Open Veterinary Journal, (2015), Vol. 5(2): 98-102
ISSN: 2226-4485 (Print)
ISSN: 2218-6050 (Online)
Original Article

Submitted: 21/02/2015 Accepted: 09/06/2015 Published: 13/07/2015

Growth performance and certain body measurements of ostrich chicks as affected by dietary protein levels during 2–9 weeks of age

Kh.M. Mahrose*, A.I. Attia, I.E. Ismail, D.E. Abou-Kassem and M.E. Abd El-Hack
Poultry Department, Faculty of Agriculture, Zagazig University, Zagazig 44511, Sharkia, Egypt

Abstract
The present work was conducted to examine the effects of dietary crude protein (CP) levels (18, 21 and 24%) on growth performance (Initial and final body weight, daily body weight gain, feed consumption, feed conversion and protein efficiency ratio) during 2-9 weeks of age and certain body measurements (body height, tibiotarsus length and tibiotarsus girth) at 9 weeks of age. A total of 30 African Black unsexed ostrich chicks were used in the present study in simple randomized design. The results of the present work indicated that initial and final live body weight, body weight gain, feed consumption, feed conversion of ostrich chicks were insignificantly affected by dietary protein level used. Protein efficiency ratio was high in the group of chicks fed diet contained 18% CP. Results obtained indicated that tibiotarsus girth was decreased ($P \leq 0.01$) with the increasing dietary protein level, where the highest value of tibiotarsus girth (18.38 cm) was observed in chicks fed 18% dietary protein level. Body height and tibiotarsus length were not significantly different. In conclusion, the results of the present study indicate that ostrich chicks (during 2-9 weeks of age) could grow on diets contain lower levels of CP (18%).
Keywords: Body measurements, Growth performance, Ostrich, Protein level.

Introduction

The ostrich industry is growing rapidly in many countries in the world instead of South Africa, like U.S.A, Australia, Canada, Zimbabwe, Botswana, Egypt, Kuwait and several European countries (Mahrose, 2002; Al-Nasser *et al*., 2003; Horbanczuk, 2005; Cooper *et al*., 2008; El-Safty and Mahrose, 2009; Mahrose, 2012; Gouda *et al*., 2014). Recent interest in ostrich farming has led to an increasing demand for information about this bird and how to manage it in a commercial environment (Deeming, 1999; Minka, 2003). Factors affecting growth in ostriches are similar to those affecting other avian species like diet, rearing environment, genetic potential, management (Bovera *et al*., 2011) and health status (Cornetto *et al*., 2003).

However, the development of the ostrich industry is influenced by inadequate knowledge of nutritional requirements, particularly those pertaining to the early–life stage (Iji, 2005). Nutrition is an important part of poultry and ratite management. So, knowledge of nutritional requirements during the various stages of growth, development and production of the ostrich are vital (Cooper *et al*., 2005; Bovera *et al*., 2014). Nutrition of ostrich chicks must be accurate, because they are most vulnerable up to the age of 3 months (Cooper, 2004). Inaccurate nutrition have significant impact on the chick's development and survival (Shanawany and Dingle, 1999; Attia *et al*., 2010). A deficiency or imbalance of the nutrients will impair growth and production, resulting in poor utilization of feed (Polat *et al*., 2003). Ostriches require rations with high protein content, an essential ingredient for optimum growth and development (Cooper, 2004). Feeding costs are the largest expense in an ostrich production system, and protein is one of the most expensive component of the diet (Carstens *et al*., 2014). Diverse recommendations concerning the protein content in starter diet (14.6 – 22% CP) of ostriches has been reported. Gandini *et al*. (1986) showed that ostrich chicks of 8 weeks of age received diets with increasing levels of protein (14, 16, 18 and 20%). The later authors added that no differences were found among diets with 16, 18 or 20% protein, while birds on these diets performed better than those on a 14% protein diet and those received 20% CP showed the superior feed conversion. So, the present study was carried out to highlight the effects of dietary crude protein level on growth performance of unsexed ostrich chicks and certain (body height, tibiotarsus length and tibiotarsus girth) body measurements during 2-9 weeks of age.

