



KORI BUSTARD
(Ardeotis kori)
CARE MANUAL

CREATED BY THE
AZA Kori Bustard Species Survival Plan®
IN ASSOCIATION WITH THE
AZA Gruiformes Taxon Advisory Group

Kori Bustard (*Ardeotis kori*) Care Manual

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Disclaimer: This manual presents a compilation of knowledge provided by recognized animal experts based on the current science, practice, and technology of animal management. The manual assembles basic requirements, best practices, and animal care recommendations to maximize capacity for excellence in animal care and welfare. The manual should be considered a work in progress, since practices continue to evolve through advances in scientific knowledge. The use of information within this manual should be in accordance with all local, state, and federal laws and regulations concerning the care of animals. While some government laws and regulations may be referenced in this manual, these are not all-inclusive nor is this manual intended to serve as an evaluation tool for those agencies. The recommendations included are not meant to be exclusive management approaches, diets, medical treatments, or procedures, and may require adaptation to meet the specific needs of individual animals and particular circumstances in each institution. Commercial entities and media identified are not necessarily endorsed by AZA. The statements presented throughout the body of the manual do not represent AZA standards of care unless specifically identified as such in clearly marked sidebar boxes.

This nutrition chapter is an excerpt
from the complete Animal Care
Manual available at the
Association of Zoos and Aquariums
(AZA)'s website:

[http://www.aza.org/animal-care-
manuals/](http://www.aza.org/animal-care-manuals/)

Further information about diets and
the nutrition of this and other species
can be found at the

AZA's Nutrition Advisory Group
(NAG)'s website:

<http://nagonline.net>

Chapter 5. Nutrition

5.1 Nutritional Requirements

A formal nutrition program is recommended to meet the behavioral and nutritional needs of all kori bustards (AZA Accreditation Standard 2.6.2). Diets should be developed using the recommendations of veterinarians as well as AZA Taxonomic Advisory Groups, Species Survival Plans, and Nutrition Advisory Group (www.nagonline.net/feeding_guidelines.htm). Diet formulation criteria should address the animal's nutritional needs, feeding ecology, as well as individual and natural histories to ensure that species-specific feeding patterns and behaviors are stimulated.

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(2.6.2) A formal nutrition program is recommended to meet the behavioral and nutritional needs of all species and specimens within the collection.

There are no established daily energy requirements or energy requirement calculations/equations that can be utilized for kori bustards at this time beyond the general nutrition information provided below and sample diet information provided below in section 5.2. Additional research that focuses on exact daily food intake and energy expenditure for this species, and that covers all life stages (e.g., chick, juvenile, reproductive adult, senescent adult), will be important to perform so that more specific nutritional requirements and recommendations can be developed for kori bustards.

Kori bustards are generally considered to be omnivorous – opportunistically taking prey items and plants when they are locally abundant (Bailey and Hallager 2003). In some local environments, insects make up a large proportion of the kori bustards' diet (see Bailey and Hallager 2003). Information on the gastro-intestinal tract of various bustard species is described in detail by Bailey et al. (1997a), and includes a discussion of the functional elements of the GI tract for kori bustards as opportunistic omnivores. Kori bustards lack a crop, although their long esophagus and longer proventriculus and ventriculus may serve a functional role of food storage (Bailey et al. 1997a). Bustards are commonly found with stones in their ventriculi, and these may be purposefully ingested and play a role in grinding up food within the ventriculus (Bailey et al. 1997a). Although the GI tract of the kori bustard is typical of an insectivorous bird (Maloiy et al. 1987), they have been historically fed in zoos as “primarily carnivorous” omnivores (Hallager and Boylan 2004).

Based on ecological studies and GI tract morphology, the recommended diet for kori bustards should include nutritionally complete feeds, whole prey (vertebrate and invertebrate), and produce. Diets in zoos typically include fruits (e.g., apple), vegetables (e.g., cabbage), invertebrates (e.g., mealworms and crickets), whole vertebrate prey (e.g., mice), processed meats (e.g., beef, horsemeat), and some form of nutritionally balanced pelleted food (e.g., game bird pellets – see Table 10) (Bailey and Hallager 2003).

The target nutrient levels established for kori bustard diets were derived from several domestic and exotic species (e.g., pheasants, quail, geese, and cranes; NRC 1994; Anderson 1995). In cases where these target values are expressed as ranges in the table below (Table 8), the low end represents a maintenance requirement, the high end (marked by a double asterisk) represents a breeding requirement, and the growth requirement tends towards the high end of the range.

Table 8: Proposed nutrient guidelines for kori bustards on a dry matter basis*

Nutrient	Proposed Nutrient Guidelines 2004
Protein, %	16.5-30.0** ¹
Fat, %	---
Crude Fiber, %	---
Ca, %	0.66-2.75**
P, %	0.33-1.0**
Ca:P	---
K, %	0.44-0.72
Na, %	0.13-0.18
Mg, %	0.05-0.06
Cu, mg/kg	5.5-8.8
Fe, mg/kg	55-77
Zn, mg/kg	55-70.1
Mn, mg/kg	66-72
Se, mg/kg	0.2

Nutrient	Proposed Nutrient Guidelines 2004
I, mg/kg	0.33-0.44
Vitamin A, IU/g	1.65-5.5
Vitamin D3, IU/g	0.22-1.2
Vitamin E, IU/kg	11.0-27.5
Thiamin, mg/kg	2.2
Riboflavin, mg/kg	2.75-4.4
Pyridoxine, mg/kg	3.3-5.0
Vitamin B12, mg/kg	0.003-0.01
Biotin, mg/kg	0.11-0.25
Choline, mg/kg	990-1650
Folacin, mg/kg	0.8-1.1
Niacin, mg/kg	22-71.5
Pantothenic acid, mg/kg	10.5-17.6

* Target values based on NRC (1994) and Anderson (1995).

** Values at high end of range for breeding only.

¹ Available data indicate that breeding diets for kori bustards that contain 26.4% crude protein on a dry matter basis should be adequate (Hallager et al. 2002). Recommendations for dietary crude protein levels of no more than 24% on a dry matter basis for growing sandhill cranes (Serafin 1982) may also be appropriate for growing kori bustards. A target of 30% crude protein in breeding diets represents a starting point.

Factors influencing nutritional requirements: The following factors affect the nutritional requirements of kori bustards, and should be carefully considered when formulating appropriate diets.

Hand-reared chicks: Limited published data are available regarding successful hand-rearing diets for kori bustard chicks (Maslanka and Ward 2003; Hallager 2005). However, nearly all hand-reared chicks prior to 2008 have developed angel wing, a condition linked to high protein diets in waterfowl and cranes (Serafin 1982; Kear 1986). Growth rates of previously hand-reared chicks that developed angel wing ranged from 5.7-8.1% of body weight on a daily basis (mean = 6.8; Hallager et al. 2002). Whereas fast growth is important for production birds with significant muscle mass, it is not the goal for exotic birds housed in zoos. Angel wing in waterfowl and cranes can be successfully “treated” by reducing the crude protein content of the diet offered. For hand-reared kori bustards, it may be more appropriate to maintain dietary protein levels that allow normal growth in waterfowl and cranes. It is recommended that diets for hand-reared kori chicks contain between 18-22% crude protein on a dry matter basis, and growth should not exceed 5% of body weight per day, in an attempt to avoid angel wing.

