

## Characteristics of the emu (*Dromaius novaehollandiae*) egg\*

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Received: 4 June 2008; Accepted: 10 July 2008

**Key words:** Emu egg, Egg characteristics

In general all poultry eggs are nutritious and favourable edible item. The emu eggs are not only a reproductive material, but also considered as a standard food product. The physical and chemical properties and egg quality of different poultry eggs are known well. The present study was conducted to analyze the characteristics of emu eggs since very scanty information is available on these aspects.

Emu eggs collected from 4½ years-old emu flock during second laying year was used for this study. The colour and surface texture of eggs and egg weights were recorded in 53 eggs. A total of 86 eggs collected hen-wise from 8 hens were evaluated for shape index. Shell thickness, albumen index, Haugh unit score and yolk index were measured in five eggs. The physical (albumen, yolk and shell) and chemical (CP, EE, CF, carbohydrates and total ash) compositions of three eggs were analyzed (AOAC 1990). Sound eggs numbering 110 were incubated. All eggs were weighed before setting and at weekly intervals during incubation. Weight loss in hatching eggs during the first 6 weeks of incubation was measured. The data was analyzed with statistical methods (Snedecor and Cochran 1989).

The colour and surface texture of the maximum of the eggs laid in flock was medium green and rough (41.5%),

followed by dark green and smooth (18.9%) and medium green and light rough (17%). The available literature did not reveal any information on colour and surface texture of emu eggs.

The majority of hens laid eggs with an egg weight between 500 and 600g with mean of 560g (Table 1). Similar values (Menezes *et al.* 2001) or slightly higher values (626–627g) (Minnar and Minnar 1993) and much higher values (711 g) (Romanoff and Romanoff 1989) for egg weight were also documented. In general, the emu eggs were about half the size of the ostrich eggs (Horbanczuk 2000). The data indicated that egg weight was not related to the potential of egg production of a hen. In this manner, considerable variation in egg weights was observed between eggs laid by the same hen and also between different hens ( $P<0.05$ ). The data indicated that egg weight being genetic character varied from hen to hen.

The shape index was the highest ( $P<0.05$ ) in one hen that laid the lowest number of eggs (2), while all other hens laid eggs that have a closer range (66.4–69.2) of shape index (Table 2). This indicates uniformity of shape in emu eggs. In general, the shape index depends on the length and width of the egg in relation to its weight. Smaller eggs are more

Table 1. Egg weight (g) of emu hens (4 ½ to 5 years of age) during second laying year

| Egg weight     | Bird identification number |                       |                       |                        |                       |                       |                        |                        | Mean     |
|----------------|----------------------------|-----------------------|-----------------------|------------------------|-----------------------|-----------------------|------------------------|------------------------|----------|
|                | 2                          | 7                     | 6                     | 5                      | 8                     | 9                     | 1                      | 4                      |          |
| Minimum        | 463                        | 526                   | 586                   | 523                    | 481                   | 552                   | 488                    | 485                    | 513±13.7 |
| Maximum        | 561                        | 594                   | 654                   | 664                    | 559                   | 614                   | 558                    | 538                    | 593±15.6 |
| Mean           | 530 <sup>a</sup> ±4.6      | 561 <sup>b</sup> ±3.6 | 625 <sup>d</sup> ±3.2 | 620 <sup>d</sup> ±10.8 | 517 <sup>a</sup> ±5.6 | 592 <sup>c</sup> ±9.8 | 525 <sup>a</sup> ±16.6 | 511 <sup>a</sup> ±12.5 | 560±4.7  |
| Egg production | 24                         | 23                    | 23                    | 17                     | 17                    | 5                     | 3                      | 3                      | 14.4     |

Means bearing similar superscripts within a row do not differ significantly ( $P<0.05$ ).

\*Part of M.V.Sc. thesis submitted by the first author to ANGR Agricultural University, Rajendranagar, Hyderabad 500 030.