Materials and Methods

The present work was carried out at the Ostrich breeding unit, Faculty of Agriculture, Zagazig University, Zagazig city, Sharkia governorate, Egypt. A total of 30 African Black unsexed ostrich chicks were used in the present study in simple randomized design to examine the effects of dietary protein levels (18, 21 and 24%) on growth performance (Initial and final body weight, weight gain, feed consumption, feed conversion and protein efficiency ratio) during 2 to 9 weeks of age and certain body measurements (body height, tibiotarsus length and tibiotarsus girth) at 9 weeks of age.

***Corresponding Author:** Dr. Khalid M.A. Mahrose. Poultry Department, Faculty of Agriculture, Zagazig University, Zagazig 44511, Sharkia, Egypt. Tel.: +201001278452. Email: ostrichkhalid@zu.edu.eg

Ingredients and composition of experimental diets of ostrich chicks are found in Table 1.

Unsexed ostrich chicks of 2 weeks of age were randomly divided into 3 groups (equal in body weights). The 1st group of chicks was fed diet contained 18% CP, the 2nd group was fed diet contained 21% CP, where the 3rd group was fed diet contained 24% CP. All diets were isocaloric. Each chick was identified by shank tag. Chicks were kept indoors until 4 weeks of age and after that, they were allowed to practice outdoors during midday and kept indoors at night. Chicks were exposed to 16:8 h light/dark cycle and light intensity for all groups ranged between 24-50 Lux. All chicks were kept under the similar managerial and hygienic conditions during the experimental period. Feed was provided *ad libitum* to all groups during the experimental period. Fresh water was made available at all times. A space requirement was 0.20 m^2 per chick at 2 weeks of age and extended by 10% per week according to Hallam (1992). Vitamin AD_3E was added to drinking water weekly by 1cm^3/L concentration, while vitamin B complex, choline and zinc were added to the ration by 1, 2 and 1 g/kg diet respectively. All chicks were individually weighed using an electronic balance accurate to 5 g and body weight was recorded at the 2nd and 9th weeks of the age (Initial and final body weights). Daily body weight gain was calculated as the difference between the initial and the final body weight and divided by the number of days. Feed consumption was recorded biweekly for each group, and calculated as gram diet per bird by dividing feed consumption of the group on the number of birds in this group. Feed conversion ratio (g feed/g gain) was calculated. Linear dimensions of the body were taken to the nearest 0.5 cm with dressmaker`s flexible tape-measure and are described as follows; bird height was taken from claws to dorsal of the thorax. The length of tibiotarsus was measured on the lateral side of the leg from the front of the patella to the back of the hock joint (according to Deeming *et al*., 1996). Tibiotarsus girth was taken from the mid.

Data of the present study was statistically analyzed by ANOVA of completely randomized design experiment, using SAS (1989) computer. The significant differences among the averages were tested using Duncan`s multiple range test (Duncan, 1955).

Table 1. Ingredients and calculated analysis of ostrich chicks diets.

	18%	*21%*	*24%*
Ingredients %			
Yellow Corn	37.70	43.80	46.20
Soybean meal 44%	36.00	31.30	19.00
Gluten meal 62%	2.60	0.00	2.00
Hay	7.25	9.40	20.00
Wheat bran	10.00	8.90	7.00
Molasses	0.85	1.25	0.95
Vit-min Premix(1)	1.25	1.00	0.80
DL Methionine	0.20	0.20	0.15
L-Lysine	0.40	0.40	0.15
Di Calcium phosphate	2.00	2.00	1.00
Limestone	1.50	1.50	2.50
NaCl	0.25	0.25	0.25
Sum	100	100	100
Calculated analysis %			
CP	24.00	21.00	24.00
ME kcal/kg	2456	2487	2456

(1)Growth vitamin and Mineral premix, each 1 kg consists of: Vit A 12000, 000 IU; Vit D_3, 2000, 000 IU; Vit. E. 10g; Vit k_3 2 g; Vit B_1, 1000 mg ; Vit B_2, 49g ; Vit B_6, 105 g; Vit B_{12}, 10 mg; Pantothenic acid, 10 g; Niacin, 20 g , Folic acid, 1000 mg; Biotin, 50 g; Choline Chloride, 500 mg, Fe, 30 g; Mn, 40 g; Cu, 3 g; Co, 200 mg; Si, 100 mg and Zn, 45 g.

