SEASONAL VARIATION IN FOOD CONSUMPTION AND WEIGHT GAIN IN MALE AND FEMALE WHITE-TAILED DEER

By JAMES F. FOWLER
Graduate Assistant
Louisiana State University

JOHN D. NEWSOM, Leader
Louisiana Cooperative Wildlife, Research Unit
Baton Rouge, Louisiana

and

HENRY L. SHORT
Wildlife Biologist, Forest Service, USDA
Nacogdoches, Texas

ABSTRACT

Feeding trials, in which ten white-tailed deer fawns, five bucks and five does, were fed a balanced ration, were conducted over an 18-month period. The commercially available ration which contained not less than 13.0 per cent protein or 2.0 percent crude fat and not more than 9.5 percent crude fiber or 4.8 percent minerals was fed *ad libitum*. Daily food consumption of each deer was recorded to the nearest ounce and weight of each deer was determined at weekly intervals to the nearest pound.

Analysis of the data indicated that seasonal variation in food consumption and body weight of the experimental deer was statistically significant at the one percent level of probability. Sex by season interaction in food consumption was highly significant. Buck deer averaged 10 percent weight loss and doe deer averaged a three percent weight loss during the second winter of the study.

Decrease in food consumption and corresponding weight loss during the winter seem to be associated with the physiological changes which occur in sexually mature white-tailed deer during the breeding season.

INTRODUCTION

The effect of white-tailed deer (*Odocoileus virginianus*) on their environment has been the subject of much research in the past. It has been difficult to evaluate the effect of various management practices on deer populations and the balance between deer populations and available food. Physical condition of harvested deer has been widely used as an indicator of food availability.

While conducting feeding experiments Gerstell (1937), Nichol (1938), Davenport (1939), McBeath (1941), French (*et al.*, 1955), and McEwen (*et al.*, 1957) found evidence of seasonal changes in food consumption and body weight of white-tailed deer. Studies to determine nutritional needs and physical condition of deer at the Pennsylvania Agricultural Experiment Station have shown a distinct correlation between food consumption and body weight in captive northern white-tailed deer (Long *et al.*, 1965). Sexually mature white-tailed deer were found to exhibit a voluntary food restriction that in general occurred at the time when natural foods were least available. Food consumption in sexually immature deer increased as body weight increased, without regard to the season of the year.

Northern and southern white-tailed deer are confronted with major environmental differences. Northern white-tailed deer face a climatic environment of mild summers and severe winters. Vegetation is physically and metabolically available to northern deer in spring and summer, then decreases rapidly in availability and palatability during the fall and winter. The environment of the southern white-tailed deer consists of severe summer weather of a high ambient temperatures and mild winters

but with the problem of a shortage of vegetation metabolically available to deer in winter.

The objectives of this research were threefold:

(1) To determine if there is a seasonal variation throughout an annual period in food consumption and body weight of penned southern white-tailed deer, fed a balanced ration.

(2) To determine if there is a variation between sexes in the rate of food consumption or in weight changes, at the different seasons.

(3) To evaluate the importance of any determined variation in the design of future forage and habitat evaluation experiments.

PROCEDURES

During the summer and fall of 1965, spotted fawns were obtained from various sections of Louisiana and bottle-fed a ration consisting of half evaporated milk and half water. Fawns were full fed three times daily. Feeding was restricted to twice daily as the fawns began taking solid food. During the late stages of bottle feeding their diet was supplemented with a pelleted ration "Calf Starter," produced by Ralston-Purina Company. Bottle feeding was continued until September 14, at which time all fawns were placed on solid food.

Seven fawns were stricken with diarrhea during the bottle-feeding period. Four ounces of kaopectate with two teaspoons of tetracycline hydrochloride were added to 12 ounces of milk for treatment of diarrhea. When the condition persisted, two cc injections of penicillin and streptomycin, in a commercially prepared antibiotic formulation "Combiotic," were given daily in addition to the kaopectate and tetracycline hydrochloride until the animals recovered.

