

SEXUAL DIMORPHISM, EGG LAYING AND EGG WEIGHT IN OSTRICHES (*STRUTHIO CAMELUS*) REARED UNDER INDIAN CONDITIONS

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ABSTRACT

Ostriches are being reared in India from 2000 onwards. The data on reproductive performance recorded over a period of seven years (2002 – 2008) were analysed. Ostriches revealed sexual dimorphism at an age of around 270 days and the mean age of sexual maturity observed was 787.8 ± 29.9 days. The average annual egg production over seven years of study was 18.6 ± 2.9 , 35.1 ± 4.9 , 34.4 ± 5.8 , 28.7 ± 4.6 , 32.5 ± 5.0 , 26 ± 5.4 and 25.1 ± 3.4 per female and no significant variations were observed. The mean egg weight during this period was 1480.02 ± 56.35 g and the effect of year of production was significant ($P \leq 0.01$). The egg weight progressively increased from 1161.1 ± 30.90 g to 1663.23 ± 37.02 g. Egg production was observed during all months of the year with maximum number of eggs recorded in the month of January 384 (13.3%) followed by 326 (11.3%) in December and the lowest of 163 eggs (5.6%) during May. The total number of eggs produced during the seven year period was 2886 at the rate of 412 eggs per year at a laying rate of 29.2 ± 4.6 eggs per hen. The result of this study reveals that the reproductive performances of ostriches are quite comparable and the birds had adapted to the Indian conditions.

Key words: Egg laying, Egg weight, Ostriches, Reproduction, Sexual maturity, Season.

INTRODUCTION

Rearing of ostriches was identified as an alternate to poultry farming and thus an ostrich unit was started by Tamil Nadu Veterinary and Animal Sciences University (TANUVAS) in the state of Tamil Nadu. Ostriches are very popular for their leather, meat and oil. In the early nineties, it was regarded as one of the most profitable agricultural venture. Among many aspects, identification of sex is confusing and misleading. Stewart (1989) concluded that ostriches can be sexed at three months of age by observing their reproductive organs. He further added that even though both the sexes attain sexual maturity at two years of age, the actual reproductive maturity is achieved when the birds are four years old. Egg laying capacity in ostriches has always evinced keen debate in terms of individual capacity of the birds to perform optimally. Shivaprasad (1993) observed that due to poor knowledge of biology and reproductive aspects of ostrich under farming

conditions, they pose tremendous problems to the veterinarians and diagnosticians. Egg laying in ostrich has been reported round the year in Israel (Degen *et al.*, 1994). According to Mellett (1993), breeding season in southern hemisphere starts from March / April and extends into September or later. So, the laying of hens would vary widely between the seasons and also between the geographical locations. Degen *et al.*, (1994) argued that onset of reproductive activity is triggered by the availability of sufficient food over a length of time. Smith *et al.* (1995) observed that egg production per hen in Oudtshoorn, South Africa was between 50 ± 20 eggs during the laying period of 120 days. More (1997) recorded egg production of 38 hens and found that the average was only 2.4 eggs per hen per month. Deeming (1993) observed that the egg size was quite large averaging 1545 g with a range of 1 – 2 kg and that ostrich eggs are one of the largest eggs laid by a bird and it is also the smallest in proportion to the

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body mass. Data obtained for a period of seven years at this unit with regard to their age at sexual maturity, numbers of eggs laid and egg weight are discussed herewith.

MATERIALS AND METHODS

One hundred ostrich chicks were imported and housed at the Livestock Research Station, Kattupakkam, a constituent unit of Tamilnadu Veterinary and Animal Sciences University, after following the mandatory quarantine procedures. This station is located about 40 kms south of Chennai, the state capital of Tamilnadu, India.

The chicks were housed in a closed environment for a period of first two months and the arrangements were similar to that followed for chick brooding. After two months, the chicks were reared under semi-intensive system. The ostriches were provided with a floor space of 10 - 20 sq. ft, 20 - 40 sq. ft, and 80 - 100 sq. ft during the period of 2, 6 and 10 months respectively. The chicks were let into the open area during day time and were under closed shelter during the night time. This system was followed till the chicks adjusted to the surroundings. Behaviour of chicks was keenly observed, as it was the best indicators of their comfort. Later, the chicks

were allowed in the open paddocks even during night time. The same was followed till the birds attained the age of 18 months. At 18 months of age, the birds were segregated into male and female and housed as breeding trios (1 male with 2 female). Each bird was provided with an area of 500 sq. m. The birds were vaccinated only against New Castle disease during 5th day, 4th week and once in every 6 months.