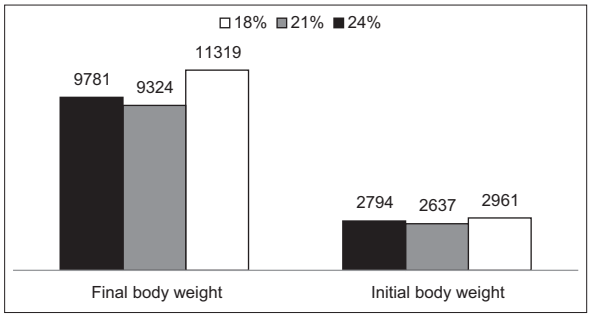

Fig. 1. Initial and final body weight of growing ostriches as affected by dietary protein levels.

Results

The results of final live body weights, daily body weight gain, feed consumption, feed conversion ratio and protein efficiency ratio are presented in Figures 1, 2, 3, 4, 5 and 6. It is evident from the results found in Figures 1 and 2 that final live body weights and daily body weight gain of ostrich chicks were insignificantly affected by dietary protein levels used. Results indicated the occurrence of insignificant differences in the initial body weight among the different groups, a finding which give an idea about the accuracy in distributing chicks among the treated feeding groups without any bias.

Figures 3 and 4 reveal that dietary protein level did not significantly change feed consumption and feed conversion ratio. However, the best ($P \leq 0.05$) value of protein efficiency ratio (1.63%) was observed in ostrich chicks fed diet contained 18%, followed by those fed 21% CP (1.23%) then those fed 24% CP (1.01%) as shown in Figure 5.

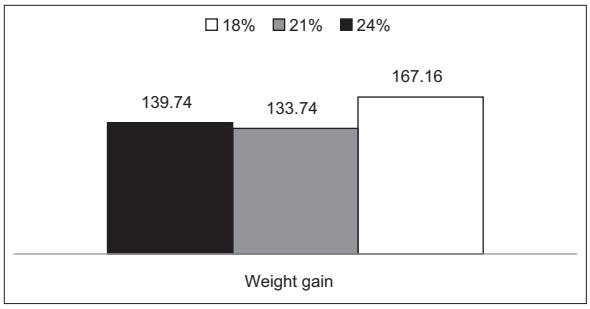

Fig. 2. Weight gain of growing ostriches as affected by dietary protein levels.

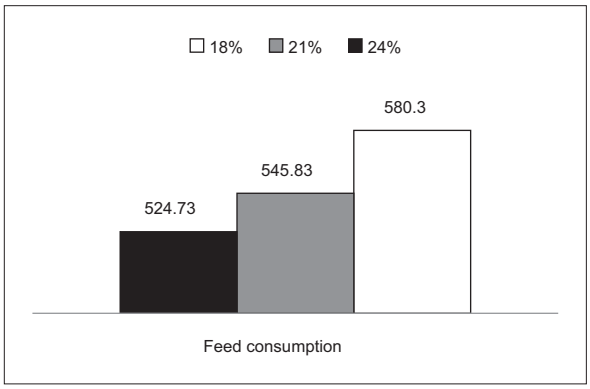

Fig. 3. Feed consumption of growing ostriches as affected by dietary protein levels.

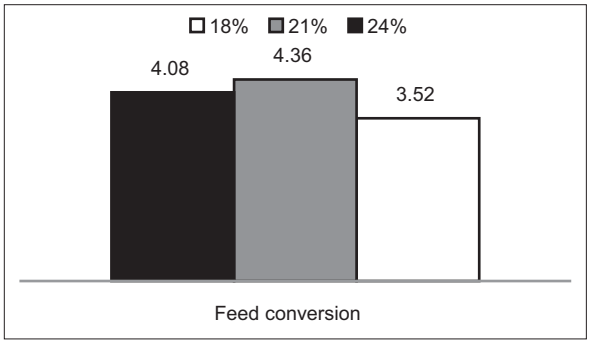

Fig. 4. Feed conversion of growing ostriches as affected by dietary protein levels.

