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EFFECT OF BREEDING SEASON AND SEX RATIO ON FERTILITY AND HATCHABILITY PERCENTAGES OF OSTRICH EGGS

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ABSTRACT: ***A total number of 8 birds of mature black neck bred ostriches (3 males and 5 females) and 130 chicks at hatch were used in the present study, for two consecutive breeding seasons, in order to study some productive and reproductive traits in ostriches.***
The fertility percentage of 52.4 % and 44.3 % for the first and second season, respectively.
The commercial hatchability percentage, which calculate from the total egg set 46.6 % and 38.7 % for the first and second season breeding season, respectively.

Key words: ***Breeding season , Sex ratio , Hatchability and Ostrich.***

INTRODUCTION

The ostrich (*Struthio camelus*) is a flightless bird belonging to the ratite family and known as the largest living bird. The adult live body weight ranged from 70 kg to 150 kg. Ostrich is native to semi-arid and desert areas of Africa, they have been raised intensively in South Africa for more than 100 years and reared commercially mainly to produce usable products, including meat, hides feathers and eggs (Kreibich and Sommer, 1995).

Nowadays, South Africa, USA, Australia, Canada, China, Zimbabwe, Botswana, Egypt, Tunis, Namibia and Several European Countries are attempting to raise significant numbers of ostrich birds (Horbanezuk, 2005).

Some factors had affected Fertility percentage, one of them, which is the important one, is sex ratio mating. Infertile eggs cause of losses in outcome, so fertility was very important factor in ostrich farms. Also breeding season is consider one of the most important factor which affecting both fertility and hatchability.

MATERIALS AND METHODS

The present study was carried out in the Ostrich Research Farm, Department of Poultry Production, Faculty of Agriculture, Shibin El-Kom, Minufiya University. The experiment was extended from 2006 to 2009 for two consecutive breeding seasons, to study the effect of breeding season and sex ratio on some productive traits in ostrich including egg production, fertility, hatchability, egg weight loss during incubation, body weight, growth

rate, egg quality, development of body temperature regulation and blood chemical analysis in ostrich chicks.

A total number of 8 birds of mature ostriches (3 males and 5 females) were used in the first breeding season. The age of birds was about 5.0 years for males and 4.5 years for females. Mature birds were maintained on the sand floor in outdoor enclosures (paddocks) surrounded by a wire fencing, providing 400 m^2 per bird (80 m x 40 m). There was a nesting area in the enclosure. Drinking water was available at all times in the enclosure. All birds were subjected to the same managerial and hygienic conditions. During the growing period, hatched chicks were housed in pens for 2 – 3 months of age, and in a shed with a access to a paddock thereafter.

After hatch, chicks were fed once a day for 30 min. during the second week of age, twice a day during the third week of age, and three times a day thereafter. The composition and calculated analysis of the experimental rations are given in Table (1)

Table (1) : Composition of the experimental diet

Ingredients	Diets * (%)			
	(1)	(2)	(3)	(4)
Clover hay	39.0	38.0	40.5	39.0
Yellow corn	25.0	27.0	28.5	28.5
Soybean meal (44%)	24.0	22.0	16.5	20.5
Wheat bran	5.0	5.0	7.5	5.0
Limestone	0.5	0.5	0.5	0.5
Premix**	7.5	7.5	6.5	6.5
Total	100.0	100.0	100.0	100.0
Crude protein	20.16	18.13	16.57	17.73
ME (kcal/kg)***	2240	2325	2280	2265

*** Anti/fungal was added to each diet from 400 - 600 g/ton diet.**

**** Starter, standard, standard and breeder premix were added to ration No. 1, 2, 3 and 4, respectively.**

**** Vegetable oil was added to each died from 12 – 16 Liters/ton to achieve the requirements from ME(K cal/kg diet).**

Collecting eggs were stored until they incubated. A total number of 315 ostrich eggs laid in different breeding seasons and months were collected. Each egg was identified with parents age, date and weight at laying. Mean

length of incubation period (d), fertility and hatchability percentages were determined.

