TECHNICAL NOTE

Kenneth D. Kerr,[1] *B.S.*

Sex Identification of White-Tailed Deer Using Frozen Venison

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ABSTRACT: Fluids from frozen muscle tissue taken from 449 white-tailed deer (*Odocoileus virginianus*) were analyzed using a radioimmunoassay technique for testosterone. Comparing 309 deer sampled in early November, antlered males had significantly higher tissue testosterone levels (range = 0.18 to 16.00 ng/mL) than females (range = 0.00 to 0.18 ng/mL) while antlerless (fawn) males overlapped both groups (range = 0.00 to 0.68 ng/mL). Samples taken from 132 deer from January through August showed no differences among ages or sexes. Antlered males can be differentiated from females during the breeding season.

KEYWORDS: pathology and biology, deer, sex determination (animals), tissues (biology), testosterone, white-tailed deer, Minnesota

Many states, including Minnesota, have adopted a bucks only deer season which allows only antlered male deer to be taken with a regular firearms licence. This makes it necessary, at times, to be able to identify the sex of an animal for enforcement purposes when only packaged meat is available for testing. Many states hold deer hunting seasons during October or November or both when the circulating testosterone levels in male white-tailed deer (*Odocoileus virginianus*) increase markedly [*1*]; these high levels should be reflected in the tissues. Sex has been determined in several species of fish [*2*] and turtles [*3*] using hormone assays. This study was undertaken to determine the sex of frozen venison, for enforcement purposes, using radioimmunoassay (RIA) techniques.

Materials and Methods

Muscle tissue samples from 309 white-tailed deer killed by hunters were collected at deer check stations in Blackduck, Garrison, Hinckley, and Cotton, Minnesota during 3-6 Nov. 1984. The specimens collected at Blackduck and Hinckley were from animals harvested locally, while those collected at Cotton and Garrison represented larger areas of the state (Fig. 1). In addition, 132 samples were collected from deer killed by cars in southern Cook County, Minnesota (Fig. 1) from January through August 1984 to determine tissue testoster-

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[1]Medical technologist, Minnesota Department of Natural Resources, Forest Wildlife Populations and Research Group, Grand Rapids, MN.

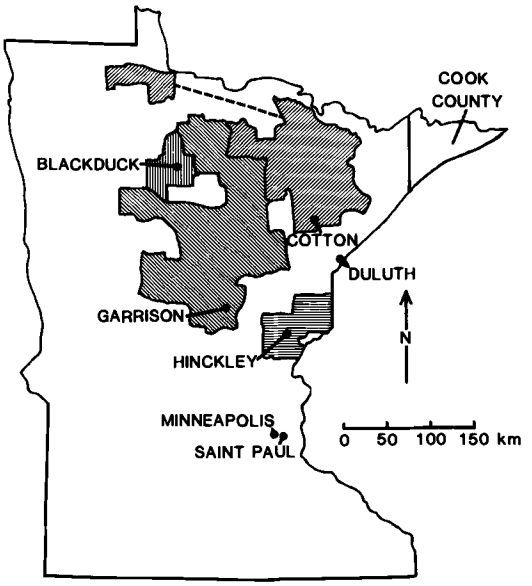

FIG. 1—*Map of Minnesota showing Cook County and the areas represented by each deer check station during the 1984 firearms deer season.*

one levels at other times of the year. Sex was determined at the check station by trained personnel using secondary sex characteristics. Deer were aged as fawns (0.5 to 1 year), yearlings (1 to 2 years), and adults (>2 years) by tooth eruption and replacement [*4*]. Samples of 2 to 15 g were taken from the exposed thigh muscle or abdominal wall, placed in WHIRL-PAKS® (Nasco Inc., 901 Janesville Ave., Fort Atkinson, WI 53538)[2], stored for three to four days at ambient temperature (−14 to 7°C), then frozen. The delay before freezing was to simulate the conditions to which the meat would normally be subjected. Before testing, the samples were thawed in the WHIRL-PAKS and fluids recovered, placed in stoppered 12- by 75-mm culture tubes, and refrozen until tested. Duplicate extracts were made from 26 meat samples which were held frozen for 6 months. These duplicates were assayed to compare with the original values to determine the stability of testosterone in frozen muscle tissue.

The tissue fluid samples were assayed for testosterone with a direct RIA procedure ("Coat-A-Count® Testosterone," Diagnostic Products Corporation, 5700 W. 96th St., Los Angeles, CA 90045). To make the procedure usable with deer muscle tissue fluids, 0.05-mL samples and aqueous standards were used. Counts were made on an Abbot LOGIC-201 gamma counter.

Assay data on the 26 duplicate extracts were statistically analyzed using a two sample *t*-test [*5*]. The November data set (309 samples) and the January–August data set (132 samples) were analyzed using the MANOVA procedure of SPSS [*6*]. The November data were transformed to ranks to eliminate unequal variances among the cells.

Results and Discussion

Testosterone levels of male deer in November (Table 1) were significantly higher (F = 454.7, $P < 0.001$) than those of females (Table 2) (Fig. 2). If samples were divided between

[2]The mention of tradenames does not constitute an endorsement of those products to the exclusion of others.

