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Research Article

Effect of Omega-3 Resource on Glucose and Total Protein in Ostriches

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Abstract

The purpose of the study was to evaluate the effectiveness of the canola oil on the some metabolites ostriches. In order to study the metabolic profile of ostriches in relation to diet, Six blue-neck male ostriches (Struthio camelus) were fed omega-3 resource (canola oil =3%) throughout a 60-day experiment. Blood samples were collected from ostriches on days 0 and 60 of the experiment to measure levels of total serum protein, albumin, total immunoglobulin, cholesterol, the activity of ASP, ALT, insulin and glucose. The results showed that from days 0 to 60 of the experiment, glucose and total protein levels increased significantly (P<0.05). whereas total immunoglobulins insulin, albumin, ALT and AST did not change.

Keywords: *Ostrich, Omega-3 resource, Glucose, Total protein*

Devekuşlarında Omega 3 Kaynağının Glukoz ve Total Protein Üzerine Etkisi

Özet

Bu çalışmanın amacı devekuşlarında kanola yağının bazı metabolic değerler üzerine etkisini araştırmaktır. Diyetle ilişkili olarak devekuşlarında metabolik değerleri araştırmak amacıyla altı adet Mavi-boyunlu devekuşu (Struthio camelus) 60 günlük çalışma periyodu süresince omega-3 kaynağı (%3'lük kanola yağı) ile beslendi. Devekuşlarından çalışmanın 0 ve 60. günlerinde total serum protein, albümin, total immunglobulin, kolesterol, ASP, ALT, insülin ve glukoz seviyelerini tespit etmek amacıyla kan örnekleri alındı. Çalışmanın sonuçları 0. ile 60. günler arasında glukoz ve total protein seviyelerinin arttığını (P<0.05) buna karşın total immunglobulin, insülin, albümin, ALT ve AST seviyelerinin ise değişmediğini ortaya koymuştur.

Anahtar sözcükler: *Devekuşu, Omega-3 kaynağı, Glukoz, Total protein*

INTRODUCTION

The ostrich industry in South Africa dates back to the 1860's when ostriches were domesticated in the Klein Karoo, Western Cape [1]. The industry was initially focused on the feathers and hides for the fashion industry. Over the last decade however focus has shifted and is now aimed at further developing and sustaining the meat production sector of the South African ostrich industry [2].

It is well recognized that a direct relationship exists between a high intake of fat in the diet, particularly saturated and the so-called 'diseases of the western world, with the latter predominantly being characterized by an increased incidence of heart disease [3]. A higher PUFA content of meat the higher meat's nutritive quality, which has a direct effect on human health, for example, the long-chain n-3 PUFA docosahexaenoic acid (DHA) is reported to contribute to brain and liver development in human infants and may also play a role in the prevention and treatment of various diseases [4].

Ostrich meat is gaining in popularity worldwide due to its high nutritive value [5,6]. In recent years ostriches *(Struthio camelus)* have been increasingly farmed in Europe with more than 40 000 head in Italy alone [7]. Ostrich industries have recently been developing in many countries around the world, especially for the production of meat due to its favorable fatty acid profile and low fat content as compared with other kinds of red meat [8]. Commercial breeding of farmed ostriches in Iran was started from 1999 [9] and at present ostrich farms are distributed in all

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regions and climates of the country, especially in the central regions. Blood profiling, initially used to detect subclinical disorders due to incorrect feeding, has recently been used more widely to evaluate the effects of different treatments on metabolic, nutritional and welfare conditions of animals [10]. Use of fats in animal feed has many benefits. Some of these benefits are increase in energy level and palatability of diet, improvement of growth rate, feed efficiency, absorption of fat soluble vitamin and decrease of metabolic heat production during heat stress. Dietary fats are also source of essential fatty acids [11]. Various studies have been conducted on the inclusion of fish oil or fish meal in the diet of broilers [12], pigs [13] and beef [14] in order to try and manipulate the lipid composition of the meat. It is known that the fatty acid composition of animal products is the result not only of biosynthesis in tissue, but also the fatty acid composition of ingested lipids [15], being stronger in monogastrics, where stored lipids in adipose tissue not only reflect ingested lipids [16]. Canola oil has a high content of α-linolenic acid, which is susceptible to oxidation, and has very rich source of monounsaturated oleic acid, it contains considerable amounts of linoleic (LA) and alpha-linoleic (ALA) acids, the precursors of omega-6 and omega-3 fatty acids and is poor of saturated fatty acid [15]. There is no report to show an academic research to evaluate the effects of canola oil on ostriches. To our knowledge, this is the first study of effects of canola oil on plasma biochemical parameters of ostriches. The purpose of the study was to evaluate the effectiveness of the canola oil on the health of ostriches.

