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SERUM CHEMISTRY OF THE COLLARED PECCARY (*TAYASSU TAJACU*)

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ABSTRACT: Values of serum biochemistry were obtained for 33 adult (16 male and 17 female) and six juvenile (four male and two female) collared peccaries collected by trapping and drugging animals from southern Texas during the period July through September 1982. Only cholesterol and aspartate aminotransferase concentrations differed significantly with respect to sex. Juvenile peccaries had significantly lower concentrations of total protein and globulins, but had higher concentrations of glucose, triglycerides, alkaline phosphatase, alanine aminotransferase, and calcium, and a higher albumin/globulin ratio than did adults. Effects of method of capture on biochemical attributes of serum from five gunshot and nine trapped adult peccaries collected from a single herd during March 1983 also were examined. Trapped peccaries had significantly higher levels of serum urea nitrogen, urea nitrogen/creatinine ratio, glucose, and chloride concentrations. Levels of uric acid, calcium, and potassium were significantly lower among the trapped animals.

INTRODUCTION

Serum biochemistry may be useful in diagnosing health and condition of populations (Bandy et al., 1957; Franzmann, 1972; Seal et al., 1972, 1978; Buckland, 1974; LeResche et al., 1974; Bahnak et al., 1979; Warren et al., 1981, 1982). Normal physiological values of serum metabolites have been reported for most North American ungulates, but information is practically nonexistent for the collared peccary. Zervanos and Hadley (1973) studied the effects of dehydration on serum levels of urea nitrogen and electrolytes among captive peccaries. Wallach et al. (1971) presented values of nine biochemical properties of captive adult peccaries (2 male, 2 female) collected by a gunshot to the head.

The peccary occupies arid habitats of the southwestern United States where prolonged periods of drought are not uncommon. Nutritional stresses during these periods have had profound influences on herd recruitment (Low, 1970; Bissonette, 1982) and serum metabolic constituents may prove to be useful indices of nutritional stress in the collared peccary. The objective of this research was to establish baseline data on the serum biochemistry of the peccary from southern Texas. Influences of sex and age on metabolic profiles were examined. Information also was obtained on the effects of capture method (gunshot versus immobilization with drugs) on adult serum attributes.

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MATERIALS AND METHODS

Thirty-three adult (16 male and 17 female) and six juvenile (4 male and 2 female) collared peccaries were trapped from the Chaparrosa Ranch, Zavala County, Texas during July through September 1982. These peccaries were captured in modified Clover deer traps baited with corn. Traps were baited and set around 2100 hours and checked the following morning by 0700 hours. Peccaries caught in traps were immobilized prior to blood-sampling with a dosage of 20 mg/kg of ketamine hydrochloride (Ketaset, Bristol Laboratories, Syracuse, New York 13201, USA) administered intramuscularly by blow-gun syringe (Lochmiller and Grant, 1983). Nine additional adult peccaries were captured using the same method on the Chaparral Wildlife Management Area, Dimmit and LaSalle counties, Texas during March 1983. Six adult animals were collected concurrently from the same herd, through killing by gunshot, in order to compare their serum biochemical profiles to those herd members trapped and subsequently drugged. These two techniques are the most frequently used collection methods for collared peccaries (Neal, 1959). Shot animals were killed with a single rifle-shot to the cervical area of the spine, and blood samples usually were obtained prior to death. All animals collected from the Chaparral Wildlife Management Area were mature adults.

Animals were sexed and classified as adult or juvenile based on tooth-replacement pattern (Kirkpatrick and Sowls, 1962) and tooth wear (Sowls, 1961). Animals lacking complete permanent dentition were considered juveniles. All blood samples consisted of 50 ml of blood drawn from the anterior vena cava using 10-ml B-D Vacutainer assemblies (Becton-Dickinson and Co., Rutherford, New Jersey 07070, USA) fitted with 21-gauge, 3.8-cm needles. Blood samples were placed on ice and fractions were separated by centrifugation within 4 hr of collection. Serum samples were stored at −20 C until analyzed.