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spherical with higher shape index and larger eggs are more ellipsoid with lower shape index (Gonzalez *et al.* 1982). The mean shape index observed in this study was in close agreement with that reported (66.07) by Majewska (2001). However, it was much lower than chicken eggs (Myandmets

Table 2. Shape index of emu eggs

| Bird No.   | Eggs recorded<br>(No) | Shape index |          |                          |
|------------|-----------------------|-------------|----------|--------------------------|
|            |                       | Highest     | Lowest   | Mean*                    |
| 1          | 2                     | 72.2        | 71.1     | 71.7 <sup>c</sup> ±0.39  |
| 2          | 20                    | 72.5        | 63.5     | 68.1 <sup>ab</sup> ±0.47 |
| 4          | 3                     | 70.0        | 65.7     | 68.3 <sup>ab</sup> ±1.12 |
| 5          | 15                    | 69.2        | 66.0     | 67.6 <sup>ab</sup> ±0.21 |
| 6          | 19                    | 70.3        | 60.8     | 66.4 <sup>a</sup> ±0.50  |
| 7          | 16                    | 71.5        | 61.1     | 67.4 <sup>a</sup> ±0.69  |
| 8          | 6                     | 71.0        | 66.2     | 68.6 <sup>b</sup> ±0.74  |
| 9          | 5                     | 74.7        | 66.6     | 69.2 <sup>b</sup> ±1.31  |
| Grand mean | 86                    | 71.4±0.57   | 65.1±1.1 | 68.4±0.26                |

\*Means bearing similar superscripts do not differ significantly (P<0.05).

*et al.* 1991) and duck eggs (Sharma *et al.* 2002).

The emu egg shell thickness recorded was 1.202 mm which is much lower than ostrich (2.1 mm) reported by Horbanczuk (2000). But it was much higher than many avian species like chicken (0.34 mm) (Simeonovova *et al.* 1989), duck (Das *et al.* 2000). Albumen index (0.095) was almost similar to that of avian species but slightly lower than duck (0.114) (Sharma *et al.* 2002). Yolk index of emu egg was observed (0.243) to be far lower than that of chicken, duck (0.39; 0.43) (Das *et al.* 2000). HU score (74.2) was almost similar to chicken (74.0) (Myandmets *et al.* 1991) but lower than duck (79.8) (Das *et al.* 2000).

The physical and chemical composition of emu egg is shown in Table 3. The content of albumen (45.6%) in emu egg was lower than chicken egg (63%) (Simeonovova *et al.* 1989) and duck egg (53%) (Tikk *et al.* 1990). While the yolk content was high in emu egg (41.2%) than chicken eggs (28.5%) (Simeonovova *et al.* 1989), duck eggs (37.8%) (Tikk *et al.* 1990). The emu egg shell content (13.2%) was also higher than chicken egg (8.5%) (Simeonovova *et al.* 1989) and duck egg (9.2%) (Tikk *et al.* 1990).

The moisture content was predominant in albumen than yolk in emu eggs (Table 3). The CP content was low in albumen and high in yolk. The EE was in traces in albumen and 34.6% in yolk. The carbohydrates in albumen and yolk were almost similar. Total ash content was much higher in yolk than in albumen. The composition of emu egg contents

in comparison to chicken (Cotterill *et al.* 1977) was observed to have similar CP (12.0%) but higher dry matter (30.6% vs. 25.3%), EE (16.4% vs. 12.3%) and total ash (1.19% vs. 0.9%). The per cent dry matter, EE, CP and ash contents in albumen (11.5, traces, 9.7 and 0.72, respectively) and yolk (51.8, 34.6, 14.6 and 1.7, respectively) were almost similar to that reported (11.3, traces, 9.6 and 0.71, respectively in albumen; 54.1, 35.8, 15.5 and 1.78, respectively in yolk) by Majewska (2001). The nutritive value of emu egg is important as it is not only a reproductive material but also considered as a standard food product. According to some reports, the emu egg white contained lower protein (9.58%) than that found in other avian species (Majewska, 2001). On dry matter basis, the protein in emu egg contents was 42.9% which was lower to that in ostrich (47.1%) and chicken eggs (47.7%) while fat was 48.1% which was higher compared to that in ostrich (43.7%) and chicken (45.4%) (Angel 1993). In comparison to chicken (Cotterill *et al.* 1977), emu egg yolk contained almost similar dry matter (51.8% vs. 50.8%) and fat (34.6% vs. 34.1%) and slightly higher total ash (1.71% vs. 1.6%).