Table 1. *Ingredients composition of the diet*
Tablo 1. *Diyet içeriğinin kompozisyonu*

Ingredients	(%)
Corn, Grain	37.4003
Alfalfa Meal-20	28.0502
Soybean Meal-44	27.5827
Dical. Phos	2.3004
Canola Oil	3
Sunflower Oil	0
Limestone	0.6924
Common Salt	0.3101
Vitamin Premix	0.2338
Mineral Premix	0.2338
DL-Methionine	0.1314
L-Lysine HCl	0.0636

Table 2. *The chemical composition of d ration*
Tablo 2. *Rasyonun kimyasal kompozisyonu*

Chemical Composition	Content
E	2600 Kcal/kg
CP (%)	22
EE (%)	5/65
CF (%)	10/69
Lysin(%)	1/19
Met + Cys(%)	0/79
Ca (%)	1/30
P (%)	0/52
Na(%)	0/18

MATERIAL and METHODS

Animals and Diet

Field work was conducted from November to January 2013 at the farming and animal husbandry station near Arak, Markazi province, Iran. Six birds of ostrichs, approximately 4 months of age were used in this investigation. The experiment was approved by the animal group committee of the Agriculture faculty of Arak University (Approval No: 2013-07/02 -366). The ostriches received increasing amounts of supplementary feed *(Table 1*, *Table 2)* that contained 3% unrefined canola oil and for period of around 60 days. This supplementary diet had a calculated energy value of 2.600 kcal/kg and a protein content of 22%. All the supplementary feed was consumed by the birds. The feed was mixed on a weekly basis and stored in bags in a cold feed storage shed. No anti-oxidants were added to diets. Water was provided *ad libitum*. They were kept in an enclosure with 1.000 m^2 of open space and 100 m^2 of covered space.

Plasma Biochemical Analyses

Blood samples for the determination of some parameters were obtained between 8 and 9 am, to avoid diurnal influences, following about a 12-h fasting by wing vein into vacutainers with heparin. The plasma was prepared by centrifugation at 2.500×g for 15 min. plasma were stored at −21°C until analysis. The biochemical parameters were measured using a standard autoanalyser (Hitachi 717, Boehringer. Mannheim, Germany). The level of total protein by Biuret reaction, albumin by Bromocresol green dye binding method, and the activity of AST and ALT was measured by the colorimetric method of Reitman and Frankel [17]. All results of enzyme activities were expressed in international units per liter written as IU/l [18].

Statistical Analysis

All results are expressed as means ±standard error of mean (SEM). Raw data were checked for normal distribution using Kolmogorov-Smirnov method. All analyses utilized parametric statistical methods. A value was considered to be statistically significant if the associated P value was less than 0.05. Paired t tests were performed using SAS software (2001).

RESULT

The effects of Omega-3 resource feeding on weight change indicated on *Table 3*. All ostrich chicks exhibited proper growth and active ingestion during the feeding period. Initial weight and final weight indicated the weight on 0 and 60 days respectively. At two month gain for six ostrich chicks were 93.900 kg. Total feed intake at this period was 743 kg. Average daily gain (ADG) was 260 g/day and feed conservation ratio (FCR) was 7.913 kg in this study.

The effects of Omega-3 resource ingestion on plasma biochemical variables *(Table 4)* are reported. There was no significant difference in total immunoglobulins, insulin, albumin, ALT and AST at two times. But from days 0 to 60 total protein levels and glucose increased significantly ($P \leq 0.05$).

DISCUSSION

Results indicated that ADG and FCR in this study was agreement with others. Trebušak et al.[19] indicated that body weight gain was not influence while feed intake was decreased and feed efficiency was improved when the rabbits fed on diets content linseed oil. Body weight gain was increased in this study Studies in the US [20] on ostriches reported that grew at only 180 g/day with a FCR of 8.7 compared with this study was low. Final body weight of sunflower oil groups (poultry) were increased [21].

Average feed intake per day, water consumption per day, feed conversion ratio (FCR) and weight gained were different from that estimated by Mushi et al.[22]. Also, Kreibich and Sommer [23] explained that feed conversion ranged from 1.4:1 to 1.6:1 for younger birds 4 to 6 months old, while for older birds ranging from 4:1 to 6:1. Studies [24,25] showed that increasing dietary energy or fat supplementing decreased feed intake and improved Feed Conversion Ratio (FCR) of broiler chicks [25].

