A PARTIAL NUTRITIONAL ANALYSIS OF WILD TURKEY HEN DIETS IN SPRINGTIME[1]

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Abstract: A partial nutritional analysis of the springtime diets in 1975 and 1976 of 40 Rio Grande turkey *(Meleagris gallopavo intermedia)* hens from southern Texas suggested they fulfilled their nutritional needs by a progressive shift in food use from forb leaves to forb fruits and seeds to animal matter to grass seeds during 5 equally-time-spaced sampling dates. It was apparent in this area that the approximately 14% protein, 2% calcium, and 0.75% phosphorus requirements for breeding turkeys could only be met by a diet composed primarily of animal matter. However, management to enhance the abundance of selected, high quality forbs could provide the absolute, minimal requirements and relieve the dependence on a potentially undependable animal food supply.

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Reproductive success of the Rio Grande turkey in Texas has fluctuated drastically from year to year, depending on annual rainfall patterns (Thomas and Green 1957, DeArment 1959). Beasom (1973) found that turkey production in south Texas was positively correlated with years of abundant rainfall (especially during the previous fall) and that a high proportion of hens failed to evidence normal gonadal development during drought years. This apparent disruption of the annual gonadal cycle may relate to low rainfall and a subsequent reduction in the quality and/or quantity of food.

Nutrition plays a critical role in reproductive processes. A diet inadequate in such essential nutrients as protein, calcium, or phosphorus could prevent turkey hens from successfully laying (Norris and Scott 1967) or at least delay the onset of laying (Gerstell 1942). Either factor could be critical to net productivity since Beasom (1973) found that the most successful years in south Texas were characterized by earlier initiation of laying and fewer unsuccessful hens. With the exception of phosphorus, Beck and Beck (1955) felt the diet of turkeys on the King Ranch in south Texas was adequate for breeding during years of normal rainfall, but in drought years insufficient amounts of other nutrients might occur and subsequently depress reproductive success. Pattee and Beasom (1979) found that increasing the nutritional plane of turkey hens in south Texas in the spring by providing a commercial turkey breeder ration could increase poult production by more than 200% in relatively dry years. The purpose of the present study was to

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determine general nutritional quality of those natural foods used by wild turkey hens during the breeding season.

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METHODS

The study area comprised approximately 10,000 ha of the Encino Division of the King Ranch in Brooks and Kenedy counties, Texas. This research was part of another study (Pattee and Beasom 1979) which examined the effects of supplemental feeding on turkey reproduction.

Food habits data were obtained by examining crop contents (Beck and Beck 1955, Korschgen 1971) from 4 hens collected approximately every 22 days from 16 February to 16 May in 1975 and 1976. Data from the 2 years were combined resulting in a sample size of 8 birds for each of the 5 sample periods. Crop contents were air-dried and stored in paper bags for later analysis. Crop contents were classified by species for plants and by order for animal matter. Separated contents were weighed, combined by collection period, and converted to percent by weight.

Simulated diets (as determined from the food items in the crops of the birds collected each sample date) were compiled within 3 days of each bird collection date. Only those plant parts, insect life forms, or growth stages utilized by the turkeys during a particular period were included. A composite for each food item over all collection periods in which it was utilized was maintained because variance in nutritive quality between periods previously was determined to be insignificant (Pattee 1977). All samples were sorted by taxon, frozen to stop biological activity, air-dried, and stored in paper bags.

After air-drying 1 - 6 months, samples were ground in an intermediate Wiley mill with a 40-mesh screen and stored individually. Ground samples were dried in an oven at 75C for 24 - 48 hours and stored in a dessicator until analyzed. Crude protein was determined using a modified micro-Kjeldahl procedure (Horwitz 1975). Calcium and phosphorus content were determined on a Spectronic 70 at 425 μ using the orthophosphate procedure for phosphorus and the ammonium oxalate procedure for calcium (Hall and Hacskaylo 1963).