Experimental animals were moved into the experimental pens on October 15, 1965. Individual animals were restricted in square pens, containing 144 square feet of floor space, and built of heavy gauge poultry wire and creosoted posts. The poultry wire proved inadequate when male deer developed antlers and was reinforced with heavy gauge hog wire. Pens were arranged side by side, five pens in a row, with two rows of pens spaced three feet apart. The floor of each pen was covered with three-inch layers of gravel and sand. Tops of the pens were covered by a sheet metal roof to shelter the deer and protect the food. One door, 34 inches in width, was provided on each pen. This allowed easy passage by a man or deer into and out of the pen, and at the same time could be used to block the aisle and allow movement of the captive deer onto a portable weighing cage affixed to a platform balance scale.

Feeding trials were initiated December 1, 1965, using five male and four female fawns. A fifth female fawn was included into the experiment on January 12, 1966. Food provided to the deer, "Purina Creep Chow," produced by Ralston-Purina Company, is a ration judged to be adequate in protein, energy, and micro-nutrients (Table I). The ration was in pelleted form, which increased palatability and ease of sampling, and minimized waste.

Food was offered to the test deer *ad libitum* from buckets placed in mangers to prevent spillage. Food was weighed daily on a "Pelouze," feed scale to the nearest ounce. Fresh water was provided daily. Deer were weighed weekly by forcing them down the aisle between the pens onto the portable weighing platform.

Parasite loads of the experimental deer were checked at three different intervals to determine if conditions in the pens were sanitary. The method used for this determination was a qualitative concentration method of fecal examination using a modification of the Sheather's Sugar Flotation Technique developed by Dr. Francis R. Bilkovich in the LSU Veterinary Science Department.

Data were analyzed with an analysis of variance program utilizing facilities of the LSU Computer Research Center. Differences in food consumption and weight changes were tested between sex, sex and season,

TABLE I — EXPERIMENTAL RATION, "PURINA CREEP CHOW," COMPONENTS WITH MANUFACTURER'S GUARANTEED ANALYSIS.

Ration Components	Guaranteed Analysis
Soybean Meal	Crude Protein = 13.0%
Cottonseed Meal	Crude Fat = 2.0%
Ground Yellow Corn	Crude Fiber = 9.5%
Ground Grain Sorghums	Minerals = 4.8%
Dehydrated Alfalfa Meal	
Alfalfa Meal	
Wheat Middlings	
Cane Molasses	
Rice Bran	
Calcium Carbonate	
Iodized Salt	
Iron Oxide	
Manganese Sulfate	
Manganous Oxide	
Copper Oxide	
Cobalt Oxide	
Zinc Oxide	

and season for significance. Months constituting seasons were December through February as winter, March through May as spring, June through August as summer, and September through November as fall.

RESULTS

Fawns reared on the ration of half evaporated milk and half water supplemented with Calf Starter were healthy individuals which proved to be satisfactory as experimental animals. Methods used for treatment of diarrhea in young fawns were successful in controlling this condition.

Sand and gravel placed in the pens eliminated wastes from the deer by allowing it to work down below the ground surface of the pens. This technique provided adequate sanitation and eliminated the unnecessary activity of cleaning the pens.

Troublesome parasite loads did not develop in the experimental animals (Table II).

TABLE II — PARASITE LOADS OF DEER DURING JULY AND AUGUST, 1966.

	MALES			FEMALES		
Date	Deer Number	Number of Ova	Parasite	Deer Number	Number of Ova	Parasite
July 1	1.	Negative		6.	Negative	
"	2.	Negative		7.	Negative	
"	3.	172	*Haemonchus, Cooperia*	8.	10	*Haemonchus*
"	4.	Negative		9.	1	*Haemonchus*
"	5.	Negative		10.	Negative	
July 21	1.	Negative		6.	Negative	
"	2.	Negative		7.	Negative	
"	3.	Negative		8.	Negative	
"	4.	2	*Cooperia*	9.	Negative	
"	5.	Negative		10.	1	*Cooperia*
Aug. 10	1.	Negative		6.	Negative	
"	2.	Negative		7.	1	*Haemonchus*
"	3.	Negative		8.	Negative	
"	4.	Negative		9.	Negative	
"	5.	Negative		10.	14	*Trichuris*

Experimental deer adjusted well to the experimental ration. Growth and development exceeded that of animals under wild conditions in Louisiana. Computed live weights of deer killed on Louisiana game management areas during the 1964 and 1965 seasons averaged 116 pounds (53 kg) for 1½-year-old bucks (Dennet, 1966), whereas experimental bucks averaged 141 pounds (64 kg) at this age.