Reproductive status: Breeding females should be given supplemental calcium at least one month prior to the beginning of egg laying. Appropriate vitamin E levels are essential for successful reproduction in most bird species, and deficiency of this vitamin has been associated with both low fertility and low hatchability (Dierenfeld 1989). Chicks and juvenile birds may also have a higher requirement for vitamin E, as researchers have found plasma concentrations of vitamin E to be lower in juvenile birds despite a higher vitamin E intake by these juveniles from their diets (Anderson et al. 2002).

Seasonal changes in nutrition: In northern latitudes, where temperatures regularly fall below 0°C (32°F), birds should be offered more food in colder months than in warmer months to accommodate a higher rate calorie requirement. Foods high in fat (e.g., peanuts or peanut butter) can be offered as occasional enrichment items during winter months. Increases in diet amounts may be based on observed behavior changes or increased consumption, but should be made in coordination with institution veterinarians and nutritionists. As with most birds, protein requirements for kori bustards increase during the breeding season, and birds should be placed on a breeder pellet instead of a maintainer pellet. Females should be provided with additional calcium in the form of oyster shell.

5.2 Diets

The formulation, preparation, and delivery of all kori bustard diets must be of a quality and quantity suitable to meet the animal's psychological and behavioral needs (AZA Accreditation Standard 2.6.3). Food should be purchased from reliable,

AZA Accreditation Standard

(2.6.3) Animal diets must be of a quality and quantity suitable for each animal's nutritional and psychological needs. Diet formulations and records of analysis of appropriate feed items should be maintained and may be examined by the Visiting Committee. Animal food, especially seafood products, should be purchased from reliable sources that are sustainable and/or well managed.

sustainable, and well-managed sources. The nutritional analysis of the food should be regularly tested and recorded.

Sample diets: Based on the reported foraging strategy of free ranging kori bustards, proposed diet proportion guidelines are presented in Table 9. These guidelines can assist with diet formulation by proportion, in order to ensure that nutrient needs are met and levels of specific nutrients are not grossly exceeded (i.e., protein). Diets can be formulated by using the table to select the desired proportions of items present in smaller amounts (e.g., vertebrate prey, invertebrate prey, and produce), and then a nutritionally complete food (see Table 10) can be used to round out 100% of the total diet. The nutritionally complete items included in the diet should provide the nutrient backbone of the diet.

Table 9: Kori bustard recommended diet proportion guidelines (as fed basis).

Item	Minimum % of Diet	Maximum % of Diet
Vertebrate prey	0	25
Invertebrate prey	5	30
Nutritionally complete feeds*	40	55**
Produce	10	20

* Nutritionally complete feeds are those designed to meet specific recommended nutrient levels. Specifications are provided in section 5.1 (Table 8).

** Diets which exceed 55% complete feeds can be considered. A diet comprised of 75% complete feed has successfully maintained kori bustards in zoos and aquariums (Anderson 1995).

There are a range of nutritionally complete foods that are capable of meeting the nutritional requirements of kori bustards, and that can be successfully included within their diets with approval from institutional veterinarians and nutritionists. See Table 10 for examples of nutritionally complete feeds capable of meeting target nutrient values within the framework provided by the recommended diet proportions listed in Table 9 above.

Table 10: A sample of nutritionally complete feeds suitable for kori bustard diets (as recommended by institutional veterinarians and nutritionists) as part of the overall diet (values on a dry mater basis).

Nutrient	Mazuri Exotic ¹ Gamebird Maint	Zeigler Avian Maint ²	Mazuri WF Maint	Mazuri Ratite	Zeigler Ratite Gr/Mai	Zeigler Crane Breeder	NARC Production Pellet ³	Kock Pellet ⁴
Protein, %	13.9	13.9 mi	15.6	16.7	17.8 mi	24.4 mi	24.3	17.8-22.1
Fat, %	3.6	2.2 mi	4.1	4.6	4.4 mi	5.6 mi	-	-
Crude Fiber, %	4.7	5.5 ma	4.6	18.0	15.6 ma	5.6 ma	-	5.0-4.5
Ca, %	0.9	0.9	1.3	1.8	1.0	3.1	3.7	1.4-3.9
P, %	0.3	0.6	0.4	0.9	0.8	0.9	0.9	0.9-1.9
Ca:P	3.0	1.5	3.2	2.1	1.25	7.8	4.6	1.7-2.1
K, %	0.6	0.6	0.6	0.8	1.3	0.8	0.9	0.9-1.0
Na, %	0.1	0.1	0.2	0.3	0.2	0.3	0.2	0.4-0.5
Mg, %	0.2	0.2	0.2	0.3	0.3	0.3	0.4	0.3-0.4
Cu, mg/kg	10.0	11.5	10.0	20.0	24.4	16.8	16.6	9.6-9.5
Fe, mg/kg	144.4	158.9	155.6	455.6	282.4	348.2	442.9	131.1-191.8
Zn, mg/kg	100.0	49.1	101.1	142.2	175.7	136.9	72.8	69.5-167.2
Mn, mg/kg	111.1	48.5	108.9	122.2	192.1	147.1	80.6	70.7-139.4
Se, mg/kg	0.5	0.4	0.5	0.6	0.6	0.5	0.3	0.2
I, mg/kg	1.2	0.6	1.3	1.2	0.6	0.4	0.9	1.4-2.3
Vitamin A, IU/g	6.7	8.2	10.8	11.3	24.6	19.2	13.8	6.6-7.1
Vitamin D3, IU/g	2.5	0.6	2.5	1.7	1.5	2.1	3.3	1-3
Vitamin E, IU/kg	138.9	140.5	133.3	188.9	173.8	78.6	37.2	75.6-222.0
Thiamin, mg/kg	11.0	6.7	6.9	9.6	12.3	16.3	5.9	12.4-16.2
Riboflavin, mg/kg	6.1	5.7	3.4	11.1	9.4	14.3	8.4	8.6-13.8

Nutrient	Mazuri Exotic ¹ Gamebird Maint	Zeigler Avian Maint ²	Mazuri WF Maint	Mazuri Ratite	Zeigler Ratite Gr/Mai	Zeigler Crane Breeder	NARC Production Pellet ³	Kock Pellet ⁴
Pyridoxine, mg/kg	6.4	10.1	5.4	6.7	126.3	15.2	8.8	9.2-13.7
Vitamin B12, mg/kg	16.7	^	0.01	0.02	^	^	0.02	0.04-0.05
Biotin, mg/kg	0.4	0.4	0.3	0.5	0.5	0.7	0.2	0.3-1.2
Choline, mg/kg	7888.9	1751.7	1133.3	1555	1637.6	2188.7	896.4	976-1494
Folacin, mg/kg	3.0	2.0	1.7	6.3	5.4	5.3	1.1	2.5-9.4
Niacin, mg/kg	103.3	88.3	86.7	121.1	126.3	136.2	68.2	75.5-88.4
Pantothenic acid, mg/kg	11.1	29.1	20.0	28.9	41.1	40.2	25.1	34.7-50.8

¹ PMI Nutrition International, LLC, Brentwood, MO 63144

² Zeigler Brothers, Gardners, PA 17324

³ Production Pellet (Anderson 1995).