Weight loss in hatching eggs during incubation ranged from 11.7 to 14.3% with mean of 12.8%. It was the highest in infertile eggs (14.3%), followed by eggs hatched (12.3%) and dead-in-shell eggs (11.7%). In general, it was observed to be higher during 1st week compared to that of subsequent weeks of incubation irrespective of the kind of condition of the incubated eggs. It was observed highest in infertile eggs during 6th week and the lowest (1.69%) in dead in shell eggs during 5th week of incubation (3.0%). As in ostrich, the weight loss in emu eggs during incubation is also an important criterion to be analyzed as a check to ascertain problems in hatchability. As per literature, the range of loss in egg weight during incubation was about 10 to 20% (Minnar and Minnar 1993). An egg weight loss of 13–15% was reported to be optimum for ostrich eggs (Ipek and Sahan 2002) while 30% was considered optimum for eggs of Japanese quail (Saylem and Sarica 1997). Lower weight loss in emu egg than other poultry eggs may be attributed to its egg characters such as thick shell thickness, less shell porosity and thick inner shell membrane than poultry eggs. Moisture loss of 12.3% was observed to be optimum for good hatchability of emu eggs in the present study. This was in agreement with that of

Table 3. Physical and chemical composition (%) of emu egg

| Component          | Proportion in<br>egg | Chemical composition of egg contents |               |               |               |             |           |
|--------------------|----------------------|--------------------------------------|---------------|---------------|---------------|-------------|-----------|
|                    |                      | Moisture                             | Crude protein | Ether extract | Carbohydrates | Crude fiber | Total ash |
| Albumen            | 45.6±0.32            | 88.5±0.19                            | 9.7±0.13      | Traces        | 0.64±0.03     | Nil         | 0.72±0.01 |
| Yolk               | 41.2±0.15            | 48.2±0.95                            | 14.6±0.31     | 34.6±0.69     | 0.62±0.01     | Nil         | 1.71±0.03 |
| Shell              | 13.2±0.17            | NA                                   | NA            | NA            | NA            | NA          | NA        |
| Whole egg contents | -                    | 69.4±0.55                            | 12.0±0.22     | 16.4±0.33     | 0.63±0.01     | Nil         | 1.19±0.02 |

NA: Not analyzed.

Table 4. Chick weight at hatch as per cent of egg weight

| Egg weight category (g) | Mean egg weight (g) | Mean chick weight at hatch (g) | Mean chick weight as per cent of egg weight |
|-------------------------|---------------------|--------------------------------|---------------------------------------------|
| 451–500                 | 476.0±9.22          | 319.5 <sup>a</sup> ±1.77       | 67.2 <sup>a</sup> ±0.96                     |
| 501–550                 | 528.5±2.68          | 355.4 <sup>b</sup> ±2.48       | 67.3 <sup>a</sup> ±0.43                     |
| 551–600                 | 566.3±4.16          | 378.4 <sup>c</sup> ±4.67       | 66.8 <sup>a</sup> ±0.39                     |
| 601–650                 | 619.9±3.53          | 418.5 <sup>d</sup> ±4.46       | 67.5 <sup>a</sup> ±0.59                     |
| 651–700                 | 669±10.64           | 445.2 <sup>e</sup> ±15.07      | 66.5 <sup>a</sup> ±1.21                     |
| Overall mean            | 568±8.07            | 381.6±5.42                     | 67.1±0.27                                   |

Means bearing similar superscripts within a column do not differ significantly.

Danczak and Majewska (1999).

The weight of chick increased significantly ( $P<0.05$ ) with increase of egg weight (Table 4). This per cent chick weight in proportion to initial egg weight was found to be fairly constant in different weight categories of eggs. The emu eggs incubated were found to have mean weight of 560g with mean chick weight of 381.6g with average of 67.1% of egg weight as chick weight. Similar results were reported for emu eggs (Menezes *et al.* 2001). The chick weight in ostrich was found to be 63.6% of its egg weight (Wilson *et al.* 1997).

