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Physical and organoleptic characteristics of ostrich (*Struthio camelus*) eggs

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Abstract
A study was conducted to assess the physical characteristics and organoleptic comparison of ostrich egg with turkey and chicken eggs. Six eggs were randomly collected and used for the study. Studies revealed that the average weight, length, width, shape index, shell thickness, albumin weight, yolk weight and yolk colour score of ostrich to be 1237.33 g, 14.92 cm, 11.67 cm, 78.28, 2.87 mm, 720 g, 283.33 g and 103.67 respectively. The organoleptic mean values given to ostrich eggs by different panelist for appearance, colour, odour, juiciness, texture, tenderness, flavor and overall acceptability were 7.83, 8.83, 7.67, 7.83, 8.67, 8.17, 8.33 and 7.67 respectively. Non-significant differences were observed for all important sensory attributes in comparison of ostrich, turkey and chicken eggs except for colour and texture. It can be summarized that the ostrich egg can be a good alternate to conventional chicken eggs.

Keywords: Ostrich eggs, physical characteristics, sensory evaluation, *Struthio camelus*

Introduction
Chicken meat and eggs are the prime source of high quality protein, which are badly needed by major group of population across the world. The poultry egg not only provides protein but also act as an important source of nutrients, like lipids, vitamins, minerals, growth factors, as well as a number of defense factors to protect against bacterial and viral infection. Even though chicken eggs are commonly eaten by the human population, eggs of other species can also serve the purpose. Other avian species eggs are getting popular day by day like Japanese quail eggs are gaining popularity in Europe and America, ostrich eggs in South Africa [1] and duck eggs in south-east Asian countries. Recently eggs of alternate poultry species including guinea fowl, ostrich, emu, pheasant and Japanese quail are emphasized, because they provide valuable niche products [2]. Since only limited farms and research institutes maintain ostrich in India, the knowledge pertaining to internal and external qualities of ostrich egg and organoleptic comparison of ostrich eggs with other eggs is still limited [3]. With these facts in the mind, the current study was undertaken to shed light on the morphological parameters of ostrich egg along with sensory comparison to eggs of other poultry species.

Materials and methods
A pair of four years old ostrich was reared at the Instructional Livestock Farm Complex, Madhavaram Milk Colony, Chennai. The ostrich were fed with concentrate mixture (consisting of maize, oats, DORB, soyabean meal, shell grit, DCP, oil, salt and mineral mixture) and chopped green fodder. Birds were maintained at well ventilated sheds with 24 hrs drinking water provision. Six eggs laid during a clutch were collected and subjected to physical characters and organoleptic test for comparison with chicken and turkey egg. Physical analysis like egg weight, length, width, shape index, shell weight and shell thickness were analysed first. Subsequently eggs were opened for analysis like albumin diameter, albumin height, albumin weight, yolk diameter (Image 1), yolk height, yolk weight, yolk colour, shell weight and shell thickness (Image 2). The yolk colour was assessed using the Roche yolk colour fan and the shell thickness was assessed using vernier caliper.

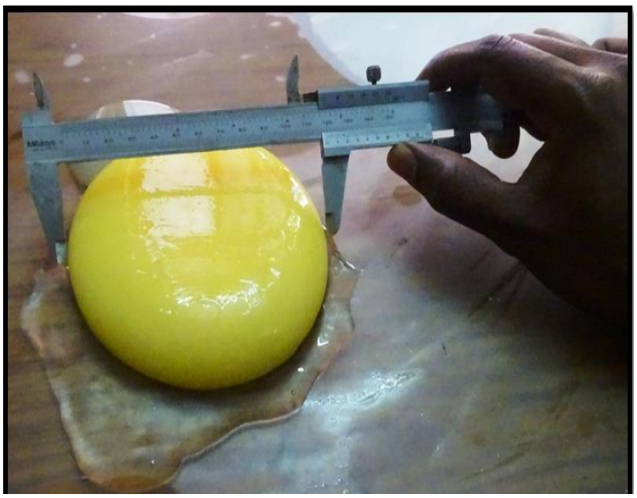

Fig 1: Evaluating yolk diameter using vernier caliper

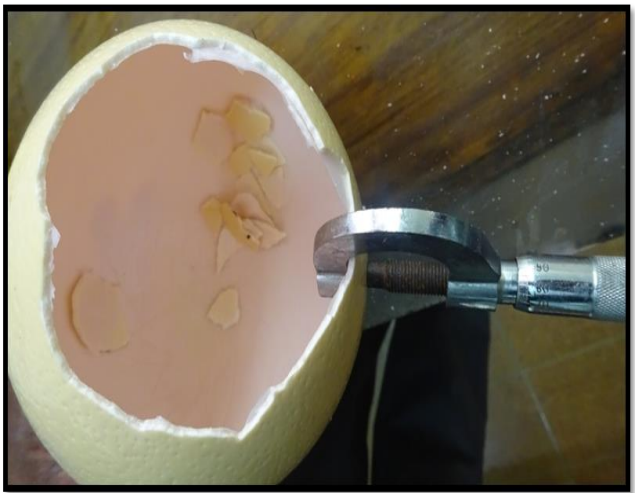

Fig 2: Evaluating egg shell thickness using screw gauge

Sensory evaluation

Six ostrich eggs were collected to assess the sensory attributes. Ostrich eggs were compared with bronze turkey eggs and native indigenous chicken eggs reared in the same farm with similar environmental conditions for appearance, colour, odour, juiciness, texture, tenderness and flavor. The eggs were hard – cooked and served as uniform sized hard – boiled eggs to the six-member semi trained taste panel. Each panelist was presented three types eggs viz., ostrich, turkey and chicken egg, which were assigned with random numbers and allowed to sample in any order. Panelists were instructed to eat unsalted-top crackers, drink water between each sample to clear the palate and pause for 25 seconds between samples. The panelists were asked to rank each sensory characteristic on a nine point hedonic scale with ascending ratings for the desired attributes of appearance, colour, odour, juiciness, texture, tenderness, flavor and overall acceptability [4].