⁴ Richard A. Kock Pelleted Diets (Kock 1990). Values expressed as a range of maintenance-breeder.

^ Missing values unavailable from manufacturer.

The diets listed in Table 11 (see Table 12 for nutrient analyses of the example diets) are not recommended diets, but examples of how the proportions listed in Table 9 can be used to formulate diets that meet nutrient guidelines. A variety of ingredients can be chosen based upon availability, palatability, and management needs.

Table 11: Examples of kori bustard diets using recommended diet proportions

Diet	Vertebrate Prey	Invertebrates (Crickets)	Nutritionally Complete Foods	Produce
1	25% (mice)	25%	35% (Zeigler Avian Maintenance ¹)	15%
2	15% (mice)	25%	40% (Mazuri Waterfowl Maintenance ²)	20%
3	0%	25%	55% (Zeigler Ratite Grower/Maintenance ¹)	20%
4	20% (mice)	25%	55% (Mazuri Exotic Gamebird Maintenance ²)	0%
5	10% (beef)	0%	75% (Kock Kori Production Pellets ³)	15%

¹ Zeigler Brothers, Gardners, PA 17324

² PMI International, LLC, Brentwood, MO

³ Kock 1990

The following table (Table 12) provides a nutrient analysis of each of the example diets listed in Table 11 above, with a comparison to the proposed nutrient guidelines (Table 8) listed in section 5.1.

Table 12: Example diets (see Table 11) that meet proposed nutrient guidelines (as of 2004) for kori bustards (analysis on a dry matter basis).

Nutrient	Example Diets ¹					Proposed Nutrient Guidelines 2004 ²
	Diet 1	Diet 2	Diet 3	Diet 4	Diet 5	
Protein, %	29.1	27.9	24.3	21.2	23.6	16.5-30.0**
Fat, %	7.5	7.6	5.5	4.7	2.8	-
Crude Fiber, %	5.3	5.0	14.4	5.3	4.3	-
Ca, %	1.1	1.2	0.9	0.8	3.6	0.66-2.75**
P, %	0.9	0.8	0.9	0.7	1.8	0.33-1.0**
Ca:P	1.2	1.5	1.0	1.1	2.0	-
K, %	0.6	0.7	1.4	0.7	1.1	0.44-0.72
Na, %	0.1	0.1	0.2	0.1	0.5	0.13-0.18
Mg, %	0.1	0.2	0.3	0.2	0.4	0.05-0.06
Cu, mg/kg	13.1	13.8	25.6	14.2	8.9	5.5-8.8

Nutrient	Example Diets ¹					Proposed Nutrient Guidelines 2004 ²
	Diet 1	Diet 2	Diet 3	Diet 4	Diet 5	
Fe, mg/kg	187.4	107.7	291.0	264.4	182.0	55-77
Zn, mg/kg	93.2	121.6	194.9	114.7	158.5	55-70.1
Mn, mg/kg	42.7	83.4	183.1	5.3	127.1	66-72
Se, mg/kg	0.3	0.3	0.8	0.4	0.2	0.2
Vitamin A, IU/g	7.9	11.4	5.5	8.8	7.8	1.65-5.5
Vitamin D3, IU/g	0.5	1.8	1.4	2.1	2.7	0.22-1.2
Vitamin E, IU/kg	105.8	96.1	162.3	118.0	203.8	11.0-27.5
Thiamin, mg/kg	5.1	5.1	11.5	8.5	15.1	2.2
Riboflavin, mg/kg	4.4	2.7	8.9	5.3	13.0	2.75-4.4
Pyridoxine, mg/kg	7.6	4.0	11.9	5.5	12.8	3.3-5.0
Vitamin B12, mg/kg	0.01	0.01	0.02	0.01	0.003	0.003-0.01
Biotin, mg/kg	0.3	0.2	0.4	0.4	1.1	0.11-0.25
Folacin, mg/kg	1.6	1.5	5.4	2.8	0.1	0.8-1.1
Niacin, mg/kg	66.8	63.0	118.7	88.1	88.8	22-71.5
Pantothenic acid, mg/kg	22.1	14.8	38.8	9.8*	47.3	10.5-17.6

¹ See Table 11

² See Table 8

* Values generated as a result of missing values in database.

** Values at high end of range for breeding only.

Kori bustards at one institution were offered the following rations on a daily basis (Anderson 1998a):

Table 13: Quantity of food provided to kori bustards (Anderson 1998a)

Food Item	% of Diet	Quantity Per Bird (g)
Bustard pellet	75.0	292.5
Minced meat	9.7	37.80
Apple	9.7	37.80
Cabbage	4.8	18.90
Calcium carbonate	0.8	3.00
Total		390.00

While the above diet is not representative of diets fed in the United States, it does give an estimate of the approximate amount of food a kori bustard needs to consume on a daily basis. Kori bustard activity level remains fairly stable year round, and food amounts are likely to remain stable throughout the year. Seasonal changes (see section 5.1) will influence food changes more than other factors.

Diet type and presentation: Kori bustards are omnivorous. General observations of free-ranging kori bustards indicate that although they consume mainly insects, they also consume lizards, leaves, seeds, acacia gum, and flowers (Osborne 1998; Osborne and Osborne 1999). Mwangi (1988) recorded kori bustards in East Africa mainly consuming flowers, seeds, fruits, and pods. Produce items included in kori bustard diets in zoos can range from fruits to leafy greens and vegetables. Insect prey consumed by wild kori bustards consisted of Hymenoptera, Orthoptera, Coleoptera, and Lepidoptera. Non-insect prey consumed included Chilopoda, Diplopoda, Annelida, and Reptilia.

The staple of most kori bustard diets in zoos is a combination of mice, beef or horsemeat, and avian pellets (e.g., gamebird or crane pellets), along with a variety of produce items and insects. All food items provided within the diet should be included in the nutritional analysis of the complete diet. Whereas free-ranging insectivores have a myriad of insect prey choices, the variety of commercially available insects is limited. It is important that the nutrient content of the insects chosen is known. There are excellent references that provide the nutrient content of invertebrate prey (e.g., Bernard and Allen 1997), and these should be carefully reviewed when formulating diet for kori bustards. 'Gut-loading' has been shown as the method of choice to improve the nutrient profile of commercially available insects (Bernard and Allen 1997). For mother-reared chicks, insects are always the preferred food item, although dams will also feed

pinkies and meatballs (beef or horsemeat mixed with avian pellets) to chicks. Pinky mice should be used instead of full-grown mice in the mother's diet, until the chick weighs 1 kg (2.2 lb), as chicks that ingest too much mouse fur can experience gut impaction. Giant mealworms should also be removed from the adult's diet to prevent them from being fed to the chicks, and the back legs of any crickets that are provided should be removed.

