Great Basin Naturalist

Volume 44 | Number 1 Article 23

1-31-1984

Fat depth at the xiphoid process—a rapid index to deer condition

Dennis D. Austin
Utah State University

FAT DEPTH AT THE XIPHOID PROCESS—A RAPID INDEX TO DEER CONDITION[1]

Dennis D. Austin[2]

ABSTRACT.— Measurement of the fat depth adjacent to the xiphoid process is described for mule deer. The index was determined sensitive to changes in physical condition of hunter-harvested mule deer.

Good physical condition of mule deer (*Odocoileus hemionus*) in fall is important to winter survival and optimal reproduction (Julander et al. 1961, Mautz 1978). Fat storage that reflects the annual nutritional cycle (Wallmo and Regelin 1981) peaks in fall (Anderson et al. 1972) and is a measure of summer habitat quality (Kistner et al. 1980). Although numerous carcass fat measurements have been reported (Anderson 1981), most require internal parts (not usually available from field-dressed deer at checking stations) and laboratory procedures and were designed for use with whole carcasses. At checking stations, where large samples can be collected, only eviscerated carcass weight and subcutaneous fat remain obtainable indexes. Although relatively few deer are needed for accurate mean eviscerated carcass weight (Anderson et al. 1972), weight appears a poor measure of condition because it is not correlated with other fat indexes used in assessments (Anderson et al. 1969).

Of various fat deposits, subcutaneous fat is deposited last and used first, and is only found on deer in good condition (Harris 1945). Thus, measurements of subcutaneous fat should be taken during the fall when physical condition is optimal (Mautz 1978, Wallmo and Regelin 1981). Measurement of back fat has been reported (Anderson et al. 1972), but requires skinning considerable portions of the rump. Experience in Utah has, understandably, shown most hunters unwilling to cooperate. Measurement of fat at the base of the sternum, which is often cut by hunters, is easy and presents no problem with hunter cooperation. This paper reports the use of this technique for hunter-harvested deer in late October.

Fig. 1. Slit through the xiphoid process and connective tissues.

METHODOLOGY

Eviscerated carcasses are slit to the base of the sternum and through the xiphoid process (xiphisternum), the posterior segment of the sternum usually being less than 5 cm in length (Fig. 1). Fat depth, determined with a clear rule and read to the nearest millimeter, is measured adjacent and perpendicular to the xiphoid process between the skin and the next tissue layer. The mean depth observed along 2–3 cm of the slit fat strip immediately below the junction of the xiphoid process and

[1]This study was supported by funds from the Pittman Robertson Act under Utah Division of Wildlife Resources Project W105R.

[2]Department of Range Science, Utah State University, Logan, Utah 84322.

Fig. 2.—Measurement of fat depth adjacent to the xiphoid process.

the sternum is recorded (Fig. 2). Often a thin layer (<1.0 mm) of flesh is observed between the fat layer and the xiphoid process and marks the boundary for the measurement. On other deer the cartilage of the xiphoid process is the boundary. Occasionally deer in excellent condition have two or three layers of fat and flesh. Layering is uncommon, however, and only the outer layer of fat is measured. Usually, fewer than 30 seconds is required for individual measurements.

Carcasses previously cut through the xiphoid process are more difficult to measure because of bloody coloration, dirt, tissue separation, expansion and dehydration, and difficulty in determining the fat segment corresponding to the xiphoid process. Nevertheless, the measurement is essentially the same with a fresh cut made across the fat layer to aid accuracy. It should be noted that, because of these difficulties, many such deer cannot be measured accurately and are excluded from the sample.

Measurement Precision

Measurement variation of different investigators was determined using eight trained personnel at a checking station. Fat depths of 25 deer ranging in age from ½ to 4½ years were measured. The xiphoid process and fat layer were cut only once and each observer measured the cut strip with individual rules. To eliminate between-observer bias, hand signals rather than vocal communication were used to relay measurements to the person recording. Results showed high precision for mean fat depths ranging from 1 to 10 mm, with 23 of 25 deer having standard deviations of less than 1.0 mm (Table 1). The 2–3-cm long fat strip in most deer is quite uniform in thickness. Occasionally, however, this strip is wedge shaped and varies several millimeters, as with deer 19 (Table 1), where the strip varied 5–12 mm. In such cases the mean is more difficult to determine.