Results and Discussions

A number of factors determine the external and internal quality of ostrich egg, like weather, housing, location, nutrition, genetics and physiological factors plays an important role [5]. The results pertaining to the external and internal characteristics of ostrich egg are given in Table.1. The average egg weight in a clutch was found to be 1.23 kg. Ostrich egg weight may vary from 1.1 to 1.5 kg [6, 7]. The egg laid during initial period of the lay was found to be less in weight when compared to eggs laid at the end of the lay period. The egg shell of ostrich egg was found to be hard (17.98%), in case of chicken eggs, the shell represents only 11.00 percentage [7]. Shape index was found to be 78.28, the results were in agreement with Sales *et al*. [3], ostrich's egg has highest shape index around 80% which is more than any other bird. Unlike chicken eggs, ostrich egg is more spherical in shape; it is hard to define round end from sharp end [8].

Table 1: External and Internal characteristics of ostrich egg (Mean ± S.E)

Sl. No.	Parameters	Mean ± S.E
Internal qualities		
1	Egg weight (g)	1237.33 ± 18.24
2	Egg length (cm)	14.92 ± 0.27
3	Egg width (cm)	11.67 ± 0.25
4	Shell weight (g)	222.50 ± 2.22
5	Shell thickness (mm)	2.87 ± 0.04
6	Shape index	78.28 ± 1.74
Internal qualities		
1	Thick Albumin diameter (cm)	21.67 ± 0.33
2	Thick Albumin height (cm)	1.00 ± 0.05
3	Albumin weight (g)	720.00 ± 15.28
4	Yolk diameter (cm)	12.50 ± 0.07
5	Yolk height (cm)	2.57 ± 0.03
6	Yolk weight (g)	283.33 ± 2.29
7	Yolk colour	103.67 ± 0.67

In the current study ostrich egg contained 22% yolk, 58% albumen and 20% shell, Christensen *et al*. [9] also reported similar findings (27% yolk, 54% albumen and 19% shell) with ostrich egg. Usually yolk percentage ranges from 21-33% and albumen ranges from 46- 57%. Both albumen (positive) and yolk (negative) have significant correlation with egg weight [10]. The yolk color of ostrich is said to be acceptable color for consumers, if ostrich's eggs were used as table eggs.

Sensory evaluation

The sensory characteristics of the ostrich eggs in comparison with turkey and chicken egg are presented in table 2. The mean values given to ostrich eggs by different panelist for appearance, colour, odour, juiciness, texture, tenderness, flavor and overall acceptability were 7.83, 8.83, 7.67, 7.83, 8.67, 8.17, 8.33 and 7.67 respectively. Non-significant differences were observed for all important sensory attributes in comparison of ostrich, turkey and chicken eggs except for colour and texture. Ostrich eggs tend to be more gelatinous than conventional chicken egg. The yolk of the ostrich egg is sticky and bright yellow in colour. Due to the gelatinous texture of the ostrich egg the consumer may have an inhibition, but the overall acceptabilityis same as that of turkey and ostrich eggs. The chicken egg may be preferred due to its classic egg taste, but that doesn't exclude that novelty of ostrich egg.

Table 2: Sensory evaluation of native chicken, turkey and ostrich eggs (Mean ± S.E)

Sensory attributes	Egg species			P value
	Ostrich	Turkey	Native chicken	
Appearance^{NS}	7.83 ± 0.31	6.83 ±0.31	7.50 ± 0.56	0.25
Colour**	8.83^{a} ± 0.17	6.67^{c} ± 0.33	7.67^{b} ± 0.33	0.00
Odour^{NS}	7.67 ± 0.42	7.33 ± 0.42	7.67 ± 0.56	0.85
Juiciness^{NS}	7.83 ± 0.48	6.50 ± 0.50	6.83 ± 0.48	0.16
Texture**	8.67^{a} ± 0.21	7.33^{b} ± 0.33	6.83^{b} ± 0.17	0.00
Tenderness^{NS}	8.17 ± 0.17	8.00 ± 0.82	7.00 ± 0.00	0.21
Flavour^{NS}	8.33 ± 0.49	7.33 ± 0.33	7.50 ± 0.34	0.20
Overall acceptability^{NS}	7.67 ± 0.33	7.33 ± 0.33	7.83 ± 0.48	0.66

Each value is a mean of six observations

^{NS} Values not significant, ** Values are highly significant, values bearing different superscript in a row differ significantly

Conclusion

The study on the evaluation of physical characteristics of ostrich eggs revealed the average weight, length, width, shape index, shell thickness, albumin weight, yolk weight and yolk colour to be 1237.33 g, 14.92 cm, 11.67 cm, 78.28, 2.87 mm, 720 g, 283.33 g and 103.67 respectively. Ostrich eggs are found to be equivalent to chicken eggs in characteristics and taste [11]. They can be incorporated in human diets without any hesitations. Ostrich eggs are impressive by their sheer size and one ostrich egg is equivalent to 20 - 24 chicken eggs. It was also contemplated to be a good alternative to chicken farming. The potential of ostrich farming has not been fully utilised. Among the various constraints, breeding, hatching and chick management are the major areas, where more intense researches are required.

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