Western Juniper Dog Bedding Project

by H. N. Engel. DVM, PhD
College of Veterinary Medicine
Oregon State University

Introduction

The goal of this project was to determine if there were any observable toxic effects in dogs which used Western Juniper shavings as a bedding. The primary systems followed were the liver, kidneys and any changes in the blood cell profiles.

Materials and Methods

A total of 11 dogs were used in this study that were housed on 2 premises. Eight of the dogs had free access to graveled outside runs with dog coops that they could run into for protection from the weather for sleeping. Inside the coops, the floors were layered with Juniper shavings. The remaining 3 dogs were confined during the day to outside cement floored runs with dog houses. The runs had partial overhead covering to protect the animals from the elements. The latter group of dogs were housed at night in fiberglass dog crates (approximately 8-10 hrs). The floor of the crates contained Juniper shavings with a wire grate placed on top.

Prior to the dogs having any contact with the Western Juniper shavings as a bedding, bloods samples were drawn. Both serum and EDTA samples were collected. Immediately after the initial blood collection, the dogs were exposed to the Juniper shavings. The dogs were exposed to the shavings for 198 days (6 1/2 months). Blood samples were again collected at the end of this period. Two dogs in the first environment were lost due the dogs being placed in other homes. Another dog from this same premise had only the terminal blood sample taken because it was initially

believed that he would not be around for the length of the experiment. Therefore, of the 11 dogs, only initial blood work was available for 2 dogs and one dog only had terminal results.

In this study there were 5 male and 6 female dogs that ranged from 12 months to 9 yrs/3m of age with an average age of 5.02 years by the end of the study. The majority of the breeds were Labrador Retrievers with 2 Whippets. The remaining breeds consisted of a Brittany, an English Setter, and a German Shorthaired Pointer. The dogs weighed from 10.0 to 40.9 kg with an average weight of 26.4 kg (See Appendices 1 and 2).

Results

In Appendix 3, the blood panels that were performed on the pre and post-exposure blood samples are presented. Statistical analysis on the data consisted of performing t-tests to compare the 90% confidence intervals of the averages of the means and standard deviations of each parameter of the complete blood counts and of the serum profiles.

Of primary concern was ALT (alanine transferase). Increase levels of this enzyme is indicative of liver damage or that the shavings were causing damage to liver cells. BUN (blood urea nitrogen) elevation can incriminate liver damage if ALT is elevated. Without ALT elevation, an increase in BUN suggests kidney damage. None of the dogs had elevated BUN values and only one dog had an elevated ALT. This dog began the study with an elevated ALT (72 IU/L) but ended the project with a slightly lower value (67 IU/L). The normal range for ALT is from 5-65 IU/L. None of the

parameters in this study exceeded the 90% confidence interval between pre and post-exposure sample means.

Summary and Conclusions

Pre and Post-exposure samples were obtained from 8 dogs that had Western Juniper shavings as bedding for 198 days. Two additional dogs were added to the pre-exposure pool of normals and one extra dog was added to the post-exposure pool. None of the means of the parameters from any of the dogs had a statistically significant increase or decrease between the pre and post-sample collection means at the end of 198 days exposure to Western Juniper shavings.

The results of the BUN and ALT values obtained before and at the conclusion of this very limited study suggest that Western Juniper shavings as a bedding for dogs is neither hepatotoxic nor nephrotoxic to dogs.

Appendix 1

Animals Used in Canine Western Juniper Study

CANINES

Gender:	5 males	6 females
Breeds:	Labrador Retriever(1 Mix)	6
	Whippets	2
	Brittany	1
	German Shorthaired Pointer	1
	English Setter	1
Age:	Range from 12 months to 9 yrs/3m	
	Average 5.02 years (s.d. = 2.95)	
Weight:	Range from 22 to 90 lbs	
	Average 58.18 lbs (s.d. = 25.08)	
	Range from 10 to 40.9 kg	
	Average 26.4 kg (s.d. = 11.4)	
Length of Study:	From 12/29/97 t0 07/17/98	
	6 months and 18 days or 198 days	