During 1981 and 1982 two checking stations were run simultaneously at nearby locations. Deer checked at the stations were harvested from the same areas and herd (Utah deer unit 13—Vernon), and no differences would be expected between samples. Fat depths were measured by 2–3 observers at each station on bucks whose ages were determined on-site to be yearling, 2½, or 3½+ years. Results showed no significant differences ($P<.05$) between sites within age classes (Table 2). Indeed, with good sample numbers in the yearling age class, differences in mean depths between sites were less than .4 and .1 mm for 1981 and 1982, respectively.

Variability in Deposition

Variability in fat deposition within age classes increased with animal age (Table 3). For yearling bucks a mean standard deviation of 2.5 mm was determined, increasing to 2.7 mm for deer 2½ years, and 3.1 mm for older deer. Even though mean fat depth exhibited considerable change between years, the variability of the index showed little fluctuation, particularly in the yearling age class. At 90 percent probability of detecting differences ($P<.05$) between yearling age groups differing in fat depth by 1 mm, a sample size of about 55 is needed, and by 2 mm about 15.

Table 1. Variability of fat depth measurements (mm) between eight observers.

Deer No.	Sex	Age (years)	Mean	Range	SD
1	M	1½	7.25	6–8	0.71
2	M	1½	4.75	4–5	0.46
3	F	1½	5.63	5–6	0.52
4	M	1½	5.88	5–7	0.64
5	F	3½	8.38	7–9	0.74
6	M	1½	6.88	6–8	0.64
7	M	1½	4.88	4–5	0.35
8	M	1½	1.13	1–2	0.35
9	M	1½	7.63	6–9	1.15
10	M	1½	4.38	4–5	0.52
11	M	1½	7.38	6–8	0.74
12	M	1½	7.00	6–8	0.76
13	M	1½	4.50	4–5	0.53
14	M	2½	9.63	9–10	0.52
15	M	1½	5.13	5–6	0.35
16	M	1½	9.00	8–10	0.76
17	M	1½	5.88	5–8	0.99
18	M	½	1.75	1–2	0.46
19	M	1½	8.63	6–11	1.60
20	M	2½	9.63	9–10	0.52
21	M	1½	2.13	2–3	0.35
22	M	1½	4.50	4–5	0.53
23	M	1½	1.00	1	0
24	M	1½	2.25	2–3	0.46
25	F	3½	3.25	2–4	0.89

Generally, significant differences ($P<.05$) in fat depth occurred between age classes (Table 3). In all comparisons, yearlings and older deer were different and, in four of five comparisons, yearlings were different from deer 2½ years of age. In only three of five comparisons were deer 2½ and 3½+ years different. It would be expected, with adequate sample sizes, that most, if not all, age classes would differ significantly.

Changes in fat deposition between years (Table 3) were found to be significant for yearlings ($P<.05$). Fall 1980 was an exceptional year for fall forage, especially berry production, and was reflected in increased fat deposition that was significantly ($P<.05$) greater than that in 1981, a poor forage year. Differences ($P<.05$) were also determined between deer units (Table 3). Deer unit 13, with limited high-quality summer range, produced yearling deer having considerably less subcutaneous fat than deer from unit 23B (Current Creek), where summer range is extensive.

Discussion and Application

The increased variability of fat deposition of buck deer older than yearlings and the difficulty in obtaining those samples suggests the technique be directed primarily to yearlings. A suggested rating scale for yearling bucks is 0–2 mm fat depth as poor physical condition, 2–4 mm as fair, 4–6 mm as good, 6–8 mm as very good, and 8+ mm as excellent. Measurements taken on does and fawns

Table 2. Variability of fat depth measurements (mm) on buck deer taken from two sites on Utah deer unit 13 (Vernon).[1]

	1981						1982					
	Site 1			Site 2			Site 1			Site 2		
Age	N	$\bar{x}$	SD	N	$\bar{x}$	SD	N	$\bar{x}$	SD	N	$\bar{x}$	SD
1½	100	3.6	2.3	51	4.0	2.9	51	4.9	2.0	36	5.0	2.6
2½	9	6.3	2.3	13	7.5	2.5	6	5.2	3.2	6	7.0	4.3
3½+	8	7.8	3.4	5	9.6	2.6	2	14.0	1.4	0	—	—

[1]No significant differences ($P<.05$) between sites within age classes were found.

