



New approach for using inedible dates in broiler chicken's diet

A A BOUAZID¹, L V TOPOROVA² and I V TOPOROVA³

Moscow State Academy of Veterinary Medicine and Biotechnology, Moscow 109 472 Russia

Received: 26 August 2018; Accepted: 15 October 2018

ABSTRACT

The aim of this study was to focus on poultry meat quality by studying the effect of using an energy-protein compound (EPC) based on inedible dates, mixed with synthetic amino acids (0.5% lysine and 1% methionine), and a complex of enzymes (α -amylase, β -glucanase) in broiler chicken's diets, which is a part of a larger project to determine whether this compound can be incorporated into Algerian meat production systems without having a negative effect on the overall product quality. Two groups of 50 heads broiler chickens each were used to evaluate nonconventional feed based on inedible dates (EPC) during 42 days. At the end of the experiment, EPC substitute 20% of maize without adversely affecting the rates of growth and mortality. After slaughter, the weight of the femoral muscles of the experimental birds was less than the control birds. But, the weight of the pectoral muscles was significantly higher in the experimental birds' carcasses compared to control group. Analysis of dry matter, protein, fat, and the levels of amino acids showed a significant difference. Control birds had a higher weight of skin and abdominal fat compared to experimental birds. Using energy-protein compound (EPC) based on inedible dates as an alternative for corn in broiler chicken's diets showed positive effect on meat quality, ameliorating weight and amino acids content in broiler's muscles. Thus, EPC can be used as compound to substitute 20% maize in the broiler diets, without affecting production performance.

Key words: Algeria, Broiler chickens, EPC, Inedible dates, Meat quality

The high demand of animal products owing to the rising population and the standard of living improvement are leading to an increase in the demand of high-quality sources of protein which are animal-based products. Thus, the cost of production (60 to 70% as cost of feed; Thirumalaisamy *et al.* 2016) raised as a result of the gap between the demand and production of conventional feed used in animal feeds, especially poultry diets (Altmann *et al.* 2018). One of the solutions to resolve this problem is using non-conventional feeds. At present, a fairly large number of non-conventional feeds used in poultry diets like broken rice, barley, sorghum. Waste of date can easily substitute maize without any loss in performance (Meradi 2009, Issa Salissou *et al.* 2015). Annual production of date of about 850,000 tonnes, make Algeria one of the important date-producing countries (Khaled *et al.* 2014). However, in this immense quantity there is an estimation of 25–50% of inedible dates (Chehma *et al.* 2000, Kaidi and Touzi 2001). The objective was evaluate the quality and the physico-chemical characteristics of broiler chicken's meat fed on date.

MATERIALS AND METHODS

In semi-arid high plateaus of Algeria, 100-day-old chicks

Present address: ¹Postgraduate Scholar (bouabou.amine@gmail.com), ²Professor (itoporova@yandex.ru), ³Assistant Professor (irinavladimiravno@yandex.ru), Department of Animal Feeding and Feed Production.

of Arbor Acres strain, weighing 41 g were divided into 2 homogeneous groups with 50 heads each.

In order to study the impact of feeding EPC on anatomical and morphological parameters in broilers, at the end of the experiment, 6 heads (3 male + 3 female) were selected from the control and experimental groups for slaughter, which were used to assess the effect of EPC on the interior organs and meat quality of broiler chicken.

The inedible dates were dried in the open air under the sun for 10 days; they were ground. In experiment, an energy-protein compound (EPC) based on inedible dates was made, and it was mixed with synthetic amino acids (0.5% lysine and 1% methionine), and a complex of enzymes (α -amylase, β -glucanase), 2 rations were designed, control with 0% of EPC and experimental containing EPC to substitute 20% maize in ration (Table 1).

The scientific data obtained were analyzed by Microsoft Office Excel 2013 software in its Descriptive Statistics analysis tool and the T-TEST functions. The difference between the experimental data and the control group data was considered significant at $P \leq 0.05$. By the AOAC method (1990), the chemical analyzes were carried out in 3 repetitions, it concerned the analysis of dry matter, ash, crude protein, crude fiber, fat, and amino acids (Table 3).

RESULTS AND DISCUSSION

For 42 days of rearing, the survival of chickens

Table 1. Composition of the experimental diets (%)