When the diet is provided to kori bustards, food items can be offered in pans, tubs, buckets, platforms, etc, or hand-fed to individual birds in a group. Kori bustards will consume pelleted foods, and so pellet dispensers should be placed in pens to encourage the consumption of appropriate dry, nutritionally complete feeds. Dispensers and other feeding approaches should be designed to minimize the consumption of the kori bustard food by pest species (Hallager and Boylan 2004). During feeding sessions, dominant birds may displace subordinate birds from the food with short chases, and sometimes even biting. During the breeding season, subordinate females can be displaced from food dispensers by the dominant female and/or dominant male. Such displacements can involve growling by the dominant birds prior to chasing, barking by the subordinate birds, and will end with both birds fluffing their feathers. It may be necessary to provide several, well-spaced feeders to allow all birds to have access to the complete diet.

Generally, kori bustards are easy to medicate by putting a pill or liquid inside a dead mouse. There are times when birds will refuse the medicated item, however, and alternative approaches need to be considered such as: peanuts in the shell (see Table 14), cherry tomatoes, earthworms (work well for thin liquid medications), large mealworms, banana, grapes, horsemeat meatballs, or a compounded, flavored medication (when possible). It is recommended that animal caretakers become familiar with favored food items before a bird becomes ill, so that appropriate food that will be readily accepted by sick/injured birds can be provided, and to increase the likelihood that medication will be taken successfully.

Kori bustard food preparation must be performed in accordance with all relevant federal, state, or local regulations (AZA Accreditation Standard 2.6.1) and an appropriate hazard analysis and critical control points (HACCP) food safety protocols for the diet ingredients, diet preparation, and diet administration should be established. Diet preparation staff should remain current on food recalls, updates, and regulations per USDA/FDA. As kori bustards do eat meat, any meat processed on site should be processed following all USDA standards. Kori bustard diets containing raw meat need careful consideration in terms of preparation, handling, and provision; meat is a perishable food item, and spoilage can occur for a variety of reasons, including growth and activity of micro-organisms, insects or parasites, natural enzyme action in meat, chemical reactions, and physical changes (Hallager and Boylan 2004).

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(2.6.1) Animal food preparations must meet all local, state/provincial, and federal regulations.

The potential for spoilage is based on the type/number of micro-organisms present on the meat, in the storage and preparation areas, or transferred by the handler or by 'pest' species with access to the kori bustard enclosures (Frazier and Westhoff 1988). Meat and whole prey items should be held at appropriate temperatures during periods of thawing, preparation, and storage, and meat items should not remain at temperatures capable of promoting excessive microbial growth for excessive periods of time once fed to the animals (Crissey et al. 2001). Uneaten meat should be disposed of according to local or state requirements.

Feeding schedules: Observations by Osborne and Osborne (1998) show that kori bustards in one park feed around 0900h and again around 1700h, resting during the heat of the day. In zoos, kori bustards should be fed twice per day, but additional feedings should be considered to allow for necessary husbandry management and to promote behavioral opportunities for foraging and feeding throughout the day. As long as birds have adequate time to consume the diet, the period of access to diet can range from several hours to all day. Minimizing the presence of pest species, and their consumption of the diet, may shorten the periods of time when the diet is offered to the birds, unless pest-proof feeders are provided (see Chapter 2, section 2.2 for additional information). The presence of pests should always be considered when determining the period of time the kori bustards have access to the diet.

Species-appropriate feeding and foraging: Kori bustards are curious, intelligent animals. Table 14 lists a range of food items that can promote foraging behavior (see Hallager and Boylan 2004 for a complete list). Most of the items can be scattered around enclosures to encourage foraging/searching and object manipulation behaviors. It is important to note that different individuals in a group of kori bustards will

respond differently to different items, and observations on preferred items that promote species-appropriate behaviors should be recorded for each individual. Approval from area veterinarians, managers, and nutritionists should be obtained if the following feeding approaches are considered.

Table 14: List of enrichment initiatives to promote foraging behaviors (adapted from Hallager and Boylan 2004).

Food Item	Description
Live Insects	Kori bustards respond well to live insects, such as super worms, crickets, regular mealworms, and waxworms. Birds that are off their food for various medical reasons will often start eating again if live insects are offered.
Whole peanuts in the shell	Whole peanuts are also useful for medicating birds. A small portion of the top of the peanut can be taken off, the nut inside removed, and a pill inserted in its place. The peanut shell can be replaced and secured with peanut butter. Peanuts covered with peanut butter work well for medicating birds when individuals become suspicious of medicated mice.
Peanut butter	A few tablespoons of peanut butter can be spread on the trunks of trees in the wintertime as a source of extra calories. The behavior required by the birds to obtain this food item replicates the behavior of wild birds eating sap from acacia trees.
Knucklebones	Kori bustards will also feed on knucklebones, pulling off and consuming any accessible meat. The bones should be large enough that there is no risk of the bird consuming the whole bone.
Live prey	If available, live mice will be relished by kori bustards. The birds are also good at capturing and consuming small snakes, lizards, toads, and small birds that make their way into their pens.
Alfalfa	Hanging bunches of alfalfa or other browse items from trees or other enclosure structures can also promote foraging.

While it is recommended to obtain approval from area veterinarians and nutritionists, the following food items can also be provided to kori bustards (e.g., hidden or scattered throughout the enclosure) to promote foraging behavior:

- Apple
- Banana
- Cherry tomatoes
- Chopped cantaloupe
- Chopped fruit/berries
- Cooked sweet potato
- Grapes (bunches or scattered)
- Mixed vegetables (e.g., peas, carrots, and corn)
- Watermelon

Many plant species have been observed in fecal samples from wild kori bustards (Mwangi 1988). If browse plants are used within the animal's diet or for enrichment, all plants should be identified and assessed for safety (from an ingestion and physical trauma perspective). Kori bustards have physically injured themselves on naturally growing browse in or around the perimeter of their enclosures. In one case an individual bird experience recurring injuries from barberry (*Berberis sp.*) thorns, from a plant that had grown into the enclosure (Hallager and Boylan 2004). The responsibility for approval of plants and oversight of the program should be assigned to at least one qualified individual (AZA Accreditation Standard 2.6.4). The program should identify if the plants have been treated with any chemicals or near any point sources of pollution and if the plants are safe for the species. If animals have access to plants in and around their exhibits, there should be a staff member responsible for ensuring that toxic plants are not available.

AZA Accreditation Standard
(2.6.4) The institution should assign at least one person to oversee appropriate browse material for the collection.

Kori bustards are not browsers however individual institutions housing them may have appropriate locale-specific lists of browse materials used for enrichment. Any browse items known to have lead to an adverse reaction in kori bustards should be reported to the AZA Kori Bustard SSP Coordinator so that these can be formally documented and widely disseminated. It is also important that institutions determine the nutrient content of any plant material and produce offered, and these data should be

incorporated into the nutrient analysis of the entire diet (Hallager and Boylan 2004). There are several resources available which report nutrient content of readily available produce items (e.g., NRC 2003) and a number of laboratories are also equipped to perform nutrient assays.