Figure 6 presents the effect of dietary protein levels on body height, tibiotarsus length and tibiotarsus girth. Results indicated that only tibiotarsus girth was decreased ($P \leq 0.01$) with the increasing dietary protein level, where the highest value of tibiotarsus girth (18.38 cm) was observed in chicks fed 18% dietary protein level. Body height and tibiotarsus length were not significantly differed.

Discussion

Results of the present study indicated that the extra protein consumed by birds could not be utilized

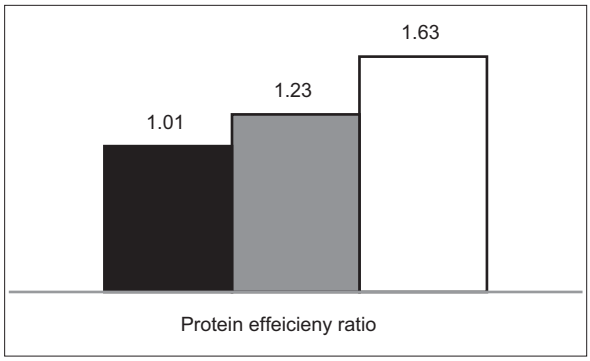

Fig. 5. Protein efficiency ratio of growing ostriches as affected by dietary protein levels.

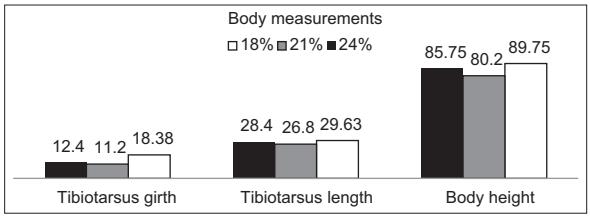

Fig. 6. Body height, tibiotarsus length and tibiotarsus girth of growing ostriches as affected by dietary protein levels.

productively by ostrich chicks and were probably eliminated via fecal nitrogen as reported in other publications (Ahmed *et al*., 2011; Bovera *et al*., 2011). However, the later author concluded that feed containing 17% CP was optimum for ostrich chicks under 20 weeks of age and feeding of growing ostriches on higher protein not only wasteful but also pollute the environment through the excretion of more unutilized nitrogen. So, according to the previous explanation, the growth rate of the ostriches appeared to be influenced by other environmental factors (Deeming and Ayres, 1994). In addition, Bunter (2002) demonstrated that variability in growth rates in ostrich chicks is attributed to general factors such as season, diet, aspects of social behavior and health. Carstens *et al*. (2014) reported insignificant differences between the high (23.48% CP) and low (16.8% CP) diets on weight gain from 1 to 49 days of age, insignificant differences between the high and medium (20.28% CP) diets on weight gain from 1 to 77 days of age and insignificant differences between the medium and low diets on weight gain from 1 to 98 days of age. Our results are similar to those obtained by Brand *et al*. (2000) who concluded that dietary protein levels (13, 15 and 17%) had no effect on the growth performance of ostrich chicks from 4 to 11 months of age. The same author added that ostrich chicks performed better up to three months of age on high-quality diets with relatively low roughage content. Gandini *et al*. (1986) also showed comparable results, where young ostriches (up to 8 weeks of age) fed diets

with increasing levels of protein (14, 16, 18 and 20%), where no differences were found in growth performance among diets with 16, 18 or 20% protein, while birds on these diets performed better on these diets compared to those on a 14% protein diet and those received 20% CP showed the superior feed conversion. Working on ostrich chicks weighed from 48.7 to 50 kg, Glatz *et al*. (2008) reported that ostrich chicks fed on low energy and low protein (10.0 MJ/kg and 126 g/kg) diet had better growth performance compared with those fed the high energy and high protein (12.5 MJ/kg and 143 g/kg) diet, where, the birds fed a low energy and low protein diet achieved a daily gain of 277.3 g/day.