The relative contribution of each food item to the total crude protein, calcium, and phosphorus content of the diet was assessed by multiplying its percent nutrient content (determined from hand-picked samples) by its relative composition (by dry weight) in the turkey crops (Pattee 1977). Unidentified items were necessarily omitted from this analysis because of unknown nutritional value. This omission was considered unimportant, however, because no single "unknown" occurred in more than trace (0.01%) amounts. Similar nutritional analyses were performed for each sample date on a composite of all food items in the crops. These values then were compared to the total calculated nutritional values for the simulated diets.

RESULTS

Plant parts comprised 48 to 98% of the turkey hen's spring diet with the balance principally comprised of animal matter (Table 1). Green vegetation comprised the bulk of the diet in February but declined steadily through the remainder of the spring. Fruits and seeds (primarily from forbs in the first 3 and grasses in the last 2 periods) were important food sources throughout the study. Insects and snails contributed substantially to the diet in mid spring, particularly in late April when they comprised approximately 52% of the total biomass.

Table 1. Relative composition (% by weight) of general foods to the diet of 40 Rio Grande turkey hens equally represented across 5 sample periods in 1975 and 1976.

Food items	Feb 16	Mar 10	Apr 1	Apr 24	May 16
Fruits and seeds	41.6	73.3	61.9	46.8	86.5
Green vegetation	56.3	22.2	16.3	1.1	0.1
Insects	1.6	4.4	15.3	29.3	13.5
Snails	0.0	0.1	6.4	22.8	tr[a]

[1] tr = less than 0.1% by weight.

Total crude protein of the turkey crop contents was approximately 20% from mid February through early April; it elevated to about 24% in late April and declined to 16% by mid May (Table 2). Calcium values fluctuated from around 1% in mid February to mid March to 2% in early April and nearly 6% in late April then dropped to about 0.1% in mid May. Phosphorus values ranged from 0.26 to 0.39% throughout the study. Hand-picked, composite samples of the foods in the crops were approximately 10 to 20% lower in crude protein than the crop contents except in May when they were about 9% higher. Conversely, calcium values were similar for the actual and hand-picked foods in all sample periods, and phosphorus values were similar except in April when the hand-picked samples were approximately 25% lower.

Table 2. Comparison of the total intake by Rio Grande turkey hens of 3 selected nutrients as determined from actual (crop samples) and simulated (hand-picked) springtime diets containing the same food items.

Sample	% Crude protein		% Calcium		% Phosphorus	
date	Actual	Simulated	Actual	Simulated	Actual	Simulated
16 Feb	19.3	16.5	1.45	1.31	0.26	0.28
10 Mar	18.6	16.6	0.80	0.91	0.30	0.25
1 Apr	20.9	15.3	1.95	1.98	0.34	0.23
24 Apr	24.5	22.6	5.75	5.19	0.39	0.29
16 May	15.7	16.8	0.10	0.14	0.28	0.25

Plant parts provided the bulk of the crude protein intake of the birds through early April whereas animal matter provided 50 to 80% of this nutrient from late April to mid May (Table 3). Beetles and grasshoppers accounted for 39 to 68% of the crude protein intake from early April to mid May. Green vegetation, mostly forbs, was an important protein source early in the study period. Similarly, forb fruits and seeds were important protein sources until May when grass seeds predominated in importance among the plant foods.

Calcium was provided almost entirely by fruits, seeds, and green forbs in February and March. Their importance subsided in early April when whole snails and empty snail shells provided 59% of the calcium intake. This source accounted for 94% of the turkey calcium intake in late April. By mid May their intake subsided markedly, and grass seeds supplied 75% of that nutrient.

The fruiting and vegative parts of forbs provided from 80 to 94% of the total phosphorus intake in February and March. By early April these items and animal matter each contributed about 40%, and by late April 80% of the phosphorus utilized orginated from animal matter. As with the other nutrients, grass seeds were an important source of phosphorus my mid May, supplying about 59% of the intake of that element, but insects still contributed 34%.