The ostrich layers were minetored by a person between laying hours, in order to, collect the eggs immediately after being laid and were coded. Eggs were dry wiped and weighed. Eggs were disinfected with a suitable disinfection for few seconds then allowed to dry for about 30 minutes. Eggs were stored for a maximum of 10 days at 18ºC and 75 % relative humidity in vertical position until incubation.

During incubation period, the incubator was adjusted to 36.5ºC and 25% relative humidity (RH), while at hatching time, the temperature was adjected to 36.0ºC and 40 % RH. Eggs were set in the incubator with air sac upside and were turned through an angle of 45ºC five times daily during the first 39 days of incubation. Infertile eggs, which were determined by candling on day 14 of incubation using a 150 – watt candling lamp, were removed from the incubator. At the end of incubation period, the hatched chicks were weighed when they were transferred to the brooder.

Data of the present study were statistically analyzed by ANOVA of factorial experiment using SPSS (1999) computer program as given in the following two / way analysis of variance model with breeding season as main effect factor as two factors as the following :

$$Y_{ij} = \mu + B_i + P_j + (B * P)_{ij} + e_{ij}$$

Where :

Y_{ij} = The observation on the j^{th} bird in the i^{th} breeding season.

μ = The overall mean

B_i = The effect due to the i^{th} breeding season.

P_j = The effect due to the jth sex ratio.

$(B * P)_{ij}$ = Interaction effect of breeding season and sex ratio.

e_{ij} = The random error

The percentages were transformed to their arc-sin values before analysis of variance. Also, the significant differences among the averages were tested using Dancan's multiple range test (Duncan, 1955).

RESULTS AND DISCUSSION

1. Fertility of Ostrich eggs :

1.1. Breeding season effect :

Tables (2 and 3) show the results of incubation out came on 315 eggs according to season effect (Table 2) and sex ratio groups (Table 3). The total egg set were 103 and 212 eggs for the first and second season, respectively, while; the number of fertile eggs were 54 and 94 eggs with fertility percentage of 52.4 and 44.3 %, for the first and second season, respectively the in significant lower fertility percentages in the first and second season may be due to young males and females which added to flock. As expected, with older ages specially of males, in the next seasons fertility become

higher than those obtained in the present work. Gowe *et al.* (1993) obtained that egg fertility, generally, considered as a trait of both parents and their ability to interact and produce a riable zygote. Bunter (2002) and Malecki *et al.* (2004) reported that fertility of ostrich eggs in the next most limiting factor, after egg production, to ostrich chick production, where fertility is a very important measure of ostriches reproductive efficiency.

Table (2) : Fertility and hatchability percentages of ostrich eggs in relation to the first and second consecutive breeding seasons

Trait	Breeding seasons		Total
	First	Second	average
Total eggs set	103.0 b	212.0 a	315
Fertil eggs	54.0 b	94.0 a	148
Fertility (%)	52.4 a	44.3 a	43.8
Hatched chicks	48.0 b	82.0 a	130
Hatchability (%)1	46.6 a	38.7 a	41.3
Hatchability (%) 2	88.9 a	87.2 a	87.8

1. Hatchability (%) from all eggs set.
2. Hatchability (%) from fertile eggs.
a,b mean have the same superscript in each raw are not differ significantly (P ≤ 0.05)

Table (3): Fertility and hatchability percentages of ostrich eggs in relation to the first and second sex ratio groups for two seasons

Trait	Sex ratio groups		Total
	First sex ratio 1 : 3	Second sex ratio 1 : 1	or average
Total eggs set	198 a	117 b	315
Fertile eggs	93 a	55 b	148
Fertility (%)	47.0 a	47.0 a	47.0
Hatched chicks	84 a	46 b	130
Hatchability (%) 1	42.4 a	39.3 a	41.3
Hatchability (%) 2	90.3 a	83.6 b	87.8

