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TECHNICAL REVIEW

Emu Farming: An Alternative to Indian Poultry

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Abstract

Poultry, which was considered a backyard venture in the early 60's has now transformed into a strong agro-based farming activity. Emus *(Dromaius novaehollandiae)* belong to an ancient group of flightless birds native to Australia, are farmed for their fat and meat. India has a 1.4 million emu population presently and Andra Pradesh is leading state in emu farming. As emu can thrive a wide range of climatic conditions, they can be easily explored in Indian subcontinent to meet the demand of animal protein. Commercial emu farming contributes more agricultural out-puts by destroying insects termed as agricultural pests as well as maintains the floral diversity in nature by dispersing of large viable seeds. However, emu farming is done for emu meat which is of high quality in terms of low fat, cholesterol and gamey flavor which renamed it as "new heart healthy". Their fat is rendered to produce oil, which is white in color and signifies dietary, therapeutic (anti inflammatory) and cosmetic value, while leathers is used for boots, belts, luggage, and accessory items. In this technical review various aspects of emu farming is discussed briefly.

Key words: Emu meat, Low cholesterol, Emu Farming, Alternative poultry.

1. Introduction

Poultry, which was considered a backyard venture in the early 60's has now transformed into a strong agro-based farming activity. Though currently the annual poultry egg and meat production in this country has gone up to 63.04 billion and 2.7 million metric tons meat respectively yet the per capita availability of eggs 53 (against 180) and poultry meat 2.15 kg (against 10.8 kg) is till far away from National Advisory Council recommendation (Prabhakaran, 2012). Bridging of the gap between the availability and requirement, poultry industry can be meet by alternate poutry like emus farming. Emus *(Dromaius novaehollandiae)* belong to an ancient group of flightless birds known as ratiles which also includes Kiwi, Ostrich and Rhea (Boopathi *et al*., 2012). Emus (*Dromaius novaehollandiae*), large flightless ratites native to Australia, are farmed for their fat and meat (Bennett *et al*., 2013).

Emus are reared commercially in many parts of the world for their meat, oil, skin and feathers, which are of high economic value. Though Australia is the native of emu farming yet United States is gaining the popularity very fast due to their resistance in wide range (temperate and tropical) of climatic conditions. Besides, these birds can be well maintained on extensive (ranches) and semi intensive rearing systems with reasonably high fibrous diets. Considering the view of adoptable features and future demand to bridge the gap, the species has been introduced in this country since 90's (Rao, 2004). Andhra Pradesh leads the country in emu farming with approximately 3,500 farmers and a bird population of 800,000, closely followed by Tamil Nadu, Maharashtra, Punjab, Haryana, Karnataka and Gujarat. The total emu population in India is estimated to be 1.4 million (Maini, 2013).

The importance of emu farming is enrooted in Indian poultry industry and spreading over the states viz. Maharashtra, Karnataka, Orissa etc. On processing of an emu, you can get emu oil, quilled body, skin (hide), reptile like leg skins and low fat, low cholesterol meat. On an average, 4 to 6 liters of processed (refined) emu oil having medicinal value can be obtained from an Emu. Hide and leg skins are used for manufacturing of very high quality leather products such as boots, belts, purses, wallets, vests, jackets, money clips, bracelets, check-book covers and a

number of other fashionable leather products. Feathers are also useful in production of pillows and other fancy items.

Table 1: Few Facts about our Emu

Particulars	Facts
Height at birth	8 - 10 inches
Adult Height	5 - 6 feet tall
Adult weight	100 - 140 pounds
Colour	Black and Brown
Health	Generally Robust, Hardy
Temperament	Friendly, Docile
Lifespan	35 to 40 years (approx)
Productive years	Up to 25 years
Eggs per year	Average egg laying 10-15 eggs in the first breeding season gradually increases up to 20-30 eggs in subsequent breeding seasons
Age at slaughter	16 – 18 months
Incubation Period	48 - 52 days
Percentage of egg hatched	Approximately 70 percent

The emus are totally different from chicken. They have long and strong legs with rudimentary wings. Average height of the adult is 1.5 to 1.8 meter each weighing about 40-50 kg. They have no comb or wattles or tail and wing feathers. Hence, they can run fast but cannot fly. Compared to the body size, they have smaller beaks which are more flat than those of chicken. They live up to 30 years of age. The usefulness of emu is as follows:

- Skin in leather industry
- Fat for extracting emu oil which has medicinal value
- Meat low in cholesterol and hence healthier than other poultry meats
- Feathers are useful in fancy garments.
- Eggs are mainly used for hatching; otherwise, they are also low in cholesterol.