Serum samples were analyzed as a batch using a Technicon SMAC biochemical analyzer (Technicon Instruments Corp., Tarrytown, New York 10591, USA) for concentrations of total protein, albumin, serum urea nitrogen, creatinine, total bilirubin, direct bilirubin, cholesterol, glucose, triglycerides, uric acid, alkaline phosphatase (ALP), gamma glutamyl transferase (GGT), aspartate aminotransferase (AST), alanine aminotransferase (ALT), lactate dehydrogenase (LD), calcium, sodium, chloride, inorganic phosphorus, and potassium. Concentration of globulins was estimated by subtracting the concentration of albumin from total protein. The albumin/globulin ratio (A/G) and serum urea nitrogen/creatinine ratio was calculated for each sample. Cortisol was assayed by radio-immunoassay using a kit provided by Radioassay Systems Laboratories, Inc. (Carson, California 90746, USA). Intraassay variability was 2.6%.

Blood data of the 30 collared peccaries collected from the Chaparrosa Ranch were compared by analysis of variance (Helwig and Council, 1979) with sex and age as the main effects. The effects of capture method on serum biochemistry was assessed for the 14 adult peccaries collected from the Chaparral Wildlife Management Area using analysis of variance with capture method as the main effect. Sexes were pooled in this analysis because the Chaparrosa Ranch data showed few sexual dimorphisms in serum biochemistry. Seasonal comparisons were not made since the two areas of collection differed drastically in habitat quality.

RESULTS AND DISCUSSION

Species comparisons

The serum biochemistry of collared peccaries had many similarities to domestic swine (*Sus scrofa*). Total protein (7.37 g/dl) and albumin (3.10 g/dl) concentrations for the adult peccary were in close agreement with respective values reported for domestic swine (Baetz and Mengeling, 1971). Values for serum urea nitrogen and creatinine were within the normal range of published values for both European wild hogs (*S. scrofa*) (Williamson and Pelton, 1975) and domestic swine (Tumbleson et al., 1969, 1972; Baetz and Mengeling, 1971). Urea nitrogen values in this study were below those reported for collared peccaries in Arizona (range 10.7–22.7 mg/dl) (Zervanos and Hadley, 1973) and four zoological park specimens (range 23.0–37.0 mg/dl) (Wallach et al., 1971).

The peccary appears to have lower concentrations of bilirubin (total and direct) than swine (Tumbleson et al., 1969) (Table 1). Wallach et al. (1971) reported total bilirubin levels of 0.0–0.9 mg/dl for the peccary. Values for serum glucose, cholesterol, and ALP presented by Wallach et al. (1971) were within the observed range of values in this study. However, uric acid levels (2.8–6.5 mg/dl) given by Wallach et al. (1971) appeared abnormally high for the collared peccary. Values in this study averaged only 0.192 ± 0.037 (SE) mg/dl.

Levels of LD in the peccary were extremely high in comparison to domestic swine (Tumbleson et al., 1969) (Table 1). Blood serum from a single feral hog trapped during the present study was found to contain a LD concentration of only 374 I.U./liter compared to the average of 2,617 I.U./liter for adult peccaries. The hog was handled in a manner

TABLE 1. Influence of sex and age on serum chemical values of collared peccaries from southern Texas (July through September 1982).

Component assay	Adults				Juveniles			
	Females (n = 17)		Males (n = 16)		Females (n = 2)		Males (n = 4)	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Total protein (g/dl)[d]	7.28	0.19	7.49	0.15	7.15	0.75	5.85	0.40
Albumin (g/dl)	3.05	0.06	3.17	0.07	3.10	0.20	3.02	0.14
Globulin (g/dl)[d]	4.22	0.18	4.32	0.15	4.05	0.55	2.82	0.28
Albumin/globulin (ratio)[e]	0.74	0.04	0.75	0.03	0.78	0.06	1.09	0.07
Serum urea nitrogen (mg/dl)	8.94	0.55	8.50	0.68	12.00	5.00	5.25	0.48
Creatinine (mg/dl)	1.52	0.06	1.71	0.12	1.85	0.65	1.08	0.11
Serum urea nitrogen/creatinine (ratio)	5.93	0.35	5.09	0.37	6.32	0.48	4.96	0.47
Total bilirubin (mg/dl)	0.106	0.005	0.106	0.006	0.100	0.000	0.100	0.000
Direct bilirubin (mg/dl)	0.023	0.106	0.044	0.013	0.0	0.0	0.0	0.0
Cholesterol (mg/dl)[a]	113	7	80	4	96	21	112	15
Glucose (mg/dl)[c]	160	12	174	12	243	33	198	15
Triglycerides (mg/dl)[d]	54	9	41	6	104	76	214	128
Uric acid (mg/dl)	0.182	0.059	0.212	0.058	0.350	0.250	0.075	0.025
Alkaline phosphatase (I.U./liter)[e]	51	5	54	5	106	44	143	10
Gamma glutamyl transferase (I.U./liter)	9.88	0.83	8.81	1.46	8.50	3.50	8.75	1.25
Aspartate aminotransferase (I.U./liter)[b]	53	13	31	3	96	40	29	4
Alanine aminotransferase (I.U./liter)[c]	33	5	25	3	55	15	46	18
Lactate dehydrogenase (I.U./liter)	2,970	397	2,242	107	2,620	480	1,765	134
Calcium (mg/dl)[d]	9.47	0.16	9.71	0.15	10.45	0.85	10.42	0.24
Sodium (mmol/liter)	151.8	1.9	150.5	1.7	154.0	6.0	145.5	3.8
Chloride (mmol/liter)	115.6	1.8	115.4	1.5	118.0	3.0	112.5	3.0
Phosphorus (mg/dl)	4.51	0.34	4.39	0.34	6.25	1.35	5.10	0.52
Potassium (mmol/dl)	3.72	0.09	3.67	0.10	4.15	0.75	3.90	0.28

