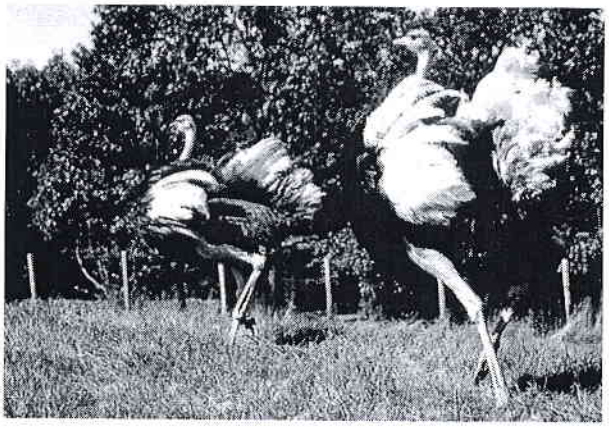
Nutrition Guidelines for Ostriches and Emus

This publication offers suggestions on nutrition for ostriches and emus.



The design of successful feeding programs for ratites (ostriches and emus) is a special challenge to nutritionists and production managers. There is little scientifically based information on nutrient requirements and efficiency of nutrient utilization by ratites. Nevertheless, successful feeding programs have been developed by using basic physiological and historical information available about ostriches and emus, combined with knowledge about the nutrient requirements of poultry and other species.

The gastrointestinal tracts of the ostrich and emu differ greatly from each other, but both animals are considered to be monogastric herbivores, with an ability to utilize substantial amounts of dietary forage. In contrast to the digestive tract of chickens and turkeys, ostriches and emus have no crop in which to store ingested food. Ostriches and emus, however, do have a relatively large true stomach (proventriculus) and gizzard, which has considerable food storage capacity. The intestinal tracts of these two ratites differ markedly. The small intestine of ostriches is relatively short and the large intestine is very long, while the opposite is true for emus *(Table I)*. Ostriches also possess relatively small ceca compared with emus.

The ostrich has the ability to utilize a good portion of fibrous substances provided in its diet after the appropriate microbial population has been established in the intestines. Research has shown that ostriches can digest up to 60 percent of the plant cell wall material (neutral detergent fiber) in their diet. Research findings on emu fiber digestion have been mixed indicating near 0 to as much as 45 percent fiber digestion with greatest digestion occurring as amounts of fiber consumed decrease. Ostriches and emus also seem to have the digestive enzymes and absorptive capacities needed to efficiently utilize dietary protein, fats, minerals, and vitamins.

Optimal weight gain and efficient growth cannot be attained without a nutritionally balanced ration. All essential nutrients including energy, protein, amino acids, vitamins and minerals must be presented to the bird in a palatable, digestible form each day of the bird's life to achieve the desired production goals. Examples of production goals for growing ostriches and emus at different ages are shown in *Table II.*

It is important to efficiently achieve desirable body weight at early ages. A guide to calculating efficiency is the animal's feed:gain ratio, the ratio of pounds of feed consumed to pounds body weight gain in a measured period of time. The lower the ratio, the more efficient the bird is in converting feed nutrients to body tissue. Broiler chickens have a feed:gain ratio near 2:1, followed by swine at 3.5:1 and beef cattle at 10:1. Feed:gain ratios measured under commercial conditions were 4:1 for the ostrich and 6:1 for the emu.

Table I. Comparative intestinal lengths of ostriches, emus, and chickens

	Ostrich[1]		*Emu*[2]		*Chicken*[3]	
	(cm)	(%)	(cm)	(%)	(cm)	(%)
Small intestine	512	36	315	88.5	61	90
Cecum	94	7	12	3.3	5	7
Large intestine	800	57	29	8.2	2	3

[1]Fowler, M.E., 1991. J. of Zoo and Wildlife Med. 22:204-227.
[2]Herd, R.M., and T.J. Dawson, 1984. Physiol. Zool. 57:70-84.
[3]Calhoun, M.L., 1954. Microscopic Anatomy of the Digestive System of the Chicken, Iowa State University Press, Ames, IA 50014.

IOWA STATE UNIVERSITY
University Extension

Ames, Iowa

Pm-1696 | January 1997

Table II. Body weights of ostriches and emus at selected ages

Months of age	Body Weight			
	Ostriches		Emus	
	Average[1]	Potential[2]	Average[1]	Potential[2]
	(lb/bird)		(lb/bird)	
0	1.9	1.9	0.9	0.9
1	9.0	9.5	5.5	5.8
3	58	62	17.6	18.6
5	115	124	35.2	37.3
7	190	220	48.4	51.3
9	240	280	60.5	63.5
11	270	310	71.5	74.4
13	285	325	80.3	83.7
15	295	330	88.0	90.6

[1]Assuming good management, average genetic potential, and moderate ambient temperatures.
[2]Assuming excellent management, greater than average genetic potential, and moderate ambient temperatures.