5.3 Nutritional Evaluations

At one institution, kori bustards are weighed on a monthly basis to determine accurate body weight measures. The birds are scale trained and step onto a scale loaded with mealworms. Using this approach, Hallager (2005) has identified that males increase in body mass during the breeding season (Table 15), with the alpha male showing a significantly greater body weight increase than the beta male. This phenomenon is currently being confirmed at other institutions (S. Hallager, personal communication, 2007). Monitoring weight increase in males is one way to determine when reproductive hormones are beginning to increase (see Chapter 7, section 7.1). Body weight evaluations are important, especially for zoos that house multiple males in the same enclosure during the non-breeding season, as weight increase in the alpha bird signify that it is time to separate the males prior to the breeding season.

Table 15: Breeding and non-breeding weights (kg) for male kori bustards at Institution A

Dominant Male						
	1999*	2000	2001	2002	2003	Ave.
Jan.	---	---	---	14.4	---	14.4
Feb.	10.6	---	---	15.0	14.6	13.4
Mar.	11.1	14.5	14.2	15.1	14.8	13.9
Apr.	11.8	14.4	16.3	16.6	15.8	15.0
May	14.3	14.4	17.5	17.6	18.6	16.5
June	14.1	16.2	18.5	18.0	18.8	17.1
July	15.1	16.1	18.0	17.4	18.2	16.9
Aug.	15.1	17.3	16.3	14.8	18.6	16.4
Sep.	16.2	14.3	16.7	14.2	18.9	16.0
Oct.	15.3	14.6	15.3	14.2	18.0	15.5
Nov.	15.2	---	15.2	15.4	16.0	15.4
Dec.	13.8	---	15	15.4	14.8	14.7
Subordinate Male						
	1999	2000	2001	2002		Ave.
Jan.	---	---	---	11.4	---	11.4
Feb.	10.3	12.1	---	11.9	---	11.4
Mar.	11.3	12.9	12.5	12.5	---	12.3
Apr.	11.3	12.5	13.4	12.6	---	12.4
May	11.3	13.5	14.1	11.0	---	12.5
June	12.1	14.5	---	11.6	---	12.7
July	13.0	14.7	14.5	11.8	---	13.5
Aug.	13.3	12.0	---	13.2	---	12.8
Sep.	12.7	-	---	13.2	---	12.9
Oct.	12.3	11.8	---	13.3	---	12.4
Nov.	12.6	---	11.5	11.0	---	11.7
Dec.	---	---	11.3	10.4	---	10.8

* The dominant male in 1999 was different than in the other years.

Other than body weight evaluations, there are currently no clinically valid nutritional evaluations that have been developed for kori bustards to assess growth, seasonal changes, etc. Body condition scores and fecal condition scores have not been used in assessments of these birds, but these scores should be developed.

Health issues: One of the most common signs of stress in kori bustards is decreased food consumption. Decreased food consumption should be monitored very closely, as it may not only be caused by environmental stressors, but also by impaction or illness. If a bird does not eat for more than one day, a veterinarian should be notified immediately. Encouraging birds to eat by providing favorite food items, or food items not normally part of the diet, may be needed after consultation with area veterinarians.

Parent-reared chicks in large naturalistic aviaries should be regularly checked for signs of metabolic bone disease, as this has been commonly seen at one institution (T. Bailey, personal communication, 2007). Kori bustards seem to be especially susceptible to nutritional bone disease (NBD), based on

clinical findings of angular deformities of the metatarsi and laxity and swelling of the hock joint in animals housed in zoo conditions (Bailey et al. 1996). Careful monitoring of calcium and vitamin D levels in the diets of growing bustards has been shown to decrease the incidence of this musculoskeletal disorder (Bailey et al. 1996). In general, birds that are not provided with appropriate levels of nutrients may also show poor feather conditions, low weights, and lack of reproductive activity.

For hand-reared chicks, it is strongly recommended that individual food items be weighed when diets are prepared, so that a more accurate determination of nutrient content can be made when assessing the diet during the early growth period of the chicks. This is an important approach for hand-reared chicks, as nutrient content and growth rate need to be carefully monitored to minimize the occurrence of 'angel wing' (see section 5.1 for additional information).

Target serum and tissue nutrient evaluations: Currently, there are insufficient data available to develop valid target serum and tissue nutrient values for kori bustards managed in AZA-accredited zoos. There are also no known model species that can be used to develop appropriate target serum and nutrient values for kori bustards. Additional information is needed and should be obtained from opportunistic blood samples taken from clinically 'normal' animals (e.g., during routine physicals) and standardized nutrient assays. A robust dataset will need to be developed before target values and related recommendations can be made. The Kori Bustard SSP Nutrition and Veterinary Advisors can be consulted for information on institutions with laboratories that are able to perform nutrient assays suitable for these evaluations.

a possible causal factor relating to a chick developing splayed legs, ultimately leading to the chick being euthanized. The short drop from the chick's night shelter to the ground was replaced with a ramp to prevent injuries to other chicks.

Females rearing their first chicks will often ignore the majority of diet items provided in favor of feeding the chicks only with live insects for between 7-10 days in some cases. Even experienced females can follow this chick-feeding strategy. It is very important that sufficient live insects are provided to the female during this time, and especially after the chicks have hatched. When females have two chicks, there may be some situations where one chick may out-compete the other for access to food. The weights of chicks and their food intake should be carefully monitored, especially during the first week, and supplemental feedings can be considered if one chick is not receiving sufficient nutrition.

Chicks can be housed with the dam until the start of the next breeding season. For females that have been separated from other birds during nesting and chick rearing, reintroductions back to the flock can occur when the chicks are around 6 months of age. Reintroductions should follow the protocols described in Chapter 4, section 4.3.

7.5 Assisted Rearing

Although dams may successfully lay eggs, there are times when they are not able to properly care for their offspring, both with *in situ* and *ex-situ* populations. Fortunately, animal care staff in AZA-accredited institutions are able to assist with the rearing of these *ex situ* offspring if necessary. Assisted rearing of kori bustards can involve artificial incubation, a combination of artificial and natural incubation, and hand-rearing techniques. Details of these techniques are provided below (Hallager and Boylan 2004).

Assisted incubation: The following protocol provides information on assisted incubation technique for chicks that will be mother-reared, utilizing a combination of both natural and artificial incubation techniques that have been successful at institutions with flocks of breeding kori bustards.

- 1) On the first day after being laid, eggs should be taken from the incubating female for weighing, measuring, and candling. During this procedure, the egg taken from the female should be replaced with a dummy egg warmed to 37.5°C (99.5°F). Once the egg assessment has been completed, the egg should be returned to the female, and the dummy egg removed.
- 2) On day 7, the egg (or first egg laid if there are two) should be removed for the remainder of the incubation period, and replaced with a warmed dummy egg. The removed egg should be re-weighed and candled, and placed in an artificial incubator (e.g., Grumbach) at 37.5°C (99.5°F) and 55% relative humidity. If a second egg has been laid, it should be left with the female for natural incubation, after the initial weighing, measuring, and candling has been performed.
- 3) The target weight loss for kori bustard eggs is 12%, and the humidity in the incubator should be adjusted to result in this weight loss. Eggs should be turned every two hours. Humidity should be increased to 70-80% once candling shows that the air cell within the egg begins to drop down. However, many kori bustard eggs are too dark to candle effectively, and in these cases, humidity should be increased at external pip.
- 4) At internal pip, the egg should be placed back under the female for hatching. Assistance with hatching is not recommended for at least 24 hours after external pipping. Once hatched, the chick should be left to imprint on the dam for the first 24 hours, where this is possible. After this time, the chick can be removed briefly so that it can be examined, weighed, its umbilicus cleaned, and yolk-sac re-absorption confirmed, before being returned. A 1% iodine solution can be applied to the umbilici of chicks when they are first handled.