[a] Sex effect ($P < 0.05$).
[b] Sex effect ($P < 0.01$).
[c] Age effect ($P < 0.05$).
[d] Age effect ($P < 0.01$).
[e] Age effect ($P < 0.001$).

identical to that used with peccaries, and the hog's blood serum was assayed along with those of the peccaries. The peccary may have naturally higher levels of LD but this difference also may be related to the physiological stress of capture. According to Henry (1979, p. 365) a 2–40-fold elevation in LD levels can occur in those patients with severe shock. Preliminary analysis of data gathered from a group of captive peccaries has shown LD concentrations to decrease over time with repeated sampling, reaching values as low as 600 I.U./liter; thus, suggesting some degree of adaptation to handling stress occurred.

Levels of sodium and chloride were high among trapped peccaries in this study (Table 1), but appeared to be within the reported range for domestic swine (Tumbleson et al., 1972). Zervanos and Hadley (1973) demonstrated that sodium and chloride levels are elevated significantly when peccaries are maintained under dehydrated conditions. Slight dehydration might have occurred among trapped peccaries. Calcium and potassium levels in this study were similar to values reported by Zervanos and Hadley (1973) for collared peccaries on a prickly pear cactus diet (*Opuntia* spp.). Serum phosphorus levels were below those reported for domestic swine (Tumbleson et al., 1969). These lower levels of phosphorus may be attributable to diet quality. Varner et al. (1976) have reported summer phosphorus content of southern Texas prickly pear to be only 0.08% compared to an average of 0.20% phosphorus for eight forb species. Prickly pear is the primary food source of the collared peccary, often comprising 80 to 90% of the diet (Eddy, 1961; Everitt et al., 1981).

Sexual dimorphisms

There is general lack of sexual dimorphism in serum biochemical attributes in wild and domestic swine (Tumbleson et al., 1969; Williamson and Pelton, 1975). A similar observation was made among collared peccaries. Only cholesterol and AST concentrations varied significantly between males and females trapped from the Chaparrosa Ranch (Table 1). Cholesterol and AST levels were highest among females. Female swine are also known to exhibit higher levels of cholesterol than males (Tumbleson et al., 1969). The serum urea nitrogen/creatinine ratio and LD concentration showed a slight, but nonsignificant ($P < 0.06$) difference between male and female peccaries.

Age differences

Age differences in serum biochemical attributes among the animals trapped from the Chaparrosa Ranch were more evident than sexual dimorphisms. Juvenile peccaries had significantly lower concentrations of total protein and globulins, but had a higher A/G ratio than did adults (Table 1). There was a significant interaction between sex and age for these three protein measures, indicating that juvenile males differed significantly from adult male and female peccaries. Tumbleson et al. (1969) reported that serum total protein concentrations increased from 4–9 mo of age to a level of 7.5 g/dl in swine. Jakobsen and Moustgaard (1950) reported that serum globulin levels of growing swine resemble those of the adult at between 5 and 6 mo of age.

Age effects also were noted for concentrations of glucose, triglycerides, ALP, ALT, and calcium (Table 1). Juvenile peccaries had significantly higher levels of these constituents than did adult peccaries. Tumbleson et al. (1969) reported that levels of serum glucose do not change with age in swine. The higher ALP levels probably are associated with osteoblastic activity in the growing juveniles (Coles, 1974). Likewise, the higher calcium levels probably resulted, in part, from skeletal and associated development in juveniles.