Nutrition guidelines for the ostrich are given in *Table III.* The guidelines are divided into age and breeder categories. Metabolizable energy values are based on the poultry energy system and could potentially underestimate the energy value of high fiber ingredients such as alfalfa meal. However, this system has worked relatively well todate for most ratite rations and should be adhered to until a more complete, species-specific energy system is derived. The metabolizable energy values for ostrich finisher and breeder rations should be kept relatively low. This will reduce the deposition of excess body fat in birds intended for slaughter, which can harm hide quality and reduce the proportion of lean meat in the carcass. Reproductive performance also can be impaired when ostrich breeders are excessively fat.

Protein level recommendations are similar to poultry species except for the breeders which are believed to require greater protein concentrations in their diet. The first limiting amino acid is methionine, a sulfur-containing amino acid required for feather growth. Methionine is not abundant in most cereals and forages, so it is often supplemented in its synthetic form in ratite rations. Lysine is considered to be the second limiting amino acid for ratites, and lysine supplementation may also be needed in some rations, especially those in which little soybean meal, an excellent source of lysine, is used. Fiber is not considered an essential nutrient but is recommended at relatively high levels for ostriches to maintain an optimal gut microflora and motility.

Recommendations for macrominerals, microminerals, and major vitamins of concern are also given in *Table III.* Calcium and phosphorus are macrominerals required for skeletal calcification as well as many other soft tissue functions. Most poultry rations recommend a 2:1 dietary ratio of calcium:total phosphorus for growing birds. Approximately two-thirds of the total phosphorus is available to monogastric species as non-phytate phosphorus and the recommendation for ratites is given as non-phytate P. Other minerals requiring supplementation to rations for ostriches include sodium and the trace minerals, copper, zinc, manganese, iodine, and iron. Copper and manganese are of particular concern because high levels of Ca and P may interfere with their availability.

Major vitamins of concern for supplementation include vitamins A, D, E, K, B_{12}, pantothenic acid, folic acid, biotin, pyridoxine, niacin, thiamin, riboflavin, and choline. Vitamin E is of special concern because of its poor absorption in newly hatched chicks and this vitamin must be supplemented in greater than normal levels found in most poultry vitamin premixes.

Nutritional guidelines for emus *(Table IV)* differ slightly from those for ostriches. Because emus are grown primarily for oil products, emu finisher diets should contain greater

Table III. Nutrition guidelines for ostriches

	Starter (to 9 wk)	*Grower (9 to 42 wk)*	*Finisher (42 wk to Mkt weight)*	*Breeder Holding (42 wk to Sexual Maturity)*	*Breeder (From 4 or 5 wk before onset of egg production)*
Metabolizable energy (Poultry Values)					
kcal/lb	1,220	1,115	1,045	900 to 950	1,045
kcal/kg	2,465	2,450	2,300	1980 to 2090	2,300
Protein, %	22	19	16	16	20 to 21
Total sulfur amino acids, %	.70	.68	.60	.60	.70
Methionine, %	.37	.37	.35	.35	.38
Lysine, %	.90	.85	.75	.75	1.00
Crude fiber, %	6 to 8	9 to 11	12 to 14	15 to 17	12 to 14
Neutral detergent fiber, %	14 to 16	17 to 20	19 to 22	24 to 27	22 to 24
Calcium, %	1.5	1.2	1.2	1.2	2.4 to 3.5
Nonphytate phosphorus, %	.75	.6	.6	.6	.7
Vitamin A, IU/lb	5,000	4,000	4,000	4,000	5,000
Vitamin D_3, IU/lb	1,200	1,000	1,000	1,000	1,000
Vitamin E, IU/lb	55	25	25	25	50
Vitamin B_{12}, µg/lb	18	9	9	9	18
Choline, mg/lb	1,000	1,000	860	860	860
Copper, mg/lb	15	15	15	15	20
Zinc, mg/lb	55	55	40	40	40
Manganese, mg/lb	70	70	70	70	70
Iodine, mg/lb	.5	.5	.4	.4	.5
Sodium, %	.2	.2	.2	.2	.2

NOTE: Concentrations of other vitamins and minerals should be similar to those provided for growing turkeys. Current thinking, however, suggests that little, if any, supplemental iron is needed.