Ingredient	Starter (1–10 Days)		Grower (11–21 days)		Finisher (22–42 days)	
	Control	Experimental	Control	Experimental	Control	Experimental
Maize	57.00	45.60	61.00	48.80	65.00	52.00
EPC	00	11.40	00	12.20	00	13.00
Soybean meal (48%)	34.0	34.0	30.00	30.00	25.00	25.00
Milk powder	1.0	1.0	0.50	0.50	00	00
Sunflower oil	0.50	0.50	1.00	1.00	2.5	2.5
Wheat bran	2.70	2.70	2.70	2.70	2.70	2.70
Organic acid	0.50	0.50	0.50	0.50	0.50	0.50
Salt	0.30	0.30	0.30	0.30	0.30	0.30
Calcium carbonate	1.50	1.50	1.50	1.50	1.50	1.50
Dicalcium phosphate	1.50	1.50	1.50	1.50	1.50	1.50
Premix*	1.00	1.00	1.00	1.00	1.00	1.00
<i>Calculated values</i>						
M.E. Kcal/100 g	287	284.6	293	290.6	306	302.6
Crude protein (%)	22.03	21.78	20.11	19.84	18.05	17.76
Crude fat (%)	3.38	3.41	4.06	4.09	5.15	5.18
Crude fibre (%)	3.67	4.81	3.43	4.65	3.19	4.49
Lysine (%)	1.18	1.19	1.05	1.07	0.92	0.94
Methionine (%)	0.33	0.42	0.31	0.41	0.29	0.39

*Content in 1 kg of premix: A, 1000000 UI; D3, 200000 UI; E, 2000 mg; K3, 15 mg; B1, 125 mg; B2, 400 mg; PP, 2500 mg; B5, 825 mg; B6, 200 mg; H, 5 mg; B9, 55 mg; B12, 1.25 Mg; Fe, 5000 mg; Cu, 1000 mg; Zn, 5000 mg; Mn, 7500 mg; I, 150 mg; Se, 20 mg. (The exchange energy is 850 Kcal/kg, the ash is 70%, the crude protein is 10%, Ca 12%, Na 13.7%).

throughout the experiment was 96% in both groups where 2 broilers fell in each group of 50 heads at the beginning of the experiment. In the control group, the average live weight was 2,423 g, and in the experimental group 2,381 g. The difference between the groups was not significant ($P < 0.244$). The feed consumption bird was 5,067 and 5,136 kg, for experimental and control group respectively. Attia *et al.* (2015) reported that inedible dates can be fed to broilers up to 20% in the final period of rearing (21–40 days) without adversely affecting the rates of growth and mortality, but the best indicators were obtained on a diet containing 5% of inedible dates. Masoudi *et al.* (2011) presents the results of using different levels of waste of dates (0, 10, 20 and 30%) in the broiler diets. As a result, increasing the rate of new feed incorporation, led to a decrease in productivity.

The inclusion of EPC in the broiler's diet substituting 20% of maize in the experimental group had no significant effect on weight of heart, pancreas, proventriculus and spleen. In chickens of the experimental group, the absolute mass of the liver and the gizzard were higher than in the control group (Table 2) whereas broilers chicken's in control group had a higher weight of skin and abdominal fat compared to birds in the experimental group.

After the anatomical and morphological study, it was found that the weight of the femoral muscles in the chicken's carcasses of the experimental group was less than those in the control group with 395 g and 406.5 g, respectively. The weight of the pectoral muscles was significantly higher in the experimental bird's carcasses compared to control birds with 542.8 g, 465.2 g, respectively ($P < 0.05$) (Table 2).

In general, the yield of edible parts of broiler chickens

Table 2. Meat quality and internal organs of broiler chickens (n=6)

Parameter	Control group	Experimental group
Live weight (g)	2470.00±96.35	2474.67±53.46
Killed weight (g)	1819.17±83.98	1874.33±33.87
% to live weight	73.78±2.35	75.84±1.43
Eviscerated carcass weight (g)	1683.33±83.43	1729.17±36.58
% to live weight	68.15±1.72	69.87±1.6
Muscles weight (g)	1044.83±74.05	1125.33±35.06*
Pectoral muscles weight (g)	465.16±40.62	542.83±24.39*
Femoral muscles weight (g)	406.50±19.03	395.00±10.45
The yield of edible parts (g)	1430.33±80.66	1501.67±42.26**
Liver (g)	59.67±2.56	64.17±2.02
Heart (g)	15.00±1.1	14.00±0.97
Gizzard (g)	61.17±2.36	67.00±3.68
Pancreas (g)	5.33±1.00	5.50±0.43
Proventriculus (g)	12.17±0.7	10.83±0.7
Spleen (g)	3.33±0.21	3.50±0.34
Skin with subcutaneous fat (g)	198.67±8.71	189.33±10.8
Abdominal fat (g)	51.00±5.02	41.83±8.46

** $P < 0.01$, * $P < 0.05$.

in experimental group significantly exceeded the control ($P < 0.01$). Kamel *et al.* (1981), Hmeidan *et al.* (1993) and Al-Homidan (2003) concluded that inedible dates did not have a negative effect on the yield of the killed and eviscerated carcass. Taking into consideration, the presence of enzymes in this compound may had an effect on carcass

yield, as reported by Kumar Govil *et al.* (2017) that amylase supplementation improved overall performance, digestibility, and carcass yield of broilers fed low energy-based diets.

As known, the meat quality of broilers is determined by the genetic characteristics and also by the composition and nutritional value of diets and the conditions of bird feeding.