In the present work, the best value of feed conversion ratio was observed (3.52) in the group of chicks which fed on 18% CP diet, and was better than that range. The average of the feed conversion ratio from hatch to 9 months of ostrich age ranges from 3.6 to 3.9 (Bunter, 2002). Ahmed *et al*. (2011) indicated that ostrich chicks during 10-14 weeks of age fed diets contained 22.5 or 17.5% CP consumed more feed and were more efficient in converting feed than birds fed diets contained 12.5% CP. However, the later author added that the differences between the two diets contained 22.5 and 17.5% CP were inconsistent and not significant on feed consumption and feed conversion ratio.

Body condition of ostriches is very important to avoid obesity. Loss of weight is an important indicator for malnutrition (Deeming *et al*., 1996). The later authors added that tibiotarsus length in growing ostriches Less than two years of age (sub-adults) ranged from 10 to 64 cm, and our results of tibiotarsus length are in this range. Mushi *et al*. (1998) pointed out that the average body height increased rapidly reaching to 134 cm in the 16th week., and this is very close to what is reported in present study with taking age into consideration.

In conclusion, the results of the present study indicated that ostrich chicks (during 2-9 weeks of age) could grow on diets contain lower levels of CP (18%). The present study suggested the needs for further research on the protein requirements for ostrich.

Acknowledgment

This project was funded by Zagazig University, and the authors want to express their gratitude to the University for their funding.

References

Ahmed, E., Azahan, E. and Noraziah, M. 2011. Evaluation of dietary protein intake by growing ostriches. Asian J. Poult. Sci. 5, 102-106.

Al-Nasser, A., Al-Khalaifa, H., Holleman, K. and Al-Ghalaf, W. 2003. Ostrich production in the arid environment of Kuwait. J. Arid. Environ. 54, 219-224.

Attia, Y.A., EL-Sharkawy, S.I., Mohamed, F.A., Sahledom, M.D. and Aggrey, S.E. 2010. Effect of dietary levels of protein on growth performance, carcass characteristics and meat quality of Golden Montazah and Gimmizah chickens in Egypt. 2010 International Poultry Scientific Forum, Jan. 25-26, 2010, Georgia World Congress Center in Atlanta, Ga., USA.

Bovera, F., Marono, S., Di Meo, C., Iannaccone, F., Attia, Y.A. and Nizza, A. 2011. Comparison of caecal and faeces fermentation characteristics of ostrich by in vitro gas production technique. Acta Agr. Scand. Section A, 61, 72-79.

Bovera, F., Nizza, S., Attia, Y.A., Di Meo, C., Piccolo, G. and Nizza, A. 2014. Prediction of digestible energy and gross energy digestibility of feeds and diets in ostriches. Br. Poult. Sci. 55, 518-523.

Brand, T.S., Nell, C.J. and van Schalkwyk, S.J. 2000. The effect of dietary energy and protein level on the production of growing ostriches. S. Afr. J. Anim. Sci. 30, 15-16.

Bunter, K.L. 2002. The genetic analysis of reproduction and production traits recorded for farmed ostriches (*Struthio camelus*). Ph.D. Thesis, Univ. of New England, Australia.

Carstens, P.D., Sharifi, A.R., Brand, T.S. and Hoffman, L.C. 2014. The growth response of ostrich (*Struthio camelus var. domesticus*) chicks fed on diets with three different dietary protein and amino acid concentrations. Br. Poult. Sci. 55, 510-517.

Cooper, R.G. 2004. Ostrich (*Struthio camelus*) chick and grower nutrition. Anim. Sci. J. 75, 487-490.

Cooper, R.G., Erlwanger, K.H. and Mahrose, KH.M. 2005. Nutrition of ostrich (*Struthio camelus Var. domesticus*) breeder birds. Anim. Sci. J. 76, 5-10.