Artificial incubation: The following table (Table 18) provides a summary of the artificial incubation protocols for kori bustard eggs used at two institutions. While the incubators used at these facilities have been successful, other models may be appropriate as well.

Table 18: Artificial incubation protocols for kori bustard eggs

	Institution A Protocol	Institution B Protocol
Incubation		
Incubator	Grumbach incubator	Petersime model 1 or Humidaire model 21 incubator
Temperature	37.5°C (99.5°F)	37.5°C (99.5°F)
Humidity/wet bulb	50-55%	26.7-30°C (80-86°F)
Egg turning	Every 4 hours	Every 1-2 hours, with additional 180° turn twice daily
Egg cleaning	No	Wiped with dry sponge
Egg weight loss	-	15%
Moved to hatchery	External pip	Day 21-22

When bustard eggs are artificially incubated, an average weight loss of 14.9% should be expected for kori bustards (Anderson 1998a). Anderson (1998b,c) provides details on the artificial incubation of buff-crested bustards and white-bellied bustards that may be relevant to kori bustards.

If artificial incubation is performed, delayed incubation of kori bustard eggs is generally not recommended. Delayed incubation of Houbara bustard (*Chlamydotis undulata*) eggs, where the eggs were stored for a period of time before being transferred to incubators, resulted in a 19% lower hatchability rate, with higher mortality recorded between 3-5 days of development (Jalme and Van Heezik 1996). Kori bustard eggs should be placed in an incubator as soon as they are discovered.

If artificially incubated bustard chicks do not hatch within established pipping intervals, or seem to be weak, then it is possible to perform radiography, endoscopy, and oviductomy, to determine the status of the embryo. Assisted hatching techniques can be successful, but survival of chicks is lower if they are used (see Bailey and Anderson 2000 for details). Table 19 provides a summary of the hatching protocols for kori bustard eggs used at two institutions. While these protocols have been successful for these facilities, other models may be appropriate as well.

Table 19: Artificial hatching protocols for kori bustard eggs

	Institution A Protocol	Institution B Protocol
Hatching		
Hatcher	Grumbach incubator	Leahy hatcher
Temperature	37.4°C (99.3°F)	36.9°C (98.4°F)
Humidity/wet bulb	70-75%	31.1-32.2°C (88-90°F)
Egg turning	None	None

Hand-rearing: Hand-rearing should be considered, and is strongly recommended, for any situation where kori bustard enclosures are not predator-proof. Kori bustard chicks are vulnerable to predation by bird and mammal species that commonly occur in and around zoos in the United States. Hand-rearing should also be considered when dams do not show normal chick rearing behaviors (e.g., feeding and brooding the chicks).

Accumulating evidence indicates that hand-rearing of kori bustards does not negatively impact the future breeding success of the chicks, and may result in animals with a better temperament for management within zoos (e.g., more tractable and more accepting of caretaker/visitor presence) (Hallager and Boylan 2004). Numerous hand-reared kori bustards have become viable breeding birds.

Hand-rearing protocol: With only rare exceptions, hatching occurs on the 23rd day of incubation. Hatch weights for chicks range from 77-116 g (0.17-0.26 lb), with an average of 98 g (0.2 lb) in chicks from an AZA Institution (n=33). After hatching, the chick's umbilicus should be cleaned with Betadine (100%)

solution, and the chick should be weighed. If the chick is clinically dehydrated or has had difficulty hatching, 2cc of half-strength Lactated Ringer's and 2.5% dextrose solution should be provided subcutaneously (Hallager and Boylan 2005). After the initial assessment, the chick should be allowed to rest for several hours in the hatcher, before being moved to a brooder. Brooders that are 69.9 cm x 33 cm x 35.5 cm (27.5 in x 13 in x 14 in) deep and that are kept at 36.1°C (97°F) have been successfully used to hand-rear chicks. The floor of the brooder should be carpeted, and a feather duster hung in one corner to simulate the mother. A small mirror affixed in the brooder can also act as a visual stimulus for the chick. When brooder conditions are appropriate and chicks are provided with sufficient food and tactile stimulation, they will often produce a light chirp or purring sound, especially when feeding (Hallager and Boylan 2004). Chicks in conditions that are not meeting their needs can produce a long, sad whistle that can escalate into a loud wailing. The nutritional requirements of hand-reared chicks are covered in Chapter 5, sections 5.1 and 5.2. The following table (Table 20) provides expected growth rates for hand-reared bustards:

Table 20: Growth rates of bustards reared in zoos.

Species	Growth Rates	Source
Kori	7.5-10% for the first month. Adult bodyweight achieved in females at 300-450 days. Adult bodyweight not achieved in males by 330 days	Anderson 1998a
Buff-crested	5-7.5% for the first month ¹	Anderson 1998b
White-bellied	7.5-10% for the first month. Adult bodyweight reached by 6 months	Anderson 1998c

¹ Anderson (1998c) reports that musculoskeletal problems were seen in buff-crested bustards with growth rates in excess of 10% during one season; recommended growth rates are less than 10% (Anderson 1998c).

At 4-5 days after hatching, hand-reared chicks can be placed with other chicks, provided that the older chick is less than two weeks old. Chicks less than 1 week old should not be placed with other chicks that are >2 weeks of age, as the older chick has the capacity to severely (and possibly fatally) wound the younger chick. When chicks are 3 weeks old, they can be housed together with slightly older chicks, but should be carefully monitored. When introducing young chicks together, the older chick will be aggressive towards the younger chick, but the period of aggression is generally limited to the first several hours after the initial introduction. Chicks should be observed carefully during the brief introduction period. Raising hand-reared chicks with a sibling or similarly aged conspecific reduces the likelihood of imprinting.

Chicks housed alone benefit from a mirror or a heterospecific companion (e.g., quail or guinea fowl chick) in their enclosure; the mirror acts as a calming agent, and serves to reduce the degree of imprinting that occurs. Typically, chicks reared alone have the highest degree of imprinting on their caretakers (e.g., approaching animal caretakers, readily accepting food from them). Placing the chicks in visual contact with adult kori bustards may also reduce human imprinting to some degree. However, this may negatively influence the behavior of the breeding flock, and should only be attempted at the end of the breeding season. Imprinted males have been known to be aggressive towards human caretakers as adults (S. Hallager, personal communication, 2006).

Cross-fostering and shared-rearing techniques have not been used with kori bustards in zoos in the United States, but further investigation into these approaches might be useful to determine if they are applicable to this species. For cross-fostering to be successful, the timing needs to be appropriate for the animals involved. Shared rearing is less likely to be appropriate for kori bustards, as chicks imprint on their dam, and females may attack a chick that is not imprinted. This technique has been used in Australian bustards (*Ardeotis australis*), where some highly capable females were regularly used to foster chicks from less competent mothers (P. Goriup, personal communication, 2007).

