/2003	V.8.6	21620								
N1	04/01/2003	N.7.10	18449		551	0.080	2.9	329			
N2	15/01/2003	N.7.12	23773		571	0.075		594			
N3	10/01/2003	N.7.11	20949		454	0.090	6.9	359			
N4	22/01/2003	N.7.14	34004		353	0.070	12	376			
3N5	20/04/2003	N.8.1	10787		448						

Table 8y SPOTTED DATA Cont.....

Srl	Date	Histo No	LIC	Histo	AMES	FADU	8-IP	8OHdG	AST	ALT	AFP	
A1	06/03/2003	A.8.4	12731	IFF	396	0.050		299				
A2	14/01/2003	A.7.10	18217		498	0.010	9.6	192				
A3	23/02/2003	A.8.2	11597	IFF	584	0.140	3.2	499				
A4	07/03/2003	A.8.5	14375		525	0.120	9.6	302				
A5	19/01/2003	A.7.11	31643		628	0.200	6.5	189				
A6	27/01/2003	A.7.13	18449					423				
A7	06/03/2003	A.8.3	18958									
A8	13/01/2003	A.7.10	35625									
A9	03/02/2003	A.8.1	17801									
3A10	30/05/2003	A.8.9	18217									
3A11	02/05/2003	A.8.10	11389									
3A12	16/03/2003	A.8.6	15625									
Cu1	13/12/2002	Cu.7.5	12407			0.200	6	265				
Cu2	01/01/2003	Cu.7.6	22083			0.128	5.7	429				
		3F.7.1							508	772	<1.1	
		F.6.1							7850	9690		1.3
		3V.7.3							478	678	<1.1	
		3.V.8.1							106	129		4.1
		3.V.8.2							538	1350	<1.1	
		3.N.7.2							581	1016	<1.1	
		N.6.1							492	668	<1.1	
		3.A.7.1							7540	10,000		1.7
		3.A.7.2							209	249		2.3
		Cu.6.1							1622	1250	<1.1	
		Cu.6.2							4113	4779		

Table z Ames Mutagenicity Test

Group	Liver fraction	Colonies 4 months	Colonies 8 months	Colonies 12 months	Colonies 16 months	Colonies 20 months
C gp	**(L)**	322	343	299	297	298
	(S9)	322	332	345	332	365
	(N)	330	332	335	317	331
	(C)	325	334	354	254	356
	(M)	282	255	300	308	288
Fe gp	**(L)**	380	267	257	238	578
	(S9)	359	332	336	382	662
	(N)	337	344	325	374	556
	(C)		360	422	412	435
	(M)		281	345	417	464
Fe + V gp	**(L)**	301	247	311	325	506
	(S9)	306	339	320	291	665
	(N)	282	279	364	360	481
	(C)	301	312	355	394	442
	(M)	372	308	275	323	417
Fe - V gp	**(L)**	334	396	310	372	618
	(S9)	309	411	355	325	643
	(N)	382	411	385	357	489
	(C)	368	365	364	412	403
	(M)	333	246	314	431	386
Fe + ASA gp	**(L)**	292	277	310	356	561
	(S9)	259	366	311	319	571
	(N)	256	303	303	356	507
	(C)	363	366	364	412	397
	(M)	340	266	314	337	413
Fe + Cu gp	**(L)**	300	287	499	400	530
	(S9)	306	458	473	412	588
	(N)	342	309	488	440	470
	(C)	355	341	401	427	457
	(M)	306	329	286	527	386

Table z Detailed results of the Ames mutagenicity test using *Samonella typhimurium* TA 102 strain. High-lighted areas indicate colony counts above 360 spontaneous revertants. L = Whole liver homogenate; S9 = Liver homogenate fraction at 9000 rpm; N = nucleosome fraction; C = Cytosolic fraction; M = microsomes.

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AESC 4/2001

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ANIMAL ETHICS SCREENING COMMITTEE

MODIFICATIONS AND EXTENSIONS TO EXPERIMENTS

a. Name: MR. G ASARE

b. Department: MEDICINE (MOLECULAR HEPATOLOGY RESEARCH UNIT)

c. Experiment to be ~~modified~~ / extended

2002/54/3

AESC NO:

~~2000~~	90	3

d. Project Title: IRON OVERLOAD, THE GENERATION OF REACTIVE OXYGEN SPECIES AND HEPATOCELLULAR CARCINOGENESIS IN EXPERIMENTAL RATS

e. Number and species of animals **originally approved:**

	400

f. Number of additional animals **previously allocated on M&Es:**

	NIL

g. Total number of animals **allocated to the experiment to date:**

	400

h. Number of animals **used to date:**

	380

i. Specific ~~modification~~ / extension requested:

TWO (2) YEARS MORE

j. Motivation for extension: 1. THERE WAS A SIX-MONTH DELAY IN THE TAKE-OFF AS A RESULT OF DIFFICULTIES IN FINDING SUITABLE ACCOMODATION FOR THE RATS. 2. FURTHER DELAY WAS CAUSED BY UNSATISFACTORY IRON LOADING WITH CARBONYL IRON. HAVING SWITCHED OVER TO FERROCENE, WHICH LOOKS PROMISING, MORE TIME IS NEEDED TO ACHIEVE IRON OVERLOADING.