2. Biology of Emu

The emu (called E-mew in Australia or E-moo in the United States) originated in Australia and belongs to an order of flightless birds called ratites and biologically known as *Dromaius novaehollandae*. Physiologically, *e*mus are long necked, having relatively small head, three toes and body covered with feathers to maintain core body temperature. Birds initially have longitudinal stripes on body (0-3 month's age) which gradually turn to brown by 4-12 months age. Adult bird attains about 6 feet height with 45-60 kg body weight. For best adaptation in hardy and dry soil legs are long and covered with scaly skin. They have exceptionally very strong gastrocnemius muscle in the legs and can run at the speed of 30-50 miles per hour. On free range system they spend their life on foraging grasses, eating insects, tender leaves of plant and different kinds of vegetables viz. carrot, cucumber, papaya. Similar to Japanese quail, females are larger and more active during breeding season over male and gives booming sound where males produce grunting sound the distinguishing features between male and female. The unique feature is that males sit on the nest for incubating the eggs till hatching. They remain in production more than 16 years in 30 years of livability. The economic value of the Emu is dependent upon the oil, meat, and hide. At market age (15-18 months), an emu can yield approximately five liters of oil which is an unsaturated fat and is currently being used in skin care products and topical arthritis creams. Seasonal breeding in the emu occurs in winter and is associated with anorexia and a loss of 20-30% body weight (Sharp *et al.,* 2005).

3. Shelter Management

Adult and young birds must have adequate protection from adverse weather conditions i.e. extreme cold or hot. To facilitate better management of emu chicks (370 to 450 g) restricted to incubator up to 48 hours for proper drying and quick absorption of the yolk. In artificial brooding, 25-40 chicks are allowed at 4 ft^2 space per chick till 3 weeks of age. To avoid jumping and straying of chicks 2.5 feet high chick guard is recommended. To maintain optimum temperature, 40 watt bulb for every 100 ft^2 area is provided inside the brooder.

Growing emus need to be fattened to improve body weight (40kg) at the time of marketing for table purpose. But for layers grower ration is continued up to 18-24 weeks of age by phase feeding. They attain sexual maturity by 18-24 months age. One adult breeder pair of emu can be housed in a shelter of at least 100 x 25 feet that is covered on top and on two or three sides. Pens must be separated by fence, 2- by 4-inch size and 5 to 6 feet height, to allow safe movements of birds. In colony pen space is provided 100ft x 100ft for 4 breeding pairs. Breeder diet (Table 3) fortifies with minerals and vitamins should commence well in advance i.e. 3-4 weeks prior to breeding program to ensure better fertility and hatchability. Separation of both sexes after breeding season is a good commercial practice where they

required maintenance ration. Normally adult bird consumes 1 kg feed /day but during breeding season feed intake will be drastically reduced hence intake of nutrients must be ensured.

4. Incubation and Hatching

Best hatchability is ensured by optimum hatchery condition, holding duration and temperature before setting the eggs. In natural habitat males sit on eggs till hatches come out during which they stop eating and drinking and reduce up to 1/3rd body weight. In artificial hatching eggs should be cold stored at 65 to 70^{o}F with rotation twice daily before setting to maintain optimum hatchability. Incubation time for emu varies between 48 and 52 days (average 50 days). Incubation temperature is 97-98.4 ^{o}F (dry bulb) with relative humidity of 20-30% (67-73 ^{o}F wet bulb) and increase the relative humidity to 30-40% after the hatch for better drying (Davis, 2005). Emu embryos in general take 2-3 times longer incubation time to reach equivalent chicken stage (Nagai *et al*., 2012).