During the first winter and spring of the study, food consumption and weight gains progressively increased. Average food consumption during the first winter for bucks was 2.8 lb/100 lb (28 g/kg) body weight; average food consumption for does was 3.1 lb/100 lb (31 g/kg) body weight. Average food consumption for bucks and does during the first spring was 3.0 lb/100 lb (30 g/kg) and 3.1 lb/100 lb (31 g/kg) body weight, respectively. During summer 1966, daily food consumption fell slightly to 2.4 lb/100 lb (24 g/kg) body weight for bucks and 2.5 lb/100 lb (25 g/kg) body weight for does, but all animals continued to gain weight (Table III). During this period, experimental animals restricted their activities.

TABLE III — FOOD CONSUMPTION AND WEIGHT CHANGE OF FIVE MALE AND FIVE FEMALE WHITE-TAIL DEER. DATA RECORDED FROM DECEMBER 1965 (FIVE-MO. OLD) TO MAY 1967 (23-MO. OLD).

Month	Average Food Consumption g food/kg body wt ± SE		Average Body Weight kg ± SE	
	Bucks	Does	Bucks	Does
Dec. 1965	24 ± 1.3	24 ± 2.4	30 ± 2.7	22 ± 1.1
Jan. 1966	26 ± 1.4	31 ± 3.2	30 ± 2.6	23 ± 0.5
Feb. 1966	25 ± 0.5	30 ± 3.8	33 ± 2.6	23 ± 0.6
Mar. 1966	28 ± 0.9	32 ± 7.3	36 ± 2.8	26 ± 1.1
Apr. 1966	33 ± 1.4	32 ± 2.6	41 ± 2.5	30 ± 1.0
May 1966	30 ± 0.7	28 ± 7.3	45 ± 2.0	32 ± 1.1
June 1966	27 ± 2.2	27 ± 1.0	52 ± 2.8	35 ± 1.6
July 1966	25 ± 1.3	25 ± 0.9	56 ± 3.0	37 ± 1.7
Aug. 1966	21 ± 1.9	21 ± 1.2	60 ± 3.2	38 ± 1.9
Sept. 1966	25 ± 1.3	28 ± 1.4	63 ± 2.8	40 ± 1.9
Oct. 1966	22 ± 1.6	27 ± 0.9	64 ± 3.0	42 ± 2.1
Nov. 1966	15 ± 0.8	22 ± 0.9	63 ± 0.8	44 ± 2.4
Dec. 1966	17 ± 1.3	20 ± 1.1	60 ± 3.5	43 ± 2.5
Jan. 1967	20 ± 1.3	17 ± 0.5	56 ± 4.1	43 ± 2.5
Feb. 1967	20 ± 0.3	19 ± 1.1	57 ± 2.9	42 ± 2.2
Mar. 1967	21 ± 0.8	18 ± 1.4	58 ± 0.9	42 ± 2.1
Apr. 1967	24 ± 1.0	22 ± 1.1	62 ± 3.1	44 ± 1.9
May 1967	24 ± 1.2	22 ± 1.0	67 ± 3.0	46 ± 1.8

Antler development in the bucks started during May and continued until September 14, when they were mature and the last buck had shed the velvet. Antler development at age 1½ averaged 5.5 points which is much higher than that of bucks of similar age class in the wild.

Food consumption and weight gain of experimental animals increased steadily during the second fall. Average weight of bucks reached a high of 141 lb (64 kg) during October, 1966. Weight and food consumption in bucks dropped sharply in November. Does did not restrict food consumption and lost weight until December. The decrease was slight in comparison to bucks. Does reached their highest average weight of 96 lb (44 kg) during November, 1966.

Bucks and does showed definite signs of the rut during October and November. Bucks became difficult to handle and does became restless. Antlers of the bucks were removed for safety in handling. None of the experimental animals were allowed to breed during this first breeding season.