Date: 06/06/02 Signature: J. J. [illegible]

RECOMMENDATIONS:

Approved: Extension of time

Date: 10th July 2002 Signature: D. A. Gray

Chairman, AESC

November 2000

AESC 4/2001

This form is also available on disk (Word Perfect 6 or MSWord 97)

Please note that only typewritten applications will be accepted. Should additional space be required for section "i" and/or "j", please use the back of this form.

ANIMAL ETHICS SCREENING COMMITTEE

MODIFICATIONS AND EXTENSIONS TO EXPERIMENTS

a. Name: MR. G ASARE

b. Department: MEDICINE (MOLECULAR HEPATOLOGY RESEARCH UNIT)

c. Experiment to be modified / ~~extended~~

AESC NO:		
2000	90	3

d. Project Title. IRON OVERLOAD, THE GENERATION OF REACTIVE OXYGEN SPECIES AND HEPATOCELLULAR CARCINOGENESIS IN EXPERIMENTAL RATS

e. Number and species of animals **originally approved:**

	400

f. Number of additional animals **previously allocated** on M&Es:

	NIL

g. Total number of animals **allocated** to the experiment to date:

	400

h. Number of animals used to date:

	380

i. Specific modification / ~~extension~~ requested:
SUBSTITUTE PENTACARBONYL IRON ~~FOR~~ WITH FERROCENE (ORGANIC IRON)

j. Motivation for modification 1. FERROCENE MORE POTENT FOR ACHIEVING HUMAN HAEMOCHROMATOSIS THAN CARBONYL IRON. *[Luis G. Valerio Jr. et al (2000); Experimental and Molecular Pathology 68, 1-12]* 2. THE SUPPLIER OF PENTACARBONYL IRON UNABLE TO TELL WHEN NEXT SUPPLY WILL BE AVAILABLE IN THE U.S.A.)

Date: 02/11/2001 Signature: J. J. Farrell

RECOMMENDATIONS:

Approved: Use of Ferrocene in place of Carbonyl Iron

Date: 28/11/01 Signature: D. A. Gray
Chairman AESC

November 2000

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To : Llewelyn Sinclair
Company : WITS University
Fax No. : 011 643 4318
From : Stephan Jacobs
Company : Epol Pretoria West
Date : 5 December 2003

Epol Mice Cubes

To my knowledge Epol Mice cubes doesn't contain any carcinogens. The mycotoxin levels of the mice cubes also fall within acceptable levels of AFMA standards for animal feeds.

Stephan Jacobs
Technical Manager
Epol Pretoria West

Gelatine Cubes

Gelatine cubes were used as a vehicle to administer the vitamins and aspirin. Cubes were prepared as follows:

- Wt. of Gelatine = 30g
- Hot water = 130ml
- No. of cubes = 64 x 2 = 128 cubes

Half a teaspoon of Bovril was added to flavour the hot water. The gelatine was gently sprayed onto the water in a beaker. This was allowed to settle-in and then heated in a microwave to dissolve. Vitamin A, dissolved in 1 ml cooking oil together with vitamin E, was introduced into the molten gelatine using a Pasteur pipette. In the case of aspirin, the aspirin was first dissolved in 130 ml hot water. The molten gel was poured onto a 150ml gel plate and allowed to solidify. Thereafter, it was divided as shown below. The appropriate cubes were given to the designated groups. A placebo (without vitamins and aspirin) was administered to the C, Fe, Fe - V and Fe + Cu groups. After 4 months when the Wistar rats were used to the gelatine cubes, Bovril was no longer added to flavour the gelatine.

Drugs for the gelatine cubes were calculated as follows:

1. Vitamin A = 0.5mg / cube (50mg/kg=0.5mg/10g diet)

   128 cubes = 0.5mg x 128 cubes

   = 64mg

   = 0.064g

2. Vitamin E = 5mg / cube (500mg/kg diet=5mg/10g diet)

= 5mg x 128 cubes

= 640mg

= 0.64g

3. Aspirin = 2mg / cube (20mg/kg wt=2mg/100g rat wt)

= 2mg x 128

= 256mg

= 0.256g

4. Cu in $CuSO_4$ = 25%

$\therefore$ 100% = 0.15 x 4

= 0.60g/l

The $CuSO_4$ was changed after 12mo to 3% $CuCO_3 \cdot Cu(OH)_2$ supplementation for the diet. This was prepared in the same way as the 2.5% carbonyl iron.

ADDUNDUM

Samples for histology and immunohistochemistry were coded as follows: i.e C.1.4, Fe.2.3, V.3.4, A.4.5, N.5.2, Cu. To decode samples, follow keys below. (C=Control group, Fe=Fe group, V=Fe + V group, N=Fe –V group, A=Fe +ASA group, Cu=Fe+Cu group).