DISCUSSION

The general food habits of Encino turkey hens was similar to those of turkeys elsewhere (Good and Webb 1940, Dalke et al. 1942, Kozicky 1942, Scott and Boeker 1973) except that they utilized more insects. The lack of insect availability data precludes an assessment of this difference. Examining food quality appears to add refinement to traditional wild turkey food habits studies. Items which comprise a large proportion of biomass in the diet may be over emphasized if they are relatively low in nutritional value, and the converse may apply to relatively uncommon but highly nutritious dietary items. For example, vegetation and animal matter each comprised about 50% of the biomass consumed by the turkeys in late April, but animal matter contributed 80, 95, and 82% of the respective crude protein, calcium, and phosphorus intake.

Further, an examination of food quality provides insight into whether a diet meets nutritional needs of an animal. A diet containing 14% protein, 2.25% calcium, and 0.75% phosphorus is considered necessary for breeding domestic turkeys (National Research Council 1971). If the nutritional needs for wild turkeys are similar, these data provide an opportunity to evaluate the adequacy of the diet for breeding in these birds. Although crude protein intake of these turkeys was in excess of 14% throughout this study, the digestibility of forbs and grasses rarely exceeds 60% (Fraps 1946) which would reduce available protein. Assuming this general level of plant digestibility and 100% for animal foods, the wild turkey hen diets contained about 12% available protein in February, March, and May and 16 to 23% in April. It appears that these birds would not acquire adequate protein intake for breeding without animal matter, principally in the form of insects. Similarly, calcium needs apparently were met only in April by the high intake of snails and snail shells. Phosphorus intake approached recommended levels only in

Table 3. Relative contribution (% of total) of the most important hand-picked food items to the total simulated diet of 3 nutrients by Rio Grande turkey hens during 5 springtime sample periods, 1975 and 1976. Subtotals of general food groups are in parentheses.

	Crude protein					Calcium					Phosphorus				
Food items[a]	Feb 16	Mar 10	Apr 1	Apr 24	May 16	Feb 16	Mar 10	Apr 1	Apr 24	May 16	Feb 16	Mar 10	Apr 1	Apr 24	May 16
Fruits and seeds	(35)	(63)	(42)	(19)	(49)	(7)	(55)	(10)	(5)	(86)	(31)	(63)	(46)	(17)	(65)
Brachiaria ciliatissima			2	2	17			tr	1	46			3	2	25
Physalis viscosa		tr	15	8	2	tr	1	2	3	1		1	17	7	2
Lantana horrida			tr	tr	2			tr	tr	8			tr	tr	4
Galactia canescens	34	27	5	1	tr	6	7	tr	tr	tr	29	21	4	tr	tr
Paspalum setaceum			3	4	17			tr	tr	18			3	4	20
Nicotiana repanda		17	tr	2	tr		23	tr	1	2		19	tr	2	tr
Pyrrhopappus multicaulis		9					9		tr			10			
Euphorbia sp.		6	4	tr			11	3	tr			5	4	tr	
Quercus virginiana		tr	3				tr	tr				tr	7		
Cyperus ovularis	tr		5	tr	1	tr		5		7	tr		4	tr	2
Panicum sp.					5					tr					6
Green vegetation	(60)	(16)	(14)	(tr)	(tr)	(89)	(43)	(29)	(tr)	(tr)	(64)	(26)	(14)	(tr)	(tr)
Setaria sp.	tr	1	2	tr		tr	tr	11	tr		tr	tr	2	tr	
Richardia humistrata	4	5	3			6	14	3			5	6	4		
Lepidium densiflorum	21	1	tr			24	2	tr			26	tr	tr		
Clematis drummondii	7	1	tr	tr		tr	1	tr	tr		7	2	tr	tr	
Parietaria pennsylvanica	11	4	3		tr	38	20	7		tr	7	8	2		tr
Indigofera miniata	13		1	tr		18		1	tr		13		tr	tr	
Animal matter	(5)	(15)	(43)	(80)	(48)	(tr)	(2)	(60)	(95)	(11)	(4)	(10)	(40)	(82)	(34)
Coleoptera	3	3	15	50	9	tr	tr	1	1	tr	2	2	16	46	4
Orthoptera		2	24	18	39		tr	tr	tr	4		tr	16	16	30
Gastropoda (snails)		tr	3	12	tr		2	58	94	7		tr	4	20	tr