Appendix 2

Animals Used in Canine Western Juniper Study

CANINES

Name	Breed	Age	Weight	Gender
Taur	Labrador Retriever (Black)	9 yrs/3m	90 lbs 40.9 kg	Male
Turbo	Labrador Retriever (Black)	2 yrs/6m	90 lbs 40.9 kg	Male
Royal	Labrador Retriever (Yellow)	3 yrs/2m	55 lbs 25 kg	Female
McGhee	Labrador Retriever (Black)	8 yrs	55 lbs 25 kg	Female
Daisy	Lab/Doberman Mix (Black)	2 yrs/6m	50 lbs 22.7 kg	Female
Sport	Labrador Retriever (Yellow)	3 yrs/6m	87 lbs 39.5 kg	Male
Charlie	Whippet	3 yrs/8m	22 lbs 10 kg	Female
Cookie	Whippet	9 yrs/3m	24 lbs 10.9 kg	Female
Roxie	Brittany (Orange/White)	4 yrs/8m	32 lbs 14.5 kg	Female
Crackers	English Setter (Orange Belton)	8 yrs/2m	65 lbs 29.5 kg	Female
Brox	German Shorthaired Pointer	12m	70 lbs 31.8 kg	Male

Appendix 3

Western Juniper Shavings Study
Data

Taur	Test	Results PRE	Results POST	Normal
	Hemoglobin	16.3 g/dl	12.9 g/dl	12-18
	Hematocrit	40.2 %	36.6 %(L)	37-55
	RBC	5.58 x10-6/µl	4.98 x10-6/µ(L)	5.5-8.5
	WBC	10,900/µl	10,300/µl	5,000-14,000
	Seg	6,867/µl (63%)	7,416/µl(72%)	3,000-11,500
	Band		206/µl (2%)	0-300
	Lymph	3,379/µl (31%)	1,957/µl(19%)	1,000-4,800
	Mono	109/µl (1%)(L)	412/µl (4%)	150-1,350
	Eos	545/µl (13%)	309/µl (3%)	100-1,250
	MCV	72.0 fl	73/5 fl	60-77
	MCHC	40.5 g/dl(H)	35.2 g/dl	32-36
	MCH	29.2 pg (H)	25.9 pg (H)	19.5-24.5
	BUN	19.0 mg/dl	15.0 mg/dl	10-30
	Creatinine	0.9 mg/dl (L)	0.8 mg/dl (L)	1-2
	Glucose	97 mg/dl	85 mg/dl	65-130
	Cholesterol	258 mg/dl	187 mg/dl	150-275
	Tot. Prot	7.0 g/dl	6.6 g/dl	5.4-7.6
	Albumin	4.8 g/dl(H)	4.0 g/dl	2.3-4
	ALP	402 IU/L(H)	149 IU/L(H)	10-84
	ALT	54 IU/L	56 IU/L	5-65
	Bile acids	14.4 umol/L(H)	5.6 umol/L	0-10

Turbo

Test	Results PRE	Results POST	Normal
Hemoglobin	19.7 g/dl (H)	18.6 g/dl(H)	12-18
Hematocrit	61.0 % (H)	54.8 %	37-55
RBC	8.67 x10-6/µl(H)	7.79 x10-6/µ	5.5-8.5
WBC	14,100/µl(H)	12,700/µl	5,000-14,000
Seg	7,755/µl (55%)	7,366/µl(58%)	3,000-11,500
Band		127/µl (1%)	0-300
Lymph	3,243/µl (23%)	4,445/µl(35%)	1,000-4,800
Mono	705/µl (5%)	127/µl(L)(1%)	150-1,350
Eos	2,397/µl (17%)(H)	635/µl (5%)	100-1,250
MCV	70.4 fl	70.3 fl	60-77
MCHC	32.3 g/dl	33.9 g/dl	32-36
MCH	22.7 pg	23.9 pg	19.5-24.5
BUN	23.0 mg/dl	20.0 mg/dl	10-30
Creatinine	1.2 mg/dl	1.2 mg/dl	1-2
Glucose	89 mg/dl	92 mg/dl	65-130
Cholesterol	171 mg/dl	166 mg/dl	150-275
Tot. Prot	6.3 g/dl	6.3 g/dl	5.4-7.6
Albumin	4.2 g/dl(H)	4.3 g/dl(H)	2.3-4
ALP	22 IU/L	20 IU/L	10-84
ALT	48 IU/L	64 IU/L	5-65
Bile acids	7.6 umol/L	6.9 umol/L	0-10