1 – Hatchability from total egg set
2 – Hatchability from fertile eggs
a,b, Means have the same superscript in each raw are not differ significantly (P ≤ 0.05)

Male infertility may result from using immature males. There are no accurate method for determining the age of ostriches, and birds are often mated when too young (Irons, 1995). Although both sexes reach puberry at 2 years of age, reproductive maturity is only achieved in males at about 4 years old (Stwart, 1989). Females generally mature about a year earlier than males – Males can also be out of season and out of cagele. They are known to lag behind females regarding the onset of sexual activity at the beginning of the breeding season, during which time many infertile eggs are laid (Irons, 1995). Hastings 1991 and Hicks, 1993, reported that deficiency of vitamins and minerals including vitamins A and E and selenium have been linked to infertility.

Behavioral disorders obtain lead to a failure to copulate. The most common problems are excessive aggression, obsessive territorial behaviour, in compatibility between males and females. (Hicks, 1993; Irons; 1995 and Huchzermeger, 1998).

Environmental stresses such as extreme climatic, particularly high temperatures have been shown to adversely affect frtility (Hicks, 1993). Bertschinger *et al.* (1991 and 1992) suggested that the determination of male fertility.

In females view, Hicks (1992 and 1993) and Huchzermeyer (1998) reported that reproductive disease is one of the most common factors affecting the reproductive capabilities of the female.

In addition they showed that egg binding is the inability of the hen to expect the egg after formation of the shell and is a conditions that can result in low egg production and infertility.

However, Mellett (1993) found infertility eggs were about 30 % in South Africa, Deeming and Ayres (1995) found 30.8 to 33.1 % percentages of in fertile eggs in Zambia. More (1996) reported on over all fertility 68 % and obtained that time of egg laying in the season, duration of egg storage prior to incubation and egg weight at the star of incubation were unconditionally associated with fertility.

In general, the non significant variation observed in the fertility percentages in the present work between both seasons was attributed to the sexual maturity of birds, where females tend to mature earlier (2 – 2.5 years) than males (3 – 3.5 years) causing a synchronization problems in which infertile eggs are laid at the beginning of the season (Gonzales, 1994). In addition, in fertility may be caused by one or more of factors such as genetic, sex ratio, nutrition, health, age of birds, climatic condition and storage of eggs prior incubation (Deeming, 1995 and 1999, Badley, 1997 and Shanawany and Dingle, 1999). The non significant effect of seasons (Table 2) was in harmony with that of attained by Zoccaroto *et al.* (2004) whose noticed that the fertility of all eggs studed was unaffected by laying season and month of laying.

1.2. Sex ratio effect :

Table (3) show the results of incubation out some according to sex ratio groups among two breeding seasons. It is clear that the number of fertile eggs of the first group with 1 male : 3 females (93 eggs) was significantly higher than that of the second group with 1 male : 1 female (55 eggs). However, the fertility percentage of each group was equal 47 %.

This may be due to the significant difference of total egg set of each group, which it was 198 eggs and 117 eggs for the first and second group, respectively.

These results showed that sex ratio had no significant effect an fertility percentage (Table 4) Shanawany and Dingle (1999) reported that a ratio of one male to one female appears to be ideal for highest fertility. In compatible pairing is a problem that some times occurs when birds are not allowed to select their mates.

In commercial operations, the producer should spend extra time observing the birds after grouping and should take a constant note of their performance and compatibility. Male – female ratios from 1 : 2 to 1 : 4 appear to give comparable and satisfactory fertility rates. A ratio in excess of 1 : 4 is not desirable as the male may not be able to mate with all the females and this in turn may result is a higher number of infertile eggs.

Mating 1 male : 1 female sex ratio caused impaired fertility (preferential mating).