TABLE 1—*Muscle tissue fluid testosterone values (ng/mL) for male white-tailed deer collected during 3-6 Nov. 1984 at four Minnesota deer check stations.*

	Hinckley			All Other Locations		
Cohort	Mean ± 1 SD	Range	*N*	Mean ± 1 SD	Range	*N*
Male fawns	0.45 ± 0.25	0.01-0.67	8	0.19 ± 0.14	0.01-0.56	30
Male yearlings	3.30 ± 1.76	0.99-8.40	38	1.89 ± 1.29	0.18-7.70	73
Male adults	8.01 ± 4.04	0.88-16.00	15	3.01 ± 1.87	0.78-8.60	34

TABLE 2—*Muscle tissue fluid testosterone values (ng/mL) for female white-tailed deer collected during 3-6 Nov. 1984 at four Minnesota deer check stations.*

Cohort	Mean ± 1 SD	Range	*N*
Female fawns	0.05 ± 0.04	0.00-0.18	32
Female yearlings	0.04 ± 0.03	0.00-0.09	14
Female adults	0.05 ± 0.03	0.00-0.14	65
All females pooled	0.05 ± 0.03	0.00-0.18	111

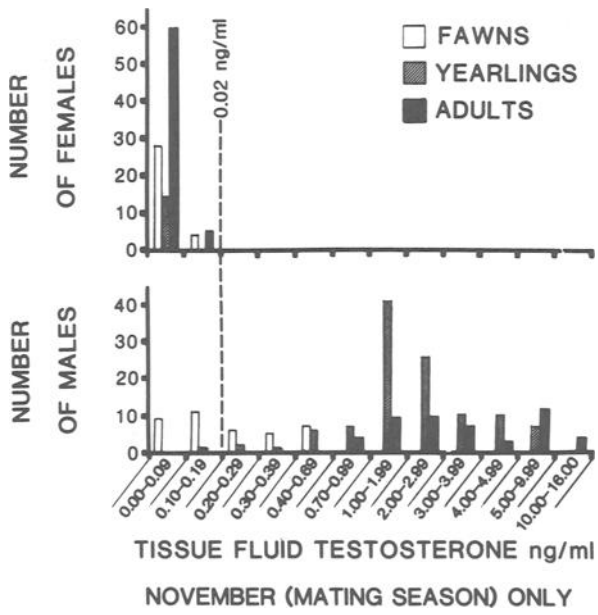

FIG. 2—*Distribution of deer meat samples collected in November grouped by testosterone, sex, and age with the vertical dotted line indicating a 0.020-ng/mL cutoff.*

antlered (yearling and adult males) and antlerless (all females and male fawns) deer, this difference should be even more pronounced. Testosterone values of males from Hinckley were substantially higher than those of the other areas (Table 1), but the sample design precluded significance testing. A significant difference occurred between sexes ($F = 199.7$, $P < 0.001$) with the Hinckley samples omitted.

Using 0.20-ng/mL tissue testosterone as the cutoff point between antlered and antlerless deer, only 1 of 160 antlered males collected in November would have been classified as antlerless. Also, 18 of 38 male fawns (47%) would have been classified as antlered. Values of male fawns overlapped values of females and yearling males, but not adult males (Fig. 2).

Comparison of 26 paired extracts made before and after 6 months showed no significant difference ($t = 0.54$, 23 d.f., $P = 0.59$) indicating that testosterone is stable in frozen meat for at least that long.

Testosterone values from deer killed from January through August did not differ significantly between sexes or ages (Fig. 3) (pooled $N = 132$, mean = 0.03, SD = 0.03, range = 0.00-0.13 ng/mL) indicating that this method cannot determine sex of deer outside the period of the breeding season.

Conclusion

Using the 0.20-ng/mL tissue testosterone as the cutoff point between antlered and antlerless deer, this technique determined meat samples were from antlered deer killed during early November with >99% accuracy, while 100% of all female deer and 53% of the male fawns were identified as antlerless. Because male fawns comprised about 20% of the antlerless deer harvested in Minnesota during the 1984 firearms season (MN DNR files), only 9% of the antlerless group would have been classified as antlered. Our data suggest geographic

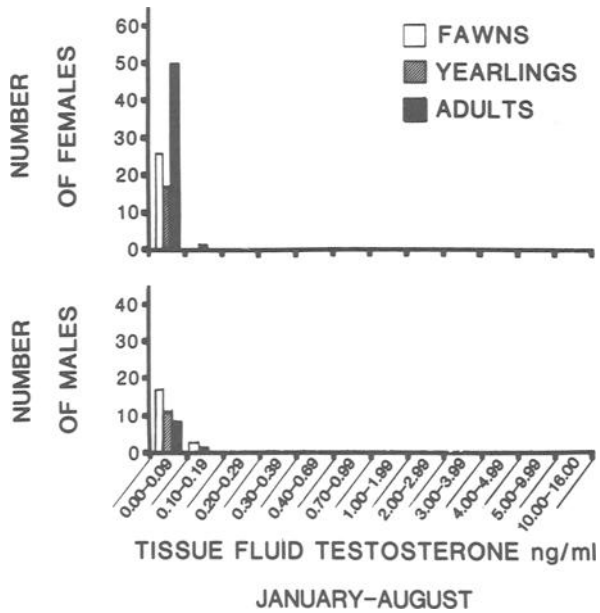

FIG. 3—*Distribution of deer meat samples collected January through August grouped by testosterone, sex, and age.*

differences, so the period and level of the testosterone peak should be determined for each area where this technique is to be applied.

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Address requests for reprints or additional information to
Kenneth D. Kerr
Forest Wildlife Populations and Research Group
Minnesota Department of Natural Resources
1201 E. Hwy. 2
Grand Rapids, MN 55744