TABLE 3. Fat depth (mm) of buck deer by age class.

	Utah deer unit 13 (Vernon)								
	1980			1981			1982		
Age	N	x̄	SD	N	x̄	SD	N	x̄	SD
1½	41	5.3[anx1]	2.6	151	3.7[aox]	2.5	85	5.0[anx]	2.2
2½	6	10.7[bn]	2.5	22	7.0[bnx]	2.4	12	6.1[aox]	3.7
3½+	10	14.3[cnx]	3.6	13	8.5[box]	3.1	2	14.0[bnx]	1.4

	Utah deer unit 23B (Current Creek)								
	1980			1981			1982		
Age	N	x̄	SD	N	x̄	SD	N	x̄	SD
1½	23	7.9[any]	2.8	85	6.0[aoy]	2.5	69	6.0[aoy]	2.7
2½		no data		5	9.4[bny]	2.1	6	8.0[bnx]	2.8
3½+	5	15.6[bnx]	5.4	11	14.0[bny]	4.6	4	14.0[cnx]	6.3

[1]Differences ($P<.05$) between age classes within years and units are denoted by letters a,b,c; differences between years within age classes and units are indicated by letters n,o; and differences between units within years and age classes are indicated by letters x,y.

would also be expected to yield good results where samples are adequate. Moreover, sample sizes for does and fawns may be smaller than those needed for bucks because of the nonsynchronous rutting behavior that increases fat depth variability of bucks (Kistner et al. 1980).

Use of this index could detect annual changes in late summer-fall forage conditions as they affect the deer population's physical condition. Differences between units could serve as a comparison for adequacy of summer ranges. Fluctuations in the deer population and corresponding changes in fat deposition could be correlated with the forage resource, thereby providing a measure of balance between population size and forage resources. Data could also be used to adjust harvest and to avoid possible excessive winter losses during years when physical condition in fall is determined to be poor and population is high.

LITERATURE CITED

ANDERSON, A. E. 1981. Morphological and physiological characteristics. Chap. 2, pages 27–97 *in* Mule and Black-tailed deer of North America. Wildlife Management Institute Book, Univ. of Nebraska Press, Lincoln. 605 pp.

ANDERSON, A. E., D. E. MEDIN, AND D. C. BOWDEN. 1972. Indices of carcass fat in a Colorado mule deer population. J. Range Manage. 36:579–594.

ANDERSON, A. E., D. E. MEDIN, AND D. P. OCHS. 1969. Relationships of carcass fat indices in 18 wintering mule deer. Proc. West. Assoc. State Game and Fish Comm. 49:329–340.

HARRIS, D. 1945. Symptoms of malnutrition in deer. J. Wildl. Manage. 9:319–322.

JULANDER, O., W. L. ROBINETTE, AND D. A. JONES. 1961. Relation of summer range condition to mule deer herd productivity. J. Wildl. Manage. 25:55–60.

KISTNER, T. P., C. E. TRAINER, AND N. A. HARTMANN. 1980. A field technique for evaluating physical condition of deer. Wildl. Soc. Bull. 8:11–17.

MAUTZ, W. W. 1978. Sledding on a bushy hillside: the fat cycle in deer. Wildl. Soc. Bull. 6:88–90.

WALLMO, O. C., AND W. L. REGELIN. 1981. Rocky Mountain and Intermountain habitats: food habits and nutrition. Chap. 10, Part 1, pages 387–398 *in* Mule and Black-tailed Deer of North America. Wildlife Management Institute Book, Univ. of Nebraska Press, Lincoln. 605 pp.