The optimum incubation conditions for emus include temperature and humidity 96.0 to 98.5^{o}F and 20 to 30% respectively. The developing embryo produces carbon dioxide and water as by-products of metabolism using by expense of yolk lipids and albumen proteins. Resulting eggs lose weight through out the incubation at 1.5 g/day. Emu chicks weigh about 370 to 450 g (about 67% of egg weight) depending on the size of egg. First 48-72 hours, emu chicks are restricted to incubator for quick absorption of the yolk and proper drying (Rao, 2004).

5. Emu Nutrition

Emu need balanced diet for their proper growth and reproduction which accounts for 60-70% of the production cost. An adult bird consumes about 1.4 to 1.5 kg feed/day. Emu prefers pellets to mash type of feed. Different Feeds Used Are:

- Chick starter – up to 2 to 3 months of age
- Grower – up to 8 months of age after chick starter till breeder ration.
- Finisher – till market as meat bird; 14 to 16 months of age.
- Breeder – From 16 months onwards till completion of lay.
- Maintenance – after completion of lay till few months before the next season of lay.

Emu are omnivorous and feed on a wide variety of plants and insects. Despite having a relatively simple gastrointestinal tract and a short digesta retention time, emus are able to digest a significant portion of the ingested dietary neutral detergent fiber (Bennett *et al*., 2013).

In natural habitat emus are good forager and spend their life on available vegetables, fruits and insect's viz. alfalfa, red clover, papaya, caterpillar, grasshopper etc. From day 4th chicks can pick up food from ground, during this period they get nutrition from yolk sac. The grower kept for breeding purpose need to be fed on maintenance feed specifically made for this purpose from 8 months to sexual maturity by 18-24 months (Jefferey, 2001).

Emu and ostrich need balanced diet for their proper growth and reproduction. So far the nutrient requirements of these birds were not worked out. Based on the literature (Scheideler, 1997; Mannion *et al*., 1999; Angel, 2003; Aganga *et al*., 2003, Rao, 2004; Reddy, 2004; Kocan and Crewford, 2005). In commercial farms, feed intake per emu breeding pair per annum varied from 394-632 kg with a mean of 527 kg (Rao, 2004). In commercial farms feeds are formulated as starter, grower, finisher, breeder etc. as per requirement given in (Table 3).

6. Healthcare Management

Ratite birds are sturdy and health problems appear mainly in chicks and juvenile stages. Emus are susceptible to diseases like encephalomyelitis, clostridiosis, salmonellosis, aspergillosis, etc. Internal and external parasitic infestation like coccidiosis, ascaridiosis and lice are not uncommon (Davis, 2005). Ivermectin the drug of choice can be given to prevent external and internal worms at 1 month interval beginning at 1 month age (Jeffery, 2001). Eastern equine encephalomyelitis (EEE) is the most dangerous viral disease reported in this species (Jefferey, 2001). In India so far few outbreaks of Ranikhet disease where vaccination at the age of 1, 4 weeks (Lasota strain) and 8, 15, 40 weeks (mukteswar Strain) gives better immunity. Avian Influenza virus ($H_{10}N_7$) was isolated from this species with signs of conjunctivitis and respiratory disorder. Indiscriminate use of medications and poor management can create problems and increase mortality rate.

7. Emu products

7.1 Meat

Emu meat is of high quality in terms of low fat, cholesterol and gamey flavor which renamed it as "new heart healthy". Compared to other species emu meat (Table 4) is suitable for all ages. Considering texture and taste, emu meat is comparable to beef and constituted 10 times less saturated fatty acid. It is rich source of protein, minerals and vitamin C. Proximate -

Table 3: Nutrient requirements suggested for Emus

Parameters	Starter	Grower	Finisher	Breeder	Maintenance
ME (kcal/kg)	2700	2600	2600	2600	2400
Crude Protein (%)	20	18	16	20	15
Crude fiber (%)	9	10	10	10	10
Lysine (%)	1.0	0.8	0.7	0.9	0.63
Methionine (%)	0.45	0.4	0.35	0.40	0.25
Tryptophan (%)	0.17	0.15	0.13	0.18	0.12
Threonine (%)	0.50	0.48	0.42	0.60	0.38
Calcium (%)	1.5	1.5	1.5	2.50	1.6
Available phosphorus (%)	0.55	0.5	0.40	0.4	0.4
Sodium chloride (%)	0.40	0.3	0.30	0.4	0.3
Vitamin A(IU/kg)	15000	8800	8800	15000	8800
Vitamin D 3 (ICU/kg)	4500	3300	3300	4500	3300
Vitamin E (IU/kg)	100	44	44	100	44
Vitamin B 12 (µ g/kg)	45	22	22	45	22
Choline (mg/kg)	2200	2200	2200	2200	2200
Copper (mg/kg)	30	33	33	30	33
Zinc (mg/kg)	110	110	110	110	110
Manganese (mg/kg)	150	154	154	150	154