Findings of this study showed that feeding of Canola oil in growing ostriches can significantly increase plasma levels of glucose and total protein in the 60th day, compared to that of day 0 *(Table 4)*. Total proteins play an important role in transport of vitamins, hormones, enzymes and electrolytes. In our study, total protein values increased on day 60. This accords with earlier observations, which showed that total protein values increased with age in male ostriches until 24-36 months [26]. Total protein values also tend to increase with age in emus, masai ostriches, and broilers [27]. The protein content of the feed may raise total proteins in ostriches. In our study, total immunoglobulin values did not change in day 60.

Enzyme activities in birds are variable and originate from different organs. There were no significant differences between albumin, AST, and ALT. These findings may indicate that canola oil supplementation to feed had effect on the health of ostriches during the experiment. The major finding of current study was a significant increased on glucose along with a significant rise in total protein concentration. This finding may reflect the beneficial effects of canola oil on health. This research will serve as a base for future studies on the effects of types of oils on health. A limitation of this study is that the numbers of ostriches were relatively small. More broadly, research also needed to determine where the effects of canola oil on other metabolit profile content of ostrich muscle, liver and plasma.

It was concluded, dietary supplementation with 3% canola oil can increase body weight and FCR in ostrich.

Table 3. *Effects of omega-3 resource feeding on weight gain at two months period*
Tablo 3. *İki aylık süreçte omega-3 kaynağı kullanımının kilo kazanımı üzerine etkisi*

Animal	Initial Weight (kg)	Final Weigh (kg)	Weight Gain (kg)	ADG (g)	FCR (kg)
Ostrich	258.1	352	93.900	260	7.913

Table 4. *Comparison between two blood sampling (day 0–60) for some plasma parameters, results are expressed as mean ± SEM (n=6)*
Tablo 4. *Bazı kan parametrelerinin iki kan örneklemesi(0 -60 gün)arasındaki karşılaştırması Sonuçlar ortalama±SEM (n=6)*

Variable	Unit of Measurement	Day 0	Day 60	P-Value	
Insulin	Mg/dl	11.98±2.39	12.48±1.44	0.28	NS
Glucose	Mg/dl	108.80±18.90	138.10±17.60	0.05	*
ALT	IU/l	38.20±2.81	37.89±2.46	0.24	NS
AST	IU/l	30.32±6.20	30.32±4.81	0.99	NS
Total protein	Mg/dl	4.31±0.25	4.95±0.40	0.05	*
Albumin	Mg/dl	4.22±0.92	4.80±0.70	0.17	NS
Total immunoglobulin	Mg/dl	0.84±0.49	0.83±0.35	0.95	NS

*AST (aspartate amino transferase), ALT (alanine amino transferase), NS not significant (P>0.05) and *P≤0.05*

In other hand omega-3resource increased total protein and glucose level on plasma.

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REFERENCES

1. Smit DJ: Ostrich farming in the Little Karoo. *Bull Dep Agric Tech,* 358, 1963.

2. Cooper RG, Horbańczuk JO: Anatomical and physiological characteristics of ostrich (*Struthio camelus* var. *domesticus*) meat determine its nutritional importance for man. *Anim Sci J,* 73, 167-173, 2002. DOI: 10.1046/j.1344-3941.2002.00024.x

3. Scollan ND, Choi NJ, Kurt E, Fisher AV, Enser M, Wood JD: Manipulating the fatty acid composition of muscle and adipose tissue in beef cattle. *Br J Nut,* 85, 115-124, 2001. DOI: 10.1079/BJN2000223

4. Zhang W, Xiao S, Samaraweera H, Lee EJ, Ahn DU: Improving functional value of meat products. *Meat Sci,* 86, 15-31, 2010. DOI: 10.1016/j.meatsci.2010.04.018

5. Sales J, Horbanczuk J: Ratite meat. *World's Poult Sci* J, 54, 59-67, 1998. DOI: 10.1079/WPS19980005

6. Sales J, Horbańczuk JO, Dingle J, Coleman R, Sensik S: Carcass characteristics of emus *(Dromaius novaehollandiae)*. *Br Poult Sci,* 40, 145-147, 1999. DOI: 10.1016/j.meatsci.2014.05.027

7. ISTAT: La consistenza degli allevamenti di struzzi in Italia. Statistiche in breve, www.istat.it. 2000.

8. Zotte DA, Brand TS, Hoffman LC, Schoon K, Cullere M, Swart R: Effect of cottonseed oilcake inclusion on ostrich growth performance and meat chemical composition. *Meat Sci,* 93, 194-200, 2012. DOI: 10.1016/j.meatsci.2012.08.027

9. Hajibabaei A, Mosavi SM, Vahedi H: Ostrich breeding in Iran. *Proceedings of the 3rd International Ratite Science Symposium of the World's Poultry Science Association (WPSA),* Madrid, Spain, 14th-16th October, 359-361, 2005.