#### SUMMARY

Present study was conducted to analyze the characteristics of emu eggs. The colour of eggs was emerald green with a rough surface. The average egg weight was 560g 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 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. The mean chick weight was 382g and it was 67.1% of the egg weight.

#### REFERENCES

- Angel C R. 1993. Nutrient profiles of ostrich and emu eggs as indicators of nutritional status of the hen and chick. *Proceedings of the meeting of the Australian Ostrich Association Inc.*, 3rd July 1993. Pro. No. 217. Postgraduate committee in Veterinary Science, University of Sydney 138–40.
- AOAC. 1990. *Official Methods of Analysis*. 14th edn. Association of Official Analytical Chemists. Washington D.C.
- Cotterill O J, Marion W N and Naber E C. 1977. A nutrient re-evaluation of shell eggs. *Poultry Science* **56**: 1927–34.
- Danczak A and Majewska D. 1999. Emu hatch success and controls on hatchlings survival. *Advances in Agricultural Sciences* **6**(1): 25–30.
- Das G C, Goswamy N, Dad D and Goswamy R N. 2000. Studies on certain egg quality traits of Khaki Campbell, Desi and their crosses. *Indian Journal of Poultry Science* **35**(2): 222–23.
- Gonzalez M, Roca P, Sainz F, Alemany M. 1982. A comparison between egg surface and volumes of several avian species. *Comparative Biochemistry and Physiology* **73A**: 301–02.
- Horbanczuk J O. 2000. Improving the technology of artificial incubation of ostrich (*Struthio camelus*) eggs with reference to biological aspects. *Praceimaterialy zootechniczne zeszyty specjalny* **10**: 1–90.
- Ipek A and Sahan U. 2002. The effects of egg weight on the hatching characteristics of ostrich eggs. *Turk Veterinerlik Ve Hayvancilik Dergisi* **26**(4): 723–28.
- Majewska D. 2001. The influence of emu egg storage time on hatchability and chick survival. *Electronic Journal of Polish Agricultural Universities* (2): Series Animal Husbandry.
- Menezes R, Reddy P V V S, Venkatramaiah A, Reddy P S and Prasad J R. 2001. Studies on incubation, hatching, and early growth rate of emus. *Indian Journal of Poultry Science* **36**(3): 268–70.
- Minnar P and Minnar M. 1993. *The Emu Farmers Handbook*. Induna Company, Groveton, Texas.
- Myandmets R, Myandmets I and Lilleoya A. 1991. Introducing a brown cross. *Ptitsevodstvo* **5**: 8–10.
- Myandmets R, Myandmets I and Lilleoya A. 1991. Introducing a brown cross. *Ptitsevodstvo* **5**: 18–10.
- Romanoff A L and Romanoff A J. 1989. *The Avian Egg*. John Wiley & Sons Inc., New York.
- Saylam S K and Sarica M. 1997. Effects of shell thickness, shell pores and egg weight Loss on hatchability of Japanese quail eggs. *Ondokuzmayis Universitesi. Ziraat Fakultesi Derjisi* **12**: 26–35.
- Sharma S S, Zaman G, Goswamy R N, Roy T C and Mahanta J D. 2002. Physical characteristics of Nageswari duck eggs of Assam. *Indian Journal of Animal Sciences* **72**(12): 1177–78.
- Simeonovova J, Ingr I, Jerabek S, Winterova J and Dvorakova V. 1989. Evaluation of eggs laid by Rhod Island Red, Rhod Island White hens. *Zivocisna-vyrova* **34**(8): 759–68.
- Snedecor G W and Cochran W G. 1989. *Statistical Methods*. 8th edn. Iowa State University Press, Ames, Iowa 50010.
- Tikk V, Tikk K H and Vikht R. 1990. White mallards. *Ptitsevodstvo* **7**: 27–8.
- Wilson H R, Eldred A R and Wilcox C J. 1997. Storage time and ostrich egg hatchability. *Journal of Applied Poultry Research* **6**(2): 216–20.