Table IV. Nutritional guidelines for emus

	Starter (to 6 wk)	*Grower (6 to 36 wk)*	*Finisher (36 to 48 wk)*	*Breeder Holding (48 wk to Sexual Maturity)*	*Breeder (From 3 to 4 wk before onset of egg production)*
Metabolizable energy (Poultry Values)					
kcal/lb	1,220	1,200	1,300	1,150	1,090
kcal/kg	2,685	2,640	2,860	2,530	2,400
Protein, %	22	20	17	16	20 to 22
Total sulfur amino acids, %	.86	.78	.65	.60	.75
Methionine, %	.48	.44	.38	.36	.40
Lysine, %	1.10	.94	.78	.75	1.00
Crude fiber, %	6 to 8	6 to 8	6 to 7	6 to 7	7 to 8
Neutral detergent fiber, %	14 to 16	14 to 17	10 to 13	14 to 16	16 to 18
Calcium, %	1.5	1.3	1.2	1.2	2.4 to 3.5
Nonphytate phosphorus, %	.75	.65	.60	.60	.6
Vitamin A, IU/lb	7,000	4,000	4,000	4,000	4,000
Vitamin D_3, IU/lb	2,000	1,500	1,500	1,500	1,500
Vitamin E, IU/lb	45	20	20	20	45
Vitamin B_{12}, µg/lb	20	10	10	10	20
Choline, mg/lb	1,000	1,000	1,000	1,000	900
Copper, mg/lb	15	15	15	15	15
Zinc, mg/lb	50	50	50	50	50
Manganese, mg/lb	70	70	70	70	70
Iodine, mg/lb	.5	.5	.5	.5	.5
Sodium, %	.2	.2	.2	.2	.2

NOTE: Concentrations of other vitamins and minerals should be similar to those provided for growing turkeys. Current thinking, however, suggests that little, if any supplemental iron is needed.

metabolizable energy and lower fiber concentrations than ostrich finisher diets. In contrast to ostrich breeders, emu breeders need to have ample energy reserves (fat pad) in the body at the onset of breeding. Feed intake by emus decreases and becomes erratic during reproduction, and body fat is needed to carry them through in reasonable condition. Recent research has shown that fiber digestion in the emu may be limited; thus, crude fiber level recommendations for emu diets have been lowered to nine percent or less in all rations.

Protein and amino acid recommendations are similar for emus and ostriches. Again, most emu rations will require synthetic methionine supplementation to meet the recommended levels in this guide. Birds will not attain optimal growth if their requirements for essential amino acids are not met. Nutrient recommendations for minerals and vitamins are similar to those for ostriches. Supplemental Ca (above 1.5 percent) in emu diets is necessary only during the egg laying season, not during the off season.

Concentrations of a number of selected nutrients in ingredients commonly used in ostrich and emu rations are presented in *Table V*. This list is certainly not totally inclusive and does not give values for forages that some ratites kept on pastures may consume. Key fiber sources often included in ratite rations are alfalfa meal, oat hulls, peanut hulls, soybean hulls, and sunflower meal. Common sources of protein used in ratite rations include canola meal, cottonseed meal, fish meal, meat and bone meal, peanut meal, soybean meal, and sunflower meal. Grains that provide energy to the ration include corn, oats, wheat, and barley. All feed ingredients must be free of molds, mildew, and excessive moisture. Peanut hulls are of special concern because of a frequent occurrence of toxic concentrations of aflatoxins. Field cases have shown that ostrich chicks may be sensitive to mycotoxins such as aflatoxin and vomitoxin.

Feed preparation, quality control of feed formulation, manufacturing, and delivery are all important components of a successful nutrition program. Pelleted complete rations are the most popular feed programs for ostriches and emus. As the industry progresses, and pasturing birds becomes more common, feed companies undoubtedly will test and offer more concentrate and supplement products. A good nutrition program for the ratite producer involves a team effort with input from the nutritionist, feed mill manager, feed salesperson, and the producer.

Often, there is the temptation to try to reduce production costs by using feeds that are relatively low in cost per ton, especially when feed prices are high. However, several questions need to be considered before "low-cost" feeds are used. Why is this feed low in cost? What ingredients are in the low cost feed? What are the nutrient concentrations? What will this feed likely do to performance of the ostriches or emus? A feed that costs less per ton will not always result in a decrease in the feed cost of producing a pound of gain or of producing an egg. A feed that seems to be economical on the basis of price paid per ton may be used so inefficiently that feed cost per pound of ostrich or emu, or feed cost per egg produced, will be greater than if a feed of higher price per ton had been used. Of course, the opposite also may be true—a high price feed may result in very good growth and feed efficiency, but the cost per unit of production may be greater than if a modest priced feed were used. Neither the price of the feed per ton nor feed efficiency alone is an adequate criterion for evaluating a feeding program. Feed cost per unit of production, as a component of total production costs, is the best criterion.