Food consumption during the second winter of the study was 1.9 lb/100 lb (19 g/kg) body weight for bucks and 2.1 lb/100 lb (21 g/kg)

body weight for does. Average weight of bucks and does declined to a low of 126 and 93 lb (58 and 42 kg), respectively, during February. Bucks averaged a 10-percent loss in weight. One buck lost 16 percent of his maximum weight from 164 lb (75 kg) to 138 lb (63 kg). Does averaged a three percent loss in weight.

Rapid increases in food consumption and weight occurred with the beginning of spring. By the end of May, bucks had increased their food consumption to 2.4 lb/100 lb (24 g/kg) body weight, and their average weight had increased to 148 lb (62 kg). The buck which had lost 16 percent of his body weight had increased from 138 lb (63 kg) to 169 lb (70 kg). Food consumption for does had increased to 2.2 lb/100 lb (21 g/kg) body weight, and their average weight had increased to 101 lb (44 kg).

Seasonal variation in food consumption and weight gains for bucks and does is graphically demonstrated in Figures 1 and 2.

Analysis of variance of differences in food consumption between bucks and does was found to be highly significant throughout the study (Table IV). Variation in food consumption was more significant during

TABLE IV — ANALYSIS OF VARIANCE OF FOOD CONSUMPTION DATA FOR THE ENTIRE STUDY.

Source of variation	Degrees of freedom	Sum of squares	Mean square	F
Sex	1	6.22	6.22	23.92**
Season	5	116.85	23.37	89.88**
Sex and Season	5	21.37	4.27	16.42**
Error (.26)	703			

** Satistically significant at the one percent level of probability.

November and December, 1966, and January and February, 1967 (Table III). Difference in weight of bucks and does was also found to be highly significant throughout the study (Table V). Significant changes in

TABLE V — ANALYSIS OF VARIANCE OF WEIGHT DATA FOR THE ENTIRE STUDY.

Source of variation	Degrees of freedom	Sum of squares	Mean square	F
Sex	1	42,015.11	42,015.11	504.21**
Season	5	68,272.34	13,654.47	163.86**
Sex and Season	5	4,265.18	853.04	10.24**
Error (83.33)	703			

** Satistically significant at the one percent level of probability.

weight occurred during December, 1966, and January, February, and March, 1967 (Table III).