Royal

Test	Results PRE	Results POST	Normal
Hemoglobin	18.4 g/dl (H)	17.4 g/dl	12-18
Hematocrit	55.5 % (H)	51.3 %	37-55
RBC	7.89 x10^{-6}/µl	7.31 x10^{-6}/µ	5.5-8.5
WBC	6.800/µl	9,300/µl	5,000-14,000
Seg	4,284/µl (63%)	4,464/µl(48%)	3,000-11,500
Band			0-300
Lymph	2,040/µl (30%)	3,906/µl(42%)	1,000-4,800
Mono	136/µl (2%)(L)		150-1,350
Eos	340/µl (5%)	930/µl (10%)	100-1,250
MCV	70.3 fl	70.2 fl	60-77
MCHC	33.2 g/dl	33.9 g/dl	32-36
MCH	23.3 pg	23.8 pg	19.5-24.5
BUN	19.0 mg/dl	22.0 mg/dl	10-30
Creatinine	1.0 mg/dl	1.2 mg/dl	1-2
Glucose	107 mg/dl	106 mg/dl	65-130
Cholesterol	214 mg/dl	245 mg/dl	150-275
Tot. Prot	5.8 g/dl	6.2 g/dl	5.4-7.6
Albumin	3.8 g/dl	4.0 g/dl	2.3-4
ALP	35 IU/L	32 IU/L	10-84
ALT	33 IU/L	58 IU/L	5-65
Bile acids	7.6 umol/L	8.7 umol/L	0-10

McGee

Test	Results PRE	Normal POST
Hemoglobin	16.8 g/dl	12-18
Hematocrit	50.5 %	37-55
RBC	7.83 x10^{-6}/µl	5.5-8.5
WBC	14,800/µl(H)	5,000-14,000
Seg	9,620/µl (65%)	3,000-11,500
Band		
Lymph	3108/µl (21%)	1,000-4,800
Mono	592/µl (4%)	150-1,350
Eos	1,480/µl(10%)(H)	100-1,250
MCV	64.5 fl	60-77
MCHC	33.3 g/dl	32-36
MCH	21/5 pg	19.5-24.5
BUN	17.0 mg/dl	10-30
Creatinine	0.8 mg/dl(L)	1-2
Glucose	106 mg/dl	65-130
Cholesterol	245 mg/dl	150-275
Tot. Prot	6.1 g/dl	5.4-7.6
Albumin	3.5 g/dl	2.3-4
ALP	20 IU/L	10-84
ALT	33 IU/L	5-65
Bile acids	7.6 umol/L	0-10

Daisy

Test	Results PRE	Results POST	Normal
Hemoglobin	19.7 g/dl (H)	17.7 g/dl	12-18
Hematocrit	56.4 % (H)	49.9 %	37-55
RBC	7.89 x10-6/µl	6.92 x10-6/µ	5.5-8.5
WBC	12,000/µl	10,900/µl	5,000-14,000
Seg	5,160/µl (43%)	4,905/µl(45%)	3,000-11,500
Band			0-300
Lymph	4,800/µl (40%)	4,578/µl(42%)	1,000-4,800
Mono	480/µl (4%)		150-1,350
Eos	1,560/µl (13%)(H)	1,417/µl (H)(13%)	100-1,250
MCV	71.5 fl	72.1 fl	60-77
MCHC	34.9 g/dl	35.5 g/dl	32-36
MCH	25.0 pg (H)	25.6 pg (H)	19.5-24.5
BUN	21.0 mg/dl	16.0 mg/dl	10-30
Creatinine	0.8 mg/dl (L)	1.1 mg/dl	1-2
Glucose	103 mg/dl	97 mg/dl	65-130
Cholesterol	197 mg/dl	203 mg/dl	150-275
Tot. Prot	6.0 g/dl	5.8 g/dl	5.4-7.6
Albumin	4.0 g/dl	3.7 g/dl	2.3-4
ALP	27 IU/L	18 IU/L	10-84
ALT	32 IU/L	34 IU/L	5-65
Bile acids	8.8 µmol/L	7.2 µmol/L	0-10