[a] Other items which contributed no more than 5% to any category were as follows: Fruits and seeds; *Setaria* sp., *Polytaenia* sp., *Panicum ovinum, Descurainia pinnata, Chloris cucullata, Cnidoscolus texanus, Sporobolus* sp., *Aristida* sp., *Linum alatum, Onosmodium* sp., *Polypteris* sp., *Sida* sp., and *Corydalis micrantha.* Green vegetation; *Brachiaria ciliatissima, Physalis viscosa, Lantana hrrida, Paspalum setaceum, Richardia scabra, Matelea parviflora, Oxalis* sp., *Cynodon dactylon, Galium* sp., *Allium* sp., and *Cynanchum maccartii.* Animal matter; Hemiptera, Diptera, and Lepidoptera.

April, again associated with the relatively high levels in insects consumed at that time. The importance of animal-derived phosphorus also is evidenced by the fact that approximately 50 to 85% of plant-derived phosphorus is in the unavilable phytate form (Nelson 1967).

Since approximately 6 weeks are required for turkeys to lay and incubate a clutch of eggs, these data support Pattee (1977) who found the peak of hatching on this area to be about 1 June, about 6 weeks after peak nutrient intake. The fact that some birds hatched prior to this period, however, suggests that individual birds obtained the necessary food fractions earlier.

Animal foods appear to be important sources of nutrients, indeed perhaps mandatory, for breeding turkeys on the study area. Similarities in the use of invertebrates as food by other female birds during the reproductive season have been reported for pintail ducks *(Anas acuta)* (Krapu 1974 *a, b*), wood ducks *(Aix sponsa)* (Landers et al. 1977), pheasants *(Phasianus colchicus)* (Dalke et al. 1942, Korschgen 1964), South African shellducks *(Tadorna cana)* (Geldenhuys 1980) and eastern wild turkeys *(M. g. silvestris)* (Korschgen 1967), but the nutritional contribution by taxon generally has not been evaluated.

It is apparent that management could be employed to enhance the relative nutritional importance of vegetation to the turkeys. Interpreting the data of Pattee (1977), several food plants contain levels of crude protein, calcium, and/or phosphorus which meet or at least approach levels required for adequate turkey reproductive success. Herbage of prairie pepperweed *(Lepidium densiflorum)*, littleleaf milkvine *(Matelea parviflora)*, and coast indigo *(Indigofera miniata)* and fruits and seeds of smallflower corydalis *(Corydalis micrantha)*, croton (*Croton* spp.), wild tobacco *(Nicotiana repanda)*, and Texas bullnettle *(Cnidoscolus texanus)* contained crude protein values approaching or exceeding 20%. Adequate calcium levels for breeding potential were recorded in the herbage of prairie pepperweed, rough mexicanclover *(Richardia scabra)*, Pennsylvania pellitory *(Parietaria pennsylvanica)*, coast indigo, and waterfall groundcherry *(Physalis viscosa)*. No plants afforded adequate phosphorus, but the herbage of prairie pepperweed and fruiting parts of Texas bullnettle, pinnate tansymustard *(Descurainia pinnata)*, and drooping melonette *(Melothria pendula)* approached that level. Since all these species were ranked low to very low in abundance on the area (Pattee 1977), the management potential to increase their numbers exists. This management would afford the potential for turkeys to obtain nutritional requirements for breeding from vegetation and lessen their apparent dependence on animal matter. Further, the cool-season forbs such as prairie pepperweed, coast indigo, and Pennsylvania pellitory would provide relatively high nutrient levels in the early spring prior to emergence of most insects. Fertilization may accomplish an elevation in nutritional value of existing vegetation, but the effects probably would not be as long lasting as a change in composition resulting from some type of soil disturbance or planting.

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