Cooper, R.G., Mahrose, KH.M., El-Shafei, M. and Marai, I.F.M. 2008. Ostrich (*Struthio camelus*) production in Egypt. Trop. Anim. Health Pro. 40, 349-355.

Cornetto, T., Angel, R. and Estevez, I. 2003. Influence of stocking density and dietary energy on ostrich (*Struthio camelus*) performance. Int. J. Poult. Sci. 2, 102-106.

Deeming, D.C. 1999. Introduction. In: The Ostrich: Biology, Production and Health. D.C. Deeming (ed.), CABI publishing, Wallingford, Oxon, 1-9.

Deeming, D.C. and Ayres, L. 1994. Factors affecting the rate of growth of ostrich (*Struthio camelus*) chicks in captivity. Vet. Rec. 135, 617-622.

Deeming, D.C., Sibly, R.M. and Magole, I.L. 1996. Estimation of the weight and body condition of ostriches (*Struthio camelus*) from body measurements. Vet. Rec. 139, 210-213.

Duncan, D.B. 1955. Multiple range and multiple F test. Biometrics 11, 1-42.

El-Safty, S. and Mahrose, KH.M. 2009. Evaluation of some phenotypic, physiological and egg quality traits of African Black Neck ostrich under arid

desert conditions of Libya. Int. J. Poult. Sci. 8, 553-558.

Glatz, P.C., Miao, Z.H., Rodda, B.K. and Wyatt, S.C. 2008. Effect of diets with different energy and protein levels on performance of grower ostriches. Aust. J. Exp. Agr. 48, 1338-1340.

Gandini, G.C.M., Burroughs, R.E.J. and Ebedes, H. 1986. Preliminary investigation into the nutrition of ostrich chicks (*Strutio camelus*) under intensive conditions. J. S. Afr. Vet. Assoc. 57, 39-42.

Gouda, N., El-Sayiad, Gh., Mahrose, KH.M., Elsayed, M.A. and Elarousy, M. 2014. Effects of exposing ostrich eggs to doses of gamma irradiation on some blood biochemicals and hormonal levels of chicks. Zag. J. Agric. Res., 41, *in press*.

Hallam, M.G. 1992. The Topaz introduction to practical ostrich farming. Ostrich Producer's Association of Zimbabwe, Topaz, Harare, Zimbabwe.

Horbanczuk, J.O. 2005. Current situation in ostrich farming and industry with special references to Middle and Eastern Europe. Inter. Conf. on Commercial Ostrich-Breeding Development 30, 1-8.

Iji, P.A. 2005. Anatomy and digestive physiology of the neonatal ostrich (*Struthio camelus*) in relation to nutritional requirements. Rec. Adv. Anim. Nut. 15, 165-170.

Mahrose, KH.M. 2002. Ostrich farming in Egypt. Proc. of World Ostrich Congress, 26-29 September 2002, Warsaw, Poland, pp: 287-289.

Mahrose, KH.M. 2012. Influences of stocking density and male: female ratio on the performance of ostrich under desert conditions of Egypt. 6th Int. Poult. Conf., Porto - Marina, Alexandria, Egypt, 26-29 March 2012, pp: 170-183.

Minka, N.S. 2003. Evaluation of the performance of farmed ostrich chicks to juvenile age in Northern Nigeria. Trop. J. Anim. Sci. 6, 69-73.

Mushi, E.Z., ISA, J.F.W., Chabo, R.G. and Segaise, T.T. 1998. Growth rate of ostrich (*Struthio camelus*) chicks under intensive management in Botswana. Trop. Anim. Health Pro. 30, 197-203.

Polat, U., Cetin, M., Turkyilmaz, O. and Ak, I. 2003. Effects of different dietary protein levels on the biochemical and production parameters of ostriches (*Struthio camelus*). Vet. Arhiv 73, 73-80.

SAS User's Guide. 1989. Statistical Analysis System. Edition 5. SAS Institute Inc., Box 8000, Cary NC 27 511-800, USA.

Shanawany, M.M. and Dingle, J. 1999. Ostrich production systems. FAO Animal Production and Health Paper 144, Rome 1999, pp: 92.