(Source: Reddy, 2004, Scheideler, 1997)

composition of emu meat indicated higher protein and ash content and lower fat, total lipids and cholesterol content than meat from other meat animals (Naveena *et al.,* 2013). The emu meat is tender, delicious and low cholesterol content (Kiran *et al.,* 2009).

7.2 Oil

Their fat is rendered to produce oil, which is white in color and signifies dietary, therapeutic (anti inflammatory) and cosmetic value. Pure form is nontoxic, non irritant and bacteriostatic. At market age (15-18 months), an emu can yield approximately five liters of oil. This oil is constituted mystiric acid (0.4%), palmitic acid (22%), stearic acid (9.6%), oleic acid (47.4%), linoleic (15.2%) and linolenic acid (0.9%).

7.3 Leathers

Approximately eight square feet of hide obtained from the adult bird used for boots, belts, luggage, and accessory items. Emu leather is a fine-grained hide that is being used by the fashion garment industry in many countries. The leather has proved difficult to tan due to a raised area around the feather follicles in the skin.

7.4 Eggs

In general all poultry eggs are nutritious and favorable edible item. The emu eggs are not only a reproductive material, but also considered as a standard food product (Rao *et al.,* 2008). An emu egg is about 700-800 gm in weight and average width and length is 87 mm and 130 mm respectively, which is equivalent to 10-12 chicken eggs in volume and weight. The chemical composition of an emu egg (Table 5) is constituted higher fat in compare to chicken. The colour of eggs is emerald green; it has a rough surface. The average egg weight is 560 g with a constant shape index of 68.4. The shells were stronger, weighing 13.2% of the egg weight with a thickness of 1.2 mm; 45.6% of the shell egg was albumen and 41.2% was yolk. The egg contents were found to have 69.4% moisture, 12.0% CP, 16.4% EE, 0.63% carbohydrates and 1.19% total ash. Moisture loss of 12.3% was observed to be optimum for good hatchability of emu eggs (Rao *et al.,* 2008).

Table 5: Chemical composition of an emu egg

Parameters	Emu
Shape index	66.07
Dry matter (%)	51.14
Protein (%)	15.54
Fat (%)	35.84
Ash (%)	1.78

(Malik and Ahmad, 2004)

7.5 Emu Feathers

Attractive double quilled feathers are required in craft industries.

Table 4: Meat composition of different species (in 100gms)

Species	Fat (gm)	Cholesterol (mg)	Energy Calories	Protein (gm)	Iron (mg)
Emu	2.4	51.7	106.2	20.9	3.0
Chicken	3.5	80.0	125.0	20.1	1.0
Pork	25.0	65.0	147	20.2	1.0
Mutton	23.4	73.0	282.0	16.6	1.55

(Anonymous, 2010)

7.6 Egg Shells

Egg shells are painted and used as decorative items.

7.7 Toe Nails

Polished and used in jewellery.

8. Economics and Marketing

Emu farm economic survey indicated that cost involved in purchase of breeding stock is expensive (68%) followed by investments of farm (19%) and hatchery (13%) construction. Better returns from emu farming would be possible with good hatchability (more than 80%), lower feeding cost and minimized chick mortality (less than 10%). A good future in emu farming is looking ahead due to the expansion of global markets and gaining importance of meat, skin and oil in socio-economic classes.

9. Conclusion

Emu is the second largest living member of the ratitae family of the flightless birds. It is very important that all aspects of the ratite business are researched since a lot of money, personal time, and energy will be invested into this 365-day-per-year enterprise. Ecologically emus are integral to food chains as consume a variety of plants and insects and being consumed by the predators. The demand of emu is increasing day by day as the species has cent percent utility in terms of market value. Therefore, it is summed up that more importance in emu husbandry may bridge the gap of demand and flourish the poultry industry in India as a whole.