Table V. Concentrations of selected nutrients in ingredients used in feeds of ostriches and emus[1]

	Dry matter	*Metabolizable energy*	*Crude protein*	*Ether extract*	*Crude fiber*	*Neutral Detergent fiber*	*Calcium*	*Total phosphorus*	*Non-phytate phosphorus*	*Methionine*	*Cystine*	*Lysine*
	(%)	(kcal/lb)						(%)				
Alfalfa meal (17% protein)	92	2,090	17.5	2.5	24.1	45.0	1.44	.22	.22	.24	.19	.73
Barley	89	3,400	11.0	1.8	5.5	19.0	.03	.36	.17	.18	.24	.40
Blood meal, spray dried	93	3,625	88.9	1.0	.6	0.0	.41	.30	.30	1.09	1.03	7.88
Brewer's grains, dried	92	2,080	25.3	6.2	15.5	46.0	.29	.52	n.a.	.57	.39	.90
Canola meal	93	2,000	38.0	3.8	12.0	n.a.[4]	.68	1.17	.30	.71	.87	1.94
Corn, grain	89	3,560[2]	8.5	3.8	2.2	9.0	.02	.28	.08	.18	.18	.26
Corn gluten feed	90	1,750	21.0	2.5	8.0	45.0	.40	.80	n.a.	.45	.51	.63
Cottonseed meal	90	2,400	41.4	.5	13.6	26.0	.15	.97	.22	.51	.62	1.76
Fish meal, Menhaden	92	2,820	60.0	9.4	.7	0	5.11	2.88	2.88	1.63	.57	4.51
Meat and bone meal	93	2,150	50.4	10.0	2.8	0	10.30	5.10	5.10	.75	.66	3.00
Oats, grain	89	3,025[2]	11.4	4.2	10.8	32.0	.06	.27	.05	.18	.22	.50
Oat hulls	92	400	4.6	1.4	28.7	78.0	.13	.10	n.a.	.07	.06	.14
Peanut meal	92	2,200	50.7	1.2	10.0	14.0	.20	.63	.13	.54	.64	1.54
Peanut hulls	91	440	7.8	2.0	62.9	74.0	.26	.07	n.a.	n.a.	n.a.	n.a.
Rice bran, defatted[3]	94	2,020	15.1	1.75	13.0	n.a.	.08	1.77	.25	.27	.28	.62
Sorghum, grain	87	3,288	8.8	2.9	2.3	18.0	.04	.32	n.a.	.16	.17	.21
Soybean meal (44% protein)	89	3,725[2]	44.0	.8	7.0	n.a.	.29	.65	.27	.62	.66	2.69
Soybean meal (48% protein)	90	2,440	48.5	1.0	3.9	n.a.	.27	.62	.22	.67	.72	2.96
Soybean hulls	91	720	12.1	2.1	40.1	67.0	.49	.21	n.a.	.12	.07	.64
Sunflower meal (32% protein)	90	2,515[2]	32.0	1.1	24.0	n.a.	.21	.93	.14	.74	.60	1.13
Wheat, grain	87	2,900	14.1	2.5	3.0	n.a.	.05	.37	.13	.21	.30	.37
Wheat bran	89	2,804[2]	15.7	3.0	11.0	51.0	.14	1.15	.20	.23	.32	.61
Wheat middlings	88	2,000	15.0	3.0	7.5	37.0	.12	.85	.30	.21	.32	.69
Yeast, Brewer's	93	1,990	44.4	1.0	2.7	n.a.	.12	1.40	n.a.	.70	.50	3.23
Limestone	92						38.0					
Dicalcium phosphate	92						16.0	21.0	21.0			
Oyster shell	92						38.0	.1	.1			

[1]Data obtained from "Nutrient Requirements of Poultry," National Research Council (1994) unless stated otherwise.
[2]These ME_n values were obtained from the Dissertation of S.C. Cilliers, University of Stellenbosch (College of Agriculture), Stellenbosch 7600, South Africa.
[3]Values adjusted from National Research Council (1994) values, according to oil removal.
[4]Information not available.

Prepared by Sheila E. Scheideler, extension poultry specialist and associate professor, University of Nebraska, and Jerry L. Sell, professor of animal science, Iowa State University.

File: Animal Science 1