Ostriches were fed with five feeding regimens as described in Table 1. All the birds were offered mash feed from day one. The quantity of feed varied from 230g during the first month to 3414g during the adult stage (> 18 month). Apart from the mash feed, juvenile ostriches were also fed *ad libitum* with fresh hedge lucerne (*Desmanthus virgatus*). Adult ostriches were allowed to graze in the paddocks sown with *Stylosanthes hemata*.

The data related to gender identification, age at sexual maturity, egg production and egg weight for a period of seven years were recorded. The data were analysed and results interpreted.

RESULTS AND DISCUSSION

Sexual dimorphism: Sexual dimorphism was observed at the age of 8 - 9 months, when the plumage coloration was black for males and grey

TABLE 1: Ingredient composition and nutrient content of the feed.

Ingredient (%)	Chick (0 - 3 m)	Grower - I (3 - 6 m)	Grower - II (6 - 12 m)	Conditioner (12 - 18 m)	Layer (> 18 m)
Maize grain	30.5	27.5	30.0	27.5	24.5
Alfalfa meal	31.0	38.0	42.0	45.5	35.5
Soya bean meal	28.5	26.5	20.5	19.2	29.8
Vegetable oil	1.0	1.5	1.5	1.3	1.5
Vitamin A, D & E ¹	0.34	0	0	0	0.1
Vitamin E ²	1.16	0	0	0	0.4
Cal. carbonate	-	-	-	-	0.7
Premix ³	7.5	6.5	6.0	6.5	7.5
TOTAL	100	100	100	100	100
Chemical Composition (%)					
C. P	22	20	19	20	22
Lysine	1.2	1.2	1.00	1.00	1.2
Methionine	0.4	0.4	0.4	0.4	0.4
Calcium	1.3	1.2	1.1	1.2	3.0
Phosphorus	0.6	0.6	0.5	0.5	0.9
M.E (Kcal/kg)	2200	2200	2100	2100	2150

¹ Contains Vit.A 1,500,000 IU/lb, Vit. D3 300,000 IU/lb, Vit. E 50 IU /lb

² Contains Vit.E 44.10 IU/lb

³ Contains Calcium 17%, Salt 7.5%, Vit.D 150,000 IU/kg, Phosphorus 9.0%, Vit.A 50,000IU/kg, Vit. E 4000 IU/kg, Lysine 0.55 %

for females. Presence of phallus or clitoris observed during urination was also taken into consideration. Based on these findings, males and females were identified and housed in the breeding paddocks. According to Samour *et al.* (1984), sexual differentiation could be done by visual and digital examination. Fowler (1991) observed that sexes could also be identified by proctoscopy method. Several authors like Samour *et al.* (1984), Gandini and Kaffen (1985) and Huchzermeyer (1998) had cautioned that the sexing should be performed carefully and very gently to prevent cloacal prolapses. Gandini and Kaffen (1985) described the technique of eversion of the proctodeum and distinguished males from females by the presence of a phallus with a sulcus and visible blood vessels. Stewart (1989) observed that in young chicks, the phallus and clitoris were of similar size and the phallus was conical in cross section and revealed a seminal groove, whereas the clitoris was laterally compressed and lacked similar groove.

Age at sexual maturity: Age at sexual maturity was determined as the age when the bird laid its first egg. The average age of sexual maturity observed in the present study was 787.8 ± 29.9 days (26.2 months). The minimum and maximum age of sexual maturity observed was 593 days (19.7 months) and 958 days (31.9 months) respectively. Out of the 15 female ostriches, 7 (46.6 %) attained sexual maturity

during 24 – 27 months of age, 4 (26.7 %) during 31 – 33 months of age and 2 (13.3 %) each between 18 – 21 months and 21 – 24 months of age. Hamid (2007) recorded that ostriches in Central Saudi Arabia started laying eggs at 19 months of age. Majority of the birds at this station had attained sexual maturity between 24 to 27 months of age.

Egg production: The results on the egg production and egg weight are presented in Table 2. During the seven year period, 2886 eggs were laid. The total egg production observed during the seven year period was 224, 562, 516, 431, 488, 338 and 327 with an average of 18.6 ± 2.9 , 35.1 ± 4.9 , 34.4 ± 5.8 , 28.7 ± 4.6 , 32.5 ± 5.0 , 26.0 ± 5.4 and 25.1 ± 3.4 per female per year. There was a wide difference between the minimum and maximum number of eggs laid per bird per year. Maximum and minimum egg production observed during the study period was 61.4 and 4.1 respectively. The findings of the present study showed wide variations during the seven years period and no specific pattern was observed. Van Schalkwyk *et al.* (1996) recorded an average egg production of 55.5 eggs per hen in South Africa. More (1996) reported that the productivity of farmed ostrich hens in Australia was very low, with over 50% of hens maintained in pairs not laying any eggs during the seasons studied. Egg laying is affected by

TABLE 2: Total egg production, average egg production and egg weight (Mean $\pm$ SE).