Sport	Test	Results PRE	Results POST	Normal
	Hemoglobin	18.4 g/dl (H)		12-18
	Hematocrit	55.4 % (H)		37-55
	RBC	7.45 x10^{-6}/µl		5.5-8.5
	WBC	10,600/µl		5,000-14,000
	Seg	5,618/µl (53%)		3,000-11,500
	Band			0-300
	Lymph	3,392/µl (32%)		1,000-4,800
	Mono	212/µl (2%)		150-1,350
	Eos	1,378/µl (13%)(H)		100-1,250
	MCV	74.4 fl		60-77
	MCHC	33.2 g/dl		32-36
	MCH	24.7 pg(H)		19.5-24.5
	BUN	20.0 mg/dl		10-30
	Creatinine	0.9 mg/dl(L)		1-2
	Glucose	106 mg/dl		65-130
	Cholesterol	242 mg/dl		150-275
	Tot. Prot	6/6 g/dl		5.4-7.6
	Albumin	4/0 g/dl		2.3-4
	ALP	46 IU/L		10-84
	ALT	51 IU/L		5-65
	Bile acids	9.2 umol/L		0-10

Charlie	Test	Results		Normal
		PRE	POST	
	Hemoglobin	20.1 g/dl (H)	17.2 g/dl	12-18
	Hematocrit	60.3 % (H)	49.7%	37-55
	RBC	8.43 x10^{-6}/µl	7.05 x10^{-6}/µl	5.5-8.5
	WBC	8,400/µl	7,800/µl	5,000-14,000
	Seg	5,796/µl (69%)	4,680/µl(60%)	3,000-11,500
	Band	84/µl (1%)	234//µl (3%)	0-300
	Lymph	1,680/µl (20%)	2,106/µl(27%)	1,000-4,800
	Mono	588/µl (7%)	312/µl (4%)	150-1,350
	Eos	252/µl (3%)	468/µl (6%)	100-1,250
	MCV	71.5 fl	70.5 fl	60-77
	MCHC	33.3 g/dl	34.6 g/dl	32-36
	MCH	23.8 pg	24.4 pg	19.5-24.5
	BUN	18.0 mg/dl	16.0 mg/dl	0-30
	Creatinine	0.7 mg/dl (L)	0.8 mg/dl (L)	1-2
	Glucose	91 mg/dl	101 mg/dl	65-130
	Cholesterol	265 mg/dl	203 mg/dl	150-275
	Tot. Prot	6.2 g/dl	5.7 g/dl	5.4-7.6
	Albumin	4.4 g/dl (H)	4.3 g/dl (H)	2.3-4
	ALP	35 IU/L	27 IU/L	10-84
	ALT	40 IU/L	50 IU/L	5-65
	Bile acids	13.5 µmol/L (H)	16.2 µmol/L (H)	0-10

Cookie	Test	Results		Normal
		PRE	POST	
	Hemoglobin	20.7 g/dl (H)	20.7 g/dl (H)	12-18
	Hematocrit	63.2 % (H)	59.5 % (H)	37-55
	RBC	8.42 x10-6/µl	7.95 x10-6/µl	5.5-8.5
	WBC	7,400/µl	5,600/µl	5,000-14,000
	Seg	4,810/µl (65%)	3,640/µl(65%)	3,000-11,500
	Band			0-300
	Lymph	1,998/µl (27%)	1,624/µl(29%)	1,000-4,800
	Mono	370/µl (5%)	112/µl (L)(2%)	150-1,350
	Eos	222/µl (3%)	224/µl (4%)	100-1,250
	MCV	75.1 fl	74.8 fl	60-77
	MCHC	32.8 g/dl	34.8 g/dl	32-36
	MCH	24.6 pg (H)	26.0 pg (H)	19.5-24.5
	BUN	14.0 mg/dl	18.0 mg/dl	10-30
	Creatinine	0.9 mg/dl (L)	1.1 mg/dl	1-2
	Glucose	95 mg/dl	80 mg/dl	65-130
	Cholesterol	356 mg/dl (H)	311 mg/dl (H)	150-275
	Tot. Prot	5.5 g/dl	5.2 g/dl (L)	5.4-7.6
	Albumin	3.5 g/dl	3.5 g/dl	2.3-4
	ALP	25 IU/L	2 IU/L (L)	0-84
	ALT	34 IU/L	60 IU/L	5-65
	Bile acids	6.3 µmol/L	17.0 µmol/L (H)	0-10