10. Bertoni G, Piccioli Cappelli F, Bald, A, Borghese A, Duranti E, Falasachini A, Formigoni A, Grasso F, Lacetera N, Lupi P, Meluzzi A, Pinna W, Rosi F, Stefanon B, Zicarelli L, Bernabucci U, Campanile G, Moniello G, Trombetta MF: Interpretation of metabolic profiles in farming animals. *Progr Nutr*, 2, 51-76, 2000.

11. Baião NC, Lara LJC: Oil and fat in broiler nutrition. *Rev Bras Cienc Avic,* 7 (3): 129-141, 2005. DOI: 10.1590/S1516-635X2005000300001

12. Herstad O, Øverland M, Haug A, Skrede A, Thomassen MS, Egaas E: Reproductive performance of broiler breeder hens fed n-3 fatty acid-rich fish oil. *Acta Agric Scand,* 50, 121-128, 2000. DOI:10.1080/09064700412331312331

13. Leskanich CO, Matthews KR, Warkup CC: The effect of dietary oil containing (n_3) fatty acids on the fatty acid, physicochemical, and organoleptic characteristics of pig meat and fat. *J Anim Sci,* 75, 673-683, 1996.

14. Choi NJ, Enser M, Wood JD, Scollan ND: Effect of breed on the deposition in beef muscle and adipose tissue of dietary n 3 poly-unsaturated fatty acids. *Anim Sci,* 71, 509-519, 2000.

15. Mourot J, Hermier D: Lipids in monogastric animal meat. *Reprod Nutr Dev,* 42, 109-118, 2001.

16. Chilliard Y, Bauch D, Lessire M, Schmidely P, Mourot J: Qualité des produits: modulation par l'alimentation des animaux la composition en acides gras du lait et de la viande. *INRA Prod Anim,* 21, 95-106, 2008.

17. Mansour MM, Farid Z, Bassily S, Salah LH, Watten RH: Serum enzyme tests in hepatosplenic schistosomiasis. *Trans Royal Soci Tropic Med Hyg,* 76 (1): 109-111, 1982.

18. Burtis CA, Ashwood ER: Textbook of Clinical Chemistry. 2nd ed., 735-888, Saunders, Philadelphia, 1994.

19. Trebušak T, Levart A, Voljč M, Tomažin U, Pirman T: The effect of linseed oil supplementation on performance, fatty acid composition and oxidative stat us of rabbits. *Acta Argic Slovenica,* 98, 119-125, 2011. DOI: 10.2478/v10014-011-0028-2

20. Baltmanis MS, Blue-McLendon AB, Angel R: The effect of feeding a lay supplement diet versus a complete-pelleted diet on the performance of growing ostriches. *Am Ostrich Res,* 20-24, 1997.

21. Karakaş Oğuz F, Numan Oğuz M, Büyükoğlu T: The effects of using chicken drippings oil instead of the sunflower oil on performance, blood parameters, cholesterol and fatty acid composition of egg yolk in laying Japanese quail *(Coturnix coturnix japonica)*. *Kafkas Univ Vet Fak Derg,* 18 (6): 945-950, 2012.

22. Mushi EZ, Binta MG, Chaba RG, Lsa JF, Modisa L: Serum biochemical values of farmed ostrich *(Struthio camelus)* in Botswana, onderstepoort. *J Vet Res,* 65 (3): 189-193, 1998.

23. Kreibich A, Sommer M: Ostrich Farm Management. pp.450, Landwirtschaftsver GmbH, Munster-Hilt up, 1995.

24. Harms RH, Russell GB, Sloan DR: Performance of four strains of commercial layers with major changes in dietary energy. *J Appl Poult Res,* 9, 535-541, 2000. DOI: 10.1093/japr/9.4.535

25. Bryant M, Wu G, Roland DA: Optimizing dietary energy for profits and performance of two strains of white leghorns. *International Poultry Scientific Forum Abstracts,* Atlanta, GA, USA, pp.23, 2005.

26. Quintavalla F, Bigliardi E, Bertoni P: Blood biochemical baseline values in the ostrich *(Struthio camelus). Annali Facoltà Med Vet,* 21, 61-71, 2001.

27. Samour J, Naldo J, Libanan N, Rahman H, Sakkir M: Age-related hematology and plasma chemistry changes in captive masai ostriches *(Struthio camelus massaicus)*. *Comp Clin Pathol,* 20 (6): 659-667, 2010.