Parameters	I Year	II Year	III Year	IV Year	V Year	VI Year	VII Year	Overall
No. of hens in production	12	16	15	15	15	13	13	99
Total egg production	224	562	516	431	488	338	327	2886
Average /hen/ year	18.6 ± 2.9	35.1 ± 4.9	34.4 ± 5.8	28.7 ± 4.6	32.5 ± 5.0	26.0 ± 5.4	25.1 ± 3.4	29.2 ± 4.6
Maximum eggs/hen/ year	42	70	70	59	69	73	47	61.4
Minimum eggs/hen/ year	7	5	1	1	5	1	9	4.1
Egg weight**	1161.1 ± 30.9^a	1327.0 ± 28.1^b	1390.2 ± 47.2^b	1595.7 ± 32.5^c	1597.5 ± 31.9^c	1625.1 ± 34.4^d	1663.2 ± 37.0^d	1480.0 ± 56.4
Minimum weight	930	1070	1159	1379	1389	1398	1395	1246
Maximum weight	1400	1513	1698	1838	1844	1987	1876	1737

**Means with different superscript differ significantly ($P \leq 0.01$)

various reasons. The findings of this study revealed that egg production was at the peak during the second (562) and third year (516) of production and thereafter the production decreased except in the fifth year. Environmental stress like sudden rain or sudden heat spells could also reduce egg laying temporarily (Anonymous, 1999).

Egg weight: Egg weight showed significant difference ($P \leq 0.01$) between the years of laying. There was a steady and significant increase in the egg weight from 1st year ($1161.17 \pm 30.9\text{g}$) to 7th year ($1663.23 \pm 37.0\text{g}$). Egg laying in ostriches has been observed round the year. The data obtained are presented month-wise and season wise in Table 3. As observed in chicken eggs, ostrich eggs also tend to increase in size as the age advances. The average egg weight during the seven year period was $1480.01 \pm 56.4\text{g}$, which is similar to that observed in other countries. Ar *et al.* (1996) recorded an average egg weight to be 1461g. Average weight of 1444g was reported by Superchi *et al.* (2002). Rizzi *et al.* (2002) recorded an average weight of $1558 \pm 167\text{g}$ in Italy. Deeming *et al.* (1993) observed that the eggs received from Namibia and United Kingdom had an average weight of 1437g and 1464g respectively. Deeming (1993) observed an average egg weight of 1403g in Zimbabwe. More (1996)

observed lower average egg weight of 1302g in Australia.

Laying Season: The results revealed that the main laying season was between October and March which collectively accounted for 1685 eggs (58.3%); April to September accounted for the rest of the 1201 eggs (41.7%). Maximum production was observed during the month of January at 384 eggs (13.3%) followed by December 326 eggs (11.3%). Lowest production was observed during the month of May at 163 eggs (5.6%) and June at 179 eggs (6.2%). Overall picture revealed that the egg production fluctuated from year to year and no two years revealed similar results. According to seasonal classifications, winter (December to February) accounted for 34.8% (1005 eggs), summer (March – May) accounted for 22.8% (658 eggs), southwest monsoon (June – August) accounted for 21.6% (622 eggs) and northwest monsoon (September – November) accounted for the rest 20.8% (601 eggs). The egg laying pattern observed was more or less unpredictable. No two years had similar pattern of laying. On an average, the annual egg production per female was 29.2 ± 4.6 eggs. Egg laying in this station has been observed round the year and similar observations were reported in Israel by Degen *et al.* (1994). Jarvis *et al.* (1985) reported that in Zimbabwe, wild ostriches laid eggs from July to December, while the domesticated ostriches laid eggs till the end of February. Hicks (1992) reported that ostriches in Northern USA laid eggs from May to September, while the birds in South laid round the year. Stewart (1989) observed that in USA, ostriches are summer breeders, but the season may extend from January to October. As observed in egg production and egg weight, laying season also varies from place to place. Reproductive performance of ostriches like sexual dimorphism, age at sexual maturity, egg production, egg weight, etc were found to be as observed in other parts of countries further emphasising that the ostriches have well adapted to our conditions.