Reference

Aganga AA, Aganga AO and Omphile VJ (2003). Ostrich feeding and nutrition. *Pakistan Journal of Nutrition*, 2(2): 60-67.

Angel CR (2003). Age changes in digestibility of nutrients in ostrich and nutrient profiles of ostrich and Emu eggs as indicators of nutritional status of the hen and chick. www.mazuri.purinamills.com/ostrichdigest.htm: 1-8.

Anonymous (2010). The info booklet on emu farming brochure in India. S.K. Emu hatchery and cattle farms pvt ltd version. www.skemupl.com: 1-41.

Bennett DC, Tun HM, Kim JE, Leung FC and Cheng KM (2013). Characterization of cecal microbiota of the Emu (*Dromaius novaehollandiae*). *Veterinary Microbiology Journal*, 166(2): 304-310.

Boopathi V, Sivakumar T and Tensing GP (2012). Production performance of Emu breeders. *The Indian Journal of Field Veterinarians*, 8(1): 22-23.

Davis GS (2005). Commercial ostrich production. *North Carolina State University* www.ces.ncsu.edu/depts/poulsci/techinfo

Jefferey JS (2001). Ostrich production. *Texas Agricultural Extension Services bulletin.* Texas A and M University, Texas: 1-4.

Kiran KB, Swapna E, Lakashman M, Reddy VR and Reddy AR (2009). Haemato-bio chemical observations in Emu (*Dromaius novaehollandiae*). *Indian Journal of Veterinary Pathology*, 33(2): 238-239.

Kocan AA and Crawford JA (2005). The Oklahoma State Ostrich Book. *Oklahoma State University,Stillwater, Oklahoma.* www.cvm.okstate.edu/instruction/kocan/ostrich/ ostbk2 htm: 1-27.

Maini S (2013). Business standard: AP Incubators plans Rs 14-cr Emu oil unit. http://www.business-standard.com/article/companies/ap-incubators-plans-rs-14-cr-emu-oil-unit1120815000301.html

Mallik BK and Ahmad M (2007). Diversification of poultry. *Central Poultry Development Organization (WR),* http://cpdomumbai.gov.in/EMU.htm.

Mannion PE, Kent PB, Barram KM, Trappet PC, Blight GW and Sales J (1999). Lysine requirements of growing Emu. *British Poultry Science Journal*, 40: 309-311.

Nagai H, Mak S, Weng W, Nakaya Y, Ladher R and Sheng G (2012). Embryonic development of the Emu, *Dromaius novaehollandiae*. *Developmental Dynamics Journal*, 240(1): 162-175.

Naveena BM, Sen AR, Muthukumar M, Girish PS, Kumar YP and Kiran M (2013). Carcass characteristics, composition, physico-chemical, microbial and sensory quality of Emu meat. *British Poultry Science Journal*, 54(3): 329-336.

Prabakaran R (2012). Overview of poultry production in India vis-à-vis global scenario. *Keynote paper, Proceeding of XXIX IPSACON, 5-7 Dec., 2012, Hyderabad.*

Rao NS (2004). A study on the performance of Emu (*Dromaius novaehollandiae*) in Andhra Pradesh. *MVSc Thesis submitted to the Acharya N.G.Ranga AgriculturalUniversity, Hyderabad.*

Rao SN, Nageswara AR, Prasad VK and Reddy VR (2008). Characteristics of the Emu (*Dromaius novaehollandiae*) egg. *Indian Journal of Animal Sciences*, 78(12): 1423-1425.

Reddy AR (2004). Nutrient requirements of Emu (*Dromaius novaehollandiae*)–review. *Presented at the review committee on Emu nutrient requirements of Bureu of Indian Standards, New Delhi:* 1-4.

Scheideler SE (1997). Nutrition guidelines for ostrich and emus. *Iowa State University, Ames Iowa*: 1-3.

Sharp PJ, Cleeff JK van, Martin GB and Blache D (2005). Photoperiodic control of seasonal breeding and appetite in the Emu. *Proceedings of the 3rd International Ratite Science Symposium of the World's Poultry Science Association (WPSA) and 12th World Ostrich Congress, Madrid, Spain*, 14th -16th October, 2005: 53-59.