Roxie

Test	Results PRE	Results POST	Normal
Hemoglobin	19.7 g/dl (H)	17.7 g/dl	12-18
Hematocrit	54.6 % (H)	49.9 %	37-55
RBC	7.89 x10^{-6}/µl	6.92 x10^{-6}/µ	5.5-8.5
WBC	12,000/µl	10,900/µl	5,000-14,000
Seg	5,160/µl (43%)	4,905/µl(52%)	3,000-11,500
Band			0-300
Lymph	4,800/µl (40%)	4,578/µl(45%)	1,000-4,800
Mono	480/µl (4%)		150-1,350
Eos	1,560/µl (13%)(H)	1,417/µl (H)(3%)	100-1,250
MCV	71.5 fl	72.1 fl	60-77
MCHC	34.9 g/dl	35.5 g/dl	32-36
MCH	25.0 pg (H)	25.6 pg (H)	19.5-24.5
BUN	21.0 mg/dl	16.0 mg/dl	10-30
Creatinine	0.8 mg/dl (L)	1.1 mg/dl (L)	1-2
Glucose	103 mg/dl	97 mg/dl	65-130
Cholesterol	197 mg/dl	203 mg/dl	150-275
Tot. Prot	6.0 g/dl	5.8 g/dl	5.4-7.6
Albumin	4.0 g/dl	3.7 g/dl	2.3-4
ALP	27 IU/L	19 IU/L	10-84
ALT	32 IU/L	34 IU/L	5-65
Bile acids	8.8 umol/L	7.2 umol/L	0-10

Crackers	Test	Results		Normal
		PRE	POST	
	Hemoglobin	18.6 g/dl (H)	16.8 g/dl	12-18
	Hematocrit	56 % (H)	44.6 %	37-55
	RBC	7.69 x10^{-6}/µl	6.19 x10^{-6}/µl	5.5-8.5
	WBC	10,800/µl	18,000/µl (H)	5,000-14,000
	Seg	7,560/µl (70%)	7,200/µl(49%)	3,000-11,500
	Band			0-300
	Lymph	2,484/µl (23%)	1,980/µl(40%)	1,000-4,800
	Mono	324/µl (3%)	0.0/µl	150-1,350
	Eos	432/µl (4%)	1,980/µl(H)(11%)	100-1,250
	MCV	72.8 fl	72.1 fl	60-77
	MCHC	33.2 g/dl	37.7 g/dl (H)	32-36
	MCH	24.2 pg	27.1 pg (H)	19.5-24.5
	BUN	14.0 mg/dl	12.0 mg/dl	10-30
	Creatinine	0.7 mg/dl (L)	0.8 mg/dl (L)	1-2
	Glucose	84 mg/dl	101 mg/dl	65-130
	Cholesterol	209 mg/dl	212 mg/dl	150-275
	Tot. Prot	7.0 g/dl	7.1 g/dl	5.4-7.6
	Albumin	4.5 g/dl (H)	4.6 g/dl (H)	2.3-4
	ALP	19 IU/L	29 IU/L	10-84
	ALT	72 IU/L (H)	67 IU/L (H)	5-65
	Bile acids	9.2 umol/L	5.3 umol/L	0-10

Brox	Test	Results		Normal
		PRE	POST	
	Hemoglobin	15.7 g/dl		12-18
	Hematocrit	45.7%		37-55
	RBC	6.35 x10^{-6}/μ		5.5-8.5
	WBC	14,400/μl(H)		5,000-14,000
	Seg	8,784/μl(61%)		3,000-11,500
	Band	144/μl (1%)		0-300
	Lymph	4,608/μl(32%)		1,000-4,800
	Mono	144/μl(L)(1%)		150-1,350
	Eos	720/μl (5%)		100-1,250
	MCV	72.0 fl		60-77
	MCHC	34.4 g/dl		32-36
	MCH	24.7 pg(H)		19.5-24.5
	BUN	25.0 mg/dl		10-30
	Creatinine	1.0 mg/dl		1-2
	Glucose	88 mg/dl		65-130
	Cholesterol	219 mg/dl		150-275
	Tot. Prot	5.8 g/dl		5.4-7.6
	Albumin	3.5 g/dl		2.3-4
	ALP	63 IU/L		10-84
	ALT	65 IU/L		5-65
	Bile acids	11.2 umol/L(H)		0-10