TABLE 3: Egg laying in ostriches as influenced by season and month of the years.

Season	Month	No. of eggs (%)	
Winter	December	326 (11.3)	1005 (34.8)
	January	384 (13.3)	
	February	295 (10.2)	
Summer	March	272 (9.4)	658 (22.8)
	April	223 (7.7)	
	May	163 (5.6)	
South west monsoon	June	179 (6.2)	622 (21.6)
	July	206 (7.2)	
	August	237 (8.2)	
North west monsoon	September	193 (6.8)	601 (20.8)
	October	178 (6.2)	
	November	230 (7.9)	
		2886	

Figures in parenthesis indicate percentage values

REFERENCES

- Anonymous, (1999). Annual Report. *Zemarch Ostriches, Jordan Valley*, Israel.
- Ar, A., M. Meir, N. Aizak and D. Campi. (1996). *Improving our understanding of ratites in a farming environment*. Deeming D.C (ed) Ratite Conference, Oxfordshire, UK, 144 – 146p.
- Deeming, D.C., Ayres L., and Ayres F.L.. (1993). Observations on the commercial production of ostrich (*Struthio camelus*) in the UK. *Vet. Record*. **132**: 602 -607.
- Deeming, D.C., (1993). In: Deeming DC and Ferguson MWJ (eds) Egg Incubation: its effect on Embryonic Development in Birds and reptiles. Cambridge University Press, Cambridge 307 – 322p.
- Degen, A.A. , Weil S. , Rosenstrauch A., Kam M., and Dawson A. (1994). Seasonal plasma levels of luteinizing hormone and steroid hormone in male and female domestic ostriches (*Struthio camelus*). *General and Comparative Endocrinology* **93**: 21 – 27.
- Fowler, M.E. (1991). Comparative clinical anatomy of ratites. *J. Zoo Wild Life Medicine* **22**: 204 – 227.
- Gandini, G.C.M., and Keffen R.H.. (1985). Sex determination of the South African ostriches (*Struthio camelus*). *J. South African Vet. Assoc.* **56**: 209 – 210.
- Hamid, A. (2007). Productivity of commercially farmed ostriches in Saudi Arabia Tropentag. *Ph.D. Thesis*, Sudan University of Science and Technology.
- Hicks, K.D. (1992). Ratite Reproduction. Proceedings of the Association of Avian Veterinarians, 318 -324p.
- Huchzermeyer, F.W. (1998). Diseases of ostriches and other ratites; Agricultural Research Council, Onderstepoort Veterinary Institute, South Africa.
- Jarvis, M.J.F., Jarvis C. and Keffen R.H. (1985). Breeding seasons and laying patterns of the Southern African Ostrich (*Struthio camelus*). *Ibis* **127**: 442 – 449
- Mellet, F.D. (1993). Ostrich production and products; Maree C and Casey NH (eds) Livestock production system; Principles and practices. Agri development Foundation, Pretoria 187 – 194 p.
- More, S.J. (1996). The performance of farmed ostrich hens in eastern Australia. *Preventive Vet. Medicine* **29**: 107 – 120.
- More, S.J., (1997). Monitoring the health and productivity of farmed ostrich flocks. *Aus. Vet. J.* **75**: 583 – 587.
- Rizzi, R., Erba M., Giulian M.G., Cerelini S. and Cerutti F.. (2002). Variability of ostrich egg production on a farm in Northern Italy. *J. Appl. Poult. Res.* **11**: 332 – 337.
- Samour, J.H., J. Markham, and O. Nieva. (1984). Sexing ratite birds by cloacal examination. *Vet. Record*. **115**: 167-169.
- Shivaprasad, H., (1993). *Proceedings of the Annual Conference of the Association of Avian Veterinarians, Nashville*. 282-293 p.
- Smith, W.A., Cilliers. S.C., Mellett E.D., and Vanschalkwyk S.J.. (1995). Proceedings of the 11th Alltech Annual Symposium. Nottingham University Press, Nottingham, 175 – 197p.
- Superchi, P., Sussi. C., Sabbioni A. and Beretti V.. (2002). *Ann.Fac.Medic. Vet.di Pharma* **22**:155 – 162p.
- Stewart, J.S., (1989). Husbandry and medical management of ostriches. Proceedings of the Association of Avian Veterinarians pp. 208 -212.
- van Schalkwyk, S.J., Cloete S.W.P and de Kock J.A. (1996). Repeatability and phenotypic correlations for body weight and reproduction in commercial ostrich breeding pairs. *British Poult. Sci.* **37**: 953 – 962.