TABLE 2. Effect of two immobilization techniques on serum biochemistry of adult collared peccaries collected from a single herd from southern Texas in March 1983.

Component assay	Capture method			
	Gunshot (n = 5)		Drugged (n = 9)	
	Mean	SE	Mean	SE
Total protein (g/dl)	8.26	0.32	8.77	0.26
Ablumin (g/dl)	3.38	0.21	3.53	0.14
Globulin (g/dl)	4.88	0.37	5.23	0.29
Albumin/globulin (ratio)	0.72	0.08	0.69	0.05
Serum urea nitrogen (mg/dl)[c]	6.80	1.32	18.33	2.44
Creatinine (mg/dl)	1.24	0.12	1.54	0.12
Serum urea nitrogen/creatinine (ratio)[c]	5.30	0.65	11.69	1.26
Total bilirubin (mg/dl)	0.120	0.020	0.100	0.000
Direct bilirubin (mg/dl)	0.020	0.020	0.011	0.011
Cholesterol (mg/dl)	112	7	143	13
Glucose (mg/dl)[b]	144	18	197	11
Triglycerides (mg/dl)	39	13	25	3
Uric acid (mg/dl)[b]	0.500	0.104	0.244	0.044
Alkaline phosphatase (I.U./liter)	60	6	45	6
Gamma glutamyl transferase (I.U./liter)	4.20	1.24	5.44	0.82
Aspartate aminotransferase (I.U./liter)	31	6	51	22
Alanine aminotransferase (I.U./liter)	30	11	37	6
Lactate dehydrogenase (I.U./liter)	1,415	195	1,726	178
Calcium (mg/dl)[d]	12.30	0.35	10.44	0.22
Sodium (mmol/liter)[a]	151.8	2.7	157.2	1.7
Chloride (mmol/liter)[c]	110.0	0.8	120.7	2.0
Phosphorus (mg/dl)	6.42	0.80	5.85	0.60
Potassium (mmol/liter)[d]	8.16	0.24	3.52	0.16
Cortisol (mg/dl)	5.53	1.51	10.02	1.85

[a] $P < 0.10$.
[b] $P < 0.05$.
[c] $P < 0.01$.
[d] $P < 0.001$.

Capture method effects

Method of capture was found to influence biochemical profiles of peccaries (Table 2). Concentration of serum urea nitrogen and the urea nitrogen/creatinine ratio were significantly higher among the trapped peccaries in comparison to those who were shot. Azotemia has been reported in stressed reindeer (*Rangifer tarandus*) (Hyvärinen et al., 1976; Rehbinder and Edgvist, 1981). The higher urea levels observed among trapped peccaries may have been due to a combination of state of hydration and circulating glucocorticoids which have a protein catabolic effect on muscle. However, although cortisol levels among trapped peccaries averaged twice as high as shot animals, this difference was not significant. The lack of any significant differences in serum enzyme levels (i.e., AST) between trapped and shot peccaries would suggest that muscular trauma contributed little to the observed azotemia. In fact, the hyperkalemic serum of gunshot animals (Table 2) suggested that tissue trauma effects were considerably more pronounced with this capture method.

Serum levels of glucose were significantly higher, while levels of uric acid were lower, among trapped peccaries. Glucose has been reported to increase initially with handling stress in bighorn sheep (*Ovis canadensis*) (Franzmann, 1972), white-tailed deer (*Odocoileus virginianus*) (Seal et al., 1972), and woodland caribou (*R. tarandus*) (Karns and Crichton, 1978). Concentrations of calcium were lower, and concentrations of chloride higher, among trapped peccaries than among gunshot animals. Sodium levels tended to be higher among trapped animals, but this difference was not significant. The higher chloride levels may have been due in part to slight dehydration. Elevated sodium levels have been demonstrated with handling stress on cattle (Gartner et al., 1965), reindeer (Hyvarinen et al., 1976), and woodland caribou (Karns and Crichton, 1978). Seal et al. (1972) did not find differences that could be attributed to handling stress in white-tailed deer calcium, potassium, or sodium concentrations.

The two areas which were sampled in this study varied considerably in habitat composition and rainfall received. Because rainfall has such a profound influence on forage nutritive quality in southern Texas, we did not attempt an analysis of seasonal influences on serum biochemistry. However, seasonal information should provide a better understanding of metabolic dynamics, hence, baseline blood values for this species in the wild.

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