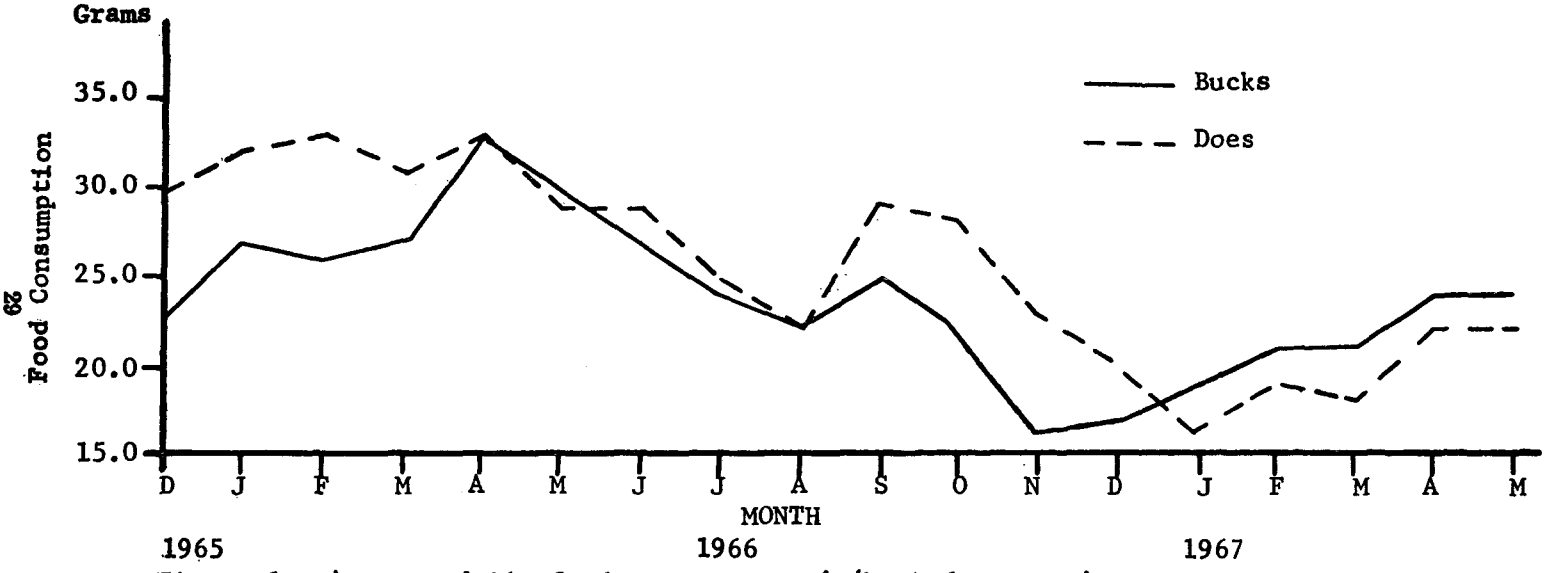

Figure 1. Average daily food consumption (g/kg body weight) for bucks and does.