As hand-reared kori bustard chicks grow, they should be exercised following each feeding session and as often as possible throughout the day. This will minimize musculoskeletal health problems such as slipped tendons. Access to larger, more complex enclosures should be provided as the chicks continue to develop. Containment for hand-reared chicks should follow recommendations made in Chapter 2, section 2.2. To minimize injuries, chicks should not be housed in enclosures with barriers and obstacles that the birds can impact or trip over (Hallager and Boylan 2004). Whenever hand-reared chicks are introduced to a new enclosure, a familiar keeper should acquaint them to the new space immediately after releasing them by walking around with the birds and showing them the resources available within the enclosure (e.g., plants, fences, walls, dishes, etc.).

Complete day-to-day hand-rearing protocols for kori bustard chicks are summarized in Appendix I. Bailey et al. (1997b) also provide recommended approaches to maximize the health of hand-reared bustard chicks.

7.6 Population Control

Many animals cared for in AZA-accredited institutions breed so successfully that contraception techniques are implemented to ensure that the population remains at a healthy size. In the case that the recommendation is made not to breed a female kori bustard, any fertile eggs that are laid should be removed as soon as they are laid and replaced with dummy eggs. The female should be allowed to sit on her nest until she abandons it at the end of the breeding season. Eggs that are removed should always be replaced with dummy eggs in order to stop the female from laying an excessive number of eggs, as females will re-clutch in some cases.

Avian egg embryo euthanasia: The disposal of fertile eggs should be done with proper consideration for animal welfare implications. The AZA Kori Bustard SSP and the American Association of Zoo Veterinarians (AAZV) recommend that institutions adopt the guidelines that states: “by 50% gestation the neural tube of avian embryos has developed sufficiently for pain perception, and therefore any bird embryos that old or older should be euthanized using methods appropriate for hatched birds (i.e., chemical).” The incubation period for kori bustards is 23 days, and so the cessation of incubation for kori bustard eggs should occur no later than the 11th day after laying, and preferably sooner. Fertile eggs older than 11 days will need to be euthanized using methods appropriate for hatched birds. The AZA Kori Bustard SSP Veterinary Advisor can provide additional information and advice on effective, safe, and humane approaches to utilize. Veterinarians at each institution should develop their own euthanasia protocols that also include egg embryo euthanasia.

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Appendix I: Kori Bustard Chick Hand-rearing Protocol

Day	Brooder/Temp.	# of Feedings	Notes
0	<ul style="list-style-type: none"> - 36.1°C (97°F) - Brooder: 69.85 cm x 33 cm x 35.5cm (27.5 in x 13 in x 14 in) deep, floor is carpeted and a feather duster is hung in a corner - Single chicks are given a mirror 	11	<ul style="list-style-type: none"> - Chicks should be fed as soon as they demonstrate a feeding response. This can be as early as 8 hours post hatch. After this period, chicks should be fed every 60-90 minutes for the first 24 hours post hatch. Night feedings may be necessary if a chick has hatched after 1700hrs. - Each feeding on Day 0: <ul style="list-style-type: none"> 1-2 cricket abdomens (remove heads and legs) 1-2 small pieces watermelon 1 green bean - Later feedings on Day 0: <ul style="list-style-type: none"> Add pellets (no more than 5 pellets). - Water is not necessary for the first three days following hatch provided watermelon is fed and chick hydration is monitored. After three days, chicks will begin drinking from a bowl with encouragement. - Crickets must be maintained on a high calcium insect diet for 72 hours prior to being fed. - Healthy chicks will attempt to grab offered food. Birds that do not show interest in food may be dehydrated. Puffy legs are a good sign of hydration, if skin on the legs appears tight, hydration is poor and chicks must be given SQ fluids. - Chicks will often have poor aim when attempting to eat, but this improves on day 3. - Keepers should brood chicks at every feeding, and as often as possible during the first 7 days. - Do not offer mealworms until day 21 as some chicks have impacted on this food.
1-2	Same as for 'day 0'	6	<ul style="list-style-type: none"> - Chicks are fed at two-hour intervals from 0630 to 1730. Refer to Tables 26, 27, and 28 for daily amounts of food to be fed. Chicks will demonstrate a preference of fruits, crickets, vegetables over pellets so pellets should be fed first followed by the remaining diet. - Healthy chicks normally lose 3-5 g on Day 1, but their weights stabilize on Day 2 and increase thereafter. - In addition to crickets, two waxworms per day should be offered. The number is limited to two per day due to high fat content. Mealworms are considered enrichment items and are not offered until day 21 to avoid impaction - Chicks can stand and walk on Day 2. - Night feedings are not necessary provided the chick is gaining weight.

Day	Brooder/Temp.	# of Feedings	Notes
3	<ul style="list-style-type: none"> - 35°C (95°F) - Carpeted nursery area (1.8 m x 3.7 m) - 3 heat bulbs suspended from the ceiling so that 3 separate sections of floor are kept at 35°C (95°F). - Several feather dusters are suspended near the heat bulbs. - Single chicks are given a mirror. Mirrors can be used with multiple chicks, but this may cause some chicks to be agitated; the mirror should be removed if this is the case. 	6	<ul style="list-style-type: none"> - Feed every 2 hours (0630-1830). - Chicks must be encouraged to exercise in the pen following each feeding to avoid problems such as slipped tendon. - Watermelon should be discontinued. Keepers should offer additional fruits (see Table 28). - Chicks should be trained to drink from a dish. Encouraging the birds to peck at shallow water dishes by using floating greens can be successful. - Use a shallow water bowl and place a rock in the bowl to prevent chicks from falling in and becoming wet. Do not use marbles as chicks can easily ingest these. - Egg (including pulverized shell) introduced into diet (scrambled, microwaved and cut into small pieces).
4-5	Same as 'day 4'	6	<ul style="list-style-type: none"> - Feed every 2 hours (0630-1830) - By Day 5, chicks are keen to pick food floating in water, so to encourage self-feeding some food is left in shallow water bowls during the day. - The need for brooding diminishes around day 6 - chicks will object strongly when brooded. - Chicks may now be offered whole crickets (no need to remove head and legs). - A mix of greens is essential for proper vitamin levels.
6-12	Same as 'day 4'	6	<ul style="list-style-type: none"> - Feed every 2 hours (0630-1830 h). - Hand-reared chicks may develop slipped wings (i.e., an outward turning of the manus) anywhere from Day 7-11. Slipped wing is easily and permanently corrected if the primaries of the affected wing(s) are taped to the body in a natural position for 7-10 days at the first sign of the problem.
13	Same as 'day 4'	5	<ul style="list-style-type: none"> - Feedings may be reduced to five per day. - Chicks are taken outside for the day if the temperature is above 24°C. Once chicks have been given access to outside yards, they should be carefully monitored for the ingestion of foreign material that could result in impaction. The chicks should be watched to