The colony mating system is recommended in order to avoid such problems. But putting too many males to gather may lead to extensive fighting and a subsequent reduction in fertility.

Depending on the size of the breeding paddock, 3 to 4 males are about the correct number per unit.

However, Deeming and Ar (1999) and Shanawany and Dingle (1999) reported that sexual behavior stimulate egg production.

In addition Stwart, 1989, noticed that social interaction within and between breeding group exert an important influence on reproductive behaviour and ultimately on egg fertility rates.

2. Hatchability :

2.1. Breeding season effect :

Table (2) presented the number of hatched chicks, commercial hatchability percentages scientific hatchability percentages in both breeding seasons. The number of hatched chicks was significantly differ from the first season (48 chicks) to the second season (82 chicks). The commercial hatchability, which calculated from the total egg set was lower in both breeding season (46.6 and 38.7 % for the first and second breeding seasons respectively). These results were due to lower fertility percentages in both seasons (Table 2).

Table (4) : Analysis of fertility and hatchability of ostrich eggs in two consecutive breeding seasons

Source of variations / Traits	Between seasons (S)		Between Sex ratio groups (g)		Interaction (s x g)		Residule	
	d.f	M.S	d.f	M.S	d.f	M.S	d.f	M.S
Fertility ratio	1	383.8	1	1728.8	1	4869.4	307	2488.3
Hatchability ratio	1	793.3	1	10089.2*	1	1414.0	305	2453.1

* Significant ($P \leq 0.05$).

The scientific hatchability percentages, which calculated only from the fertile eggs, were higher and more accurated in both breeding seasons. They were 88.9 % and 87.2 % for the first and second seasons, respectively. These results were in agreement with those obtained by Rania Aeta (2008). Deeming (1996) and More (1996) found that the hatchability percentages of total eggs set were ranged from less than 30 % to approximately 60 % Breeding season had non significant effect on hatchability percentage. Similar results were founded by More *et al.* (1994) who observed that hatchability percentage has not been found to decline with breeding season. The similar results were obtained by Zoccarato *et al.* (2004). However, Rania Aeta (2008) reported significant effect of breeding season.

These results indicated that all factors affecting hatchability such as microbial contamination, pre - incubation storage, temperature, exchange of water vapour, oxygen and carbon dioxide exchange. Turning of eggs and all incubation conditions were satisfied and suitable for hatching prosses.

2.2. Sex ratio effect :

Table (3) showed the effect of sex ratio groups on hatchability percentages, commercial hatchability percentages were 42.4 % and 39.3 % for the first and second sex ratios.

Where the scientific hatchability percentages were 90.3 and 83.6 % for sex ratios.

Significant and higher value for the sex ratio 1 male : 3 females (90.3 %) was recorded.

These result indicated that sex ratio 1 : 3 was more efficient than 1 : 1 sex ratio for egg production and hatchability percentage.

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تأثير موسم التربية والنسبة الجنسية علي نسب الخصوبة والفقس في بيض النعام

محمد سلطان ، جودة جبريل ، مرضي قلمه ، عصام عاطف مصطفي

قسم إنتاج الدواجن – كلية الزراعة – جامعة المنوفية

الملخص العربي

استخدم في هذه الدراسة عدد ٨ طيور بالغة من نوع النعام الأسود الرقبة (يحتوي علي ٣ ذكور + ٥ إناث) وعدد ١٣٠ كتكوت عند الفقس في موسم التربية الأول والثاني بهدف دراسة بعض الصفات الإنتاجية والتناسلية في النعام .

١ – النسبة المئوية للإخصاب قدرت بـ ٥٢.٤ % و ٤٤.٣ % للموسم الأول والثاني علي الترتيب .

٢ – قدرت النسبة المئوية للفقس بالنسبة للبيض الكلي ٤٦.٦ % و ٣٨.٧ % للموسم الأول والثاني علي الترتيب .