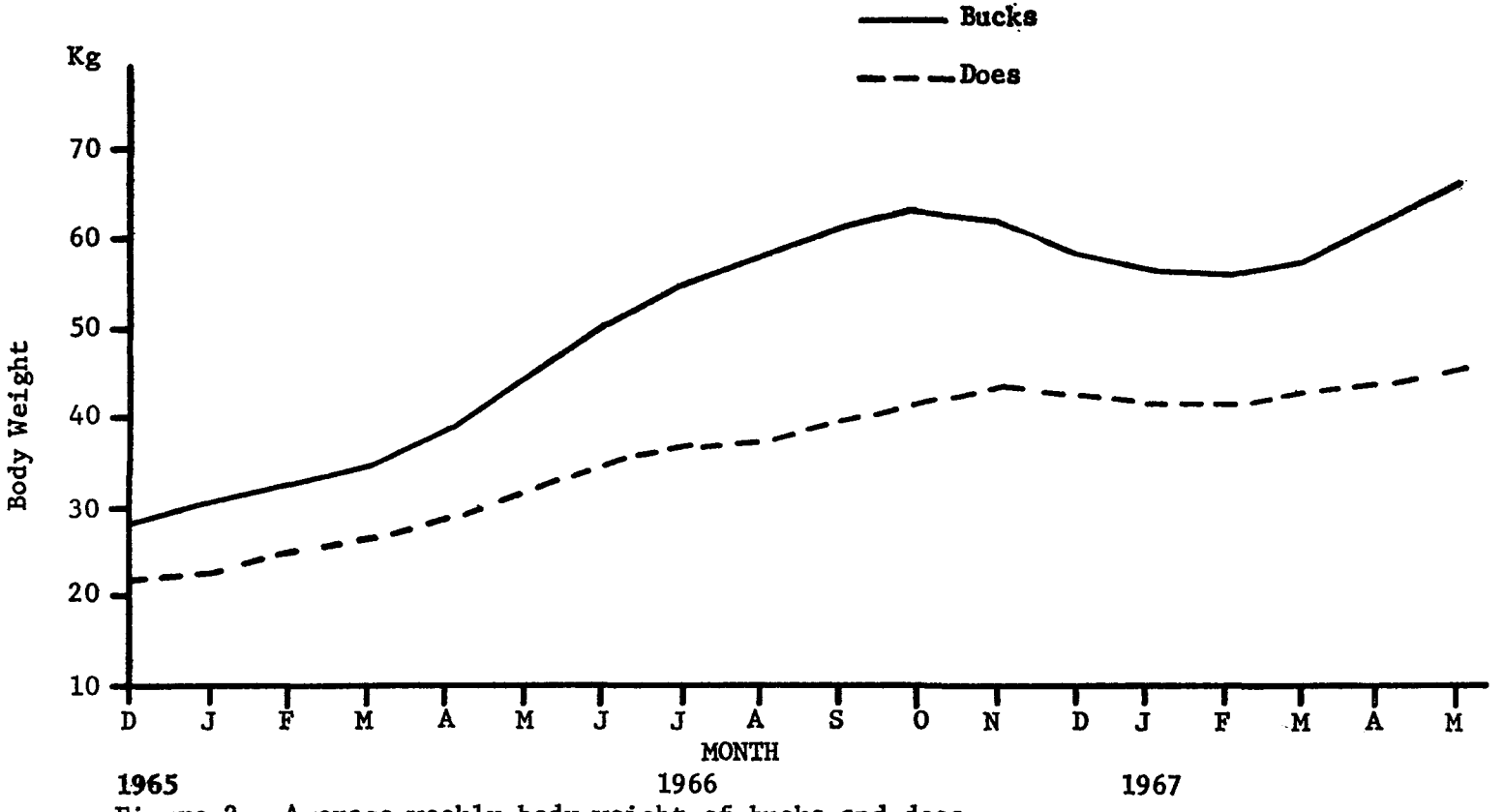

Figure 2. Average weekly body weight of bucks and does.

CONCLUSIONS

During the first winter and spring, food consumption and weight of fawns increased steadily. Food consumption decreased slightly through the summer and reached a low in August, but weight gains remained constant. Food consumption increased again in the fall and reached a peak during September for bucks and November for does. Bucks continued to increase in weight through October and does increased in weight through November. Food consumption decreased during the late fall and early winter of the second year to a low during November in bucks and January in does. Weight steadily decreased from November to March in bucks and from December to February in does. During the second spring, food consumption and body weight of bucks and does increased to a high during May, when this portion of the study terminated.

A distinct correlation between food consumption and weight change occurred during the different seasons of the year in both male and female white-tailed deer. Food consumption and weight change occurred at the time when natural food was least available. Data obtained in this study indicate that loss of weight in sexually mature white-tailed deer during the winter months may be associated with their sex cycle.

An analysis of variance was run on food consumption and weight data of the experimental deer. Differences in food consumption and weight gains of bucks and does were highly significant between sex and season, and season for the entire study. Sex by season interaction in food consumption was highly significant.

Buck deer go through severe physiological changes from a practically sexless animal in the summer all the way through stages of adolescence, to puberty, to sexual maturity, and all the way back again to sexlessless in the course of a year's time (Cowan, 1962). Doe deer are confronted with a similar problem but for only short duration, at which time they are usually bred and the sex cycle stops. Voluntary decrease in food consumption and the corresponding weight loss, seems to be associated with these sexual changes.

Captive sexually mature white-tailed deer did not maintain body weight during winter months when fed a balanced ration *ad libitum*. This suggests the possibility that wild deer may also demonstrate a similar reaction during this same period. Under these conditions, it appears that sexually mature deer may be able to maintain themselves on relatively smaller quantities of food than immature deer.

LITERATURE CITED

Cowan, Ian McTaggart. 1962. Proceedings of 1st national white-tailed deer disease symposium. Univ. Georgia, Athens, Ga. 8 p.

Davenport, L. A. 1939. Results of deer feeding experiments at Cusino, Michigan. Trans. Fourth N. Amer. Wildl. Conf. 268-274.

Dennet, Dan. 1966. Deer investigations, p. 112-115. *In* 11th Biennial Report, 1964-1965. Louisiana Wild Life and Fisheries Comm., New Orleans, La.

French, C. E., L. C. McEwen, N. D. Magruder, R. H. Ingram and R. W. Swift. 1955. Nutritional requirements of white-tailed deer for growth and antler development. Pennsylvania Agr. Exp. Sta. Bull. 600P. 8 p.

Long, T. A., R. L. Cowan, G. D. Strawn, R. S. Wetzel, and R. C. Miller. 1965. Seasonal fluctuations in feed consumption of the white-tailed deer. Penn. Agr. Exp. Sta. Progress Report 262. 5 p.

McBeath, Donald. 1941. White-tailed traps and tags. Mich. Conservation 10(11):6-7, 11; 10(12):6-7.

McEwen, L. C., C. E. French, N. D. Magruder, R. W. Swift and R. H. Ingram. 1957. Nutrient requirements of the white-tail deer. Trans. North American Wildl. Conf. 22:119-132.

Nichol. 1938. Experimental feeding of deer. Univ. Arizona, College Agric., Agric. Exp. Sta., Tech. Bull. 75:1-39.