Day	Brooder/Temp.	# of Feedings	Notes
			<ul style="list-style-type: none"> ensure that they do not consume too many pebbles, or stones that are too large. - Ensuring that chicks continue to defecate normally is important. - Once outside, chicks should be monitored frequently for internal parasites and treated as necessary.
14-30	Same as 'day 4'	4	<ul style="list-style-type: none"> - Move the heat lamps up as the chicks grow so that they do not burn the top of their head. Also, beware of chicks jumping- they can jump very high and if heat lamps are too low, they will hit the bulb and break it. - Mealworms may now be introduced into the diet as an enrichment food, but limit the total number fed each day to <10 to reduce the risk of impaction. Mealworms must be maintained on a high calcium insect diet 72h prior to feeding. - Feed chicks 4 times per day.
30-60	When chicks are 30-40 days old, they are moved outside to a covered yard measuring 5m x 15m. The young birds spend the day outside and are housed in a heated shed at night.	3	<ul style="list-style-type: none"> - If chicks are scale trained, weights may be continued. Otherwise, daily weights can be discontinued at around 30 days to minimize the risks associated with repeated handling. - Maintain daily diet components in same approximate percentages as Day 30. - Three feedings / day is sufficient for chicks 30 days and older. - Chicks will likely demonstrate decreased interest in fruit and vegetables by 60 days. Greens are relished up until 8-12 months. - At 60+ days, add pellet-carnivore diet "meatballs" (see Table 29). Although chicks have been successfully reared without mammalian whole prey and carnivore diet introduced into their diet, at 60 days fuzzies may be introduced for behavioral management (scale training, close up viewing, etc.) but amounts should be limited to 4 per day.

Table 26: Daily quantities of food items offered to 1 kori bustard chick, based on 35% BW intake

Days of Age	Average BW (g)	Total Food Offered (g)	Pellet (g)	Insects \Rightarrow (g)	Crickets each	Waxworms each	Egg (g)	Greens (g)	Vegetables (g)	Fruits (g)
0	99.7									
1	93.4	32.7	6.5	3.3 g =	10	2	0.0	1.6	8.2	13.1
2	98.7	34.5	6.9	3.5 g =	11	2	0.0	1.7	8.6	13.8
3	102.0	35.7	8.9	3.6 g =	12	2	1.8	3.6	8.9	8.9
4	110.8	38.8	9.7	3.9 g =	13	2	1.9	3.9	9.7	9.7
5	123.0	43.1	10.8	4.3 g =	15	2	2.2	4.3	10.8	10.8
6	130.3	45.6	11.4	4.6 g =	16	2	2.3	4.6	11.4	11.4
7	145.8	51.0	12.8	5.1 g =	18	2	2.6	5.1	12.8	12.8
8	157.3	55.0	13.8	5.5 g =	20	2	2.8	5.5	13.8	13.8
9	175.0	61.3	15.3	6.1 g =	22	2	3.1	6.1	15.3	15.3
10	192.5	67.4	16.8	6.7 g =	24	2	3.4	6.7	16.8	16.8
11	217.8	76.2	25.2	5.3 g =	18	2	3.8	11.4	19.1	11.4
12	240.0	84.0	27.7	5.9 g =	20	2	4.2	12.6	21.0	12.6
13	253.5	88.7	29.3	6.2 g =	22	2	4.4	13.3	22.2	13.3
14	287.5	100.6	33.2	7.0 g =	25	2	5.0	15.1	25.2	15.1
15	316.3	110.7	36.5	7.7 g =	27	2	5.5	16.6	27.7	16.6
16	338.8	118.6	39.1	8.3 g =	29	2	5.9	17.8	29.6	17.8
17	358.5	125.5	41.4	8.8 g =	31	2	6.3	18.8	31.4	18.8
18	390.0	136.5	45.0	9.6 g =	34	2	6.8	20.5	34.1	20.5
19	418.8	146.6	48.4	10.3 g =	37	2	7.3	22.0	36.6	22.0
20	444.5	155.6	51.3	10.9 g =	39	2	7.8	23.3	38.9	23.3
21	475.0	166.3	54.9	11.6 g =	41	2	8.3	24.9	41.6	24.9
22	513.3	179.6	59.3	12.6 g =	44	2	9.0	35.9	44.9	18.0
23	560.8	196.3	64.8	13.7 g =	48	2	9.8	39.3	49.1	19.6
24	596.5	208.8	68.9	14.6 g =	51	2	10.4	41.8	52.2	20.9
25	631.3	220.9	72.9	15.5 g =	54	2	11.0	44.2	55.2	22.1
26	665.3	232.8	76.8	16.3 g =	57	2	11.6	46.6	58.2	23.3
27	700.0	245.0	80.9	17.2 g =	60	2	12.3	49.0	61.3	24.5
28	743.0	260.1	85.8	18.2 g =	64	2	13.0	52.0	65.0	26.0
29	786.3	275.2	90.8	19.3 g =	68	2	13.8	55.0	68.8	27.5
30	825.8	289.0	95.4	20.2 g =	71	2	14.5	57.8	72.3	28.9

Table 27: Relative proportions of dietary components, fresh weight

Dietary Component	Day (d) 0-2	d 3-10	d 11-21	d 22-30
Pellet	20%	25%	33%	33%
Insects (crickets, waxworms)	10%	10%	7%	7%
Egg	0%	5%	5%	5%
Greens	5%	10%	15%	20%
Vegetables	25%	25%	25%	25%
Fruits	40%	25%	15%	10%

Table 28: Kori bustard chick hand-rearing diet, food items and feeding information by dietary component category

Dietary Component	Food Items and Feeding Information
Pellet	Mixture of 50% Ratite + 50% Gamebird Maintenance or Crane Maintenance, by weight <u>Product Examples:</u> Mazuri Ratite Diet (5647) Mazuri Exotic Gamebird Maintenance (5643) Zeigler Crane Maintenance
Insects	Crickets + Waxworms, offered daily / Mealworms occasionally after d20 Crickets and mealworms must be maintained on a high calcium insect diet 72h prior to feeding <u>Product Examples:</u> Marion Zoological Insect Supplement Mazuri Hi-Ca Cricket Diet Zeigler Hi-Cal Cricket
Egg	Whole egg, including finely chopped shell, scrambled and cooked (microwave)
Greens	Offer a mixture of 2+ varieties: Chicory (Endive) Dandelion Kale Romaine Spinach Chicks will readily consume increasing quantities of greens through ~d45 and as through the first year
Vegetables	Offer a mixture: Peas, frozen, thawed Green beans, frozen, thawed
Fruits	Offer a mixture of 2+ varieties beginning d3: Watermelon – offer as 100% of fruit allotment days 0-2 (for hydration) Apple Banana Cantaloupe Grapes Honeydew Papaya Fruit initially serves as an important source of hydration, and is then decreased with an increased emphasis on the other diet components.

Table 29: Example proportions for kori bustard pellet-carnivore diet “meatballs”

Amount (g)	Meatball Ingredients and Information
150 g	Mazuri Exotic Gamebird
50 g	Mazuri Ratite Diet
250 g	Water
	Allow water to fully absorb, store mixture under refrigeration overnight
150 g	Commercial carnivore diet
	Thaw under refrigeration overnight
	<u>Product Examples:</u>
	Natural Balance Meat-Eating Bird Diet / Carnivore Diet, various
	Central Nebraska Bird of Prey Diet / Carnivore Diet, various