Results showed that feeding EPC reduces the weight of abdominal fat 41.8 g compared to control group 51 g. The study of the fat content in the edible parts of the carcass of broiler chickens indicated a decreased level in both femoral ($P<0.05$) and pectoral muscles tissues of the experimental group birds (Table 3).

The results of anatomical and morphological studies of broilers showed that in the carcasses of experimental chickens, the yield of muscle tissue and the killed weight increased compared to the control. Thus, adding EPC in diets of the experimental birds had a positive effect on the yield of edible parts of broiler chicken's carcasses. In the experimental group, this indicator was 1501.67 g significantly higher than the control group (1,430.33 g). At the same time, the yield of muscles tissue in the experimental group had better weight compared to the

control group. Similar studies were conducted by Al-Homidan (2003), Al-Harthi (2006) and El-Deek *et al.* (2010), where they noted that including inedibles dates in broilers' diet did not adversely affect the slaughter yield and the total weight of edible parts.

In accordance with the methods of research, the chemical composition of meat was studied. The analysis of the water content and dry matter in the pectoral muscle revealed that there were no significant differences between the control and experimental groups.

The levels of crude protein and fat content in pectoral muscular tissue, were very close. The percentages on dry matter basis of pectoral muscle tissue of the samples of the experimental group compared to control showed higher level for protein and mineral elements. Otherwise, the content of lipids in the meat of experienced broilers was lower compared to control (Table 3).

The chemical analysis of the femoral muscle of broilers chicken (Table 3) revealed that the dry matter in the femoral muscle of broilers in the control group was significantly higher than that in the experimental group ($P<0.001$). In the experimental group, there were significant differences between groups in fat content. The femoral muscle of broilers in the control group, fat content was higher by 1.97% ($P<0.05$) compared to femoral muscle tissue of chicks fed EPC. El-Deek *et al.* (2010) found that feeding inedible dates (up to 15% in the diet) to broilers did not significantly affect the quality of meat: the content of dry matter, crude protein, lipids, ash in the pectoral and femoral muscles and organoleptic indicators, such as tenderness, color intensity and pH of meat. According to Alaeldein (2015), increasing the level of amino acids in the diet increased the yield of pectoral muscle in broilers and reduced the amount of abdominal fat compared to the normal level of amino acids.

The study of the amino acid composition of meat revealed an increase in the content of essential amino acids in the protein of the pectoral and femoral muscles of the experimental group. Excess was noted for almost all amino acids (Table 3) including the total of essential amino acids ($P<0.05$).

The results of analysis of the amino acid profile of muscles tissue in broilers showed a significant superiority of the experimental group in comparison with the control. Our assumptions of this effect are related to a source of easily metabolizable carbohydrates in EPC. We believe that the proteins in diets were more efficiently used by chickens of the experimental group for the synthesis of muscle proteins, and because of presence of more easily degradable (fructose and glucose) present in EPC compared to more complex source of energy in maize (starch). This effect requires further study and confirmation. In harmony with the findings in the present study, Suthama (2018) reported that meat quality improvement is found in broilers fed dietary inclusion of soybean oligosaccharide at the level of 0.30%.

In addition, dates contain antioxidants, such as β -

Table 3. Chemical composition of pectoral and femoral muscles tissues of broiler chickens (n=3)

Parameter	Pectoral muscles		Femoral muscles	
	Control group	Experimental group	Control group	Experimental group
Dry matter (%)	25.31±0.58	24.4±0.10	26.88±0.19	24.4±0.1***
protein (%)	22.49±0.42	22.22±0.34	18.73±0.44	18.09±0.59
Fat (%)	1.48±0.05	1.30±0.12	7.17±0.05	5.2±0.70*
Ash (%)	1.44±0.12	1.44±0.05	1.22±0.12	1.05±0.03
Amount of amino acids	17.7±0.1	18.09±0.05*	16.32±0.13	16.86±0.04*
Essential amino acids	9.97±0.09	10.26±0.03*	9.1±0.12	9.16±0.03
Nonessential amino acids	7.73±0.02	7.83±0.08	7.21±0.11	7.7±0.04*
Lysine	7.34±0.34	8.59±0.12*	7.23±0.08	7.40±0.06
Histidine	4.35±0.16	5.35±0.12*	2.95±0.13	4.2±0.06**
Arginine	5.13±0.01	5.49±0.08*	6.14±0.20	6.84±0.10*
Asparagine	7.65±0.14	7.89±0.04	7.33±0.15	8.71±0.14**
Threonine	3.82±0.02	4.48±0.07**	4±0.07	4.44±0.09*
Serine	3.33±0.01	3.68±0.02**	3.82±0.15	4.45±0.07*
Glutamine	13.10±0.06	11.89±0.27*	15.41±0.25	14.77±0.25
Proline	2.91±0.17	3.42±0.09	3.36±0.76	5.24±0.06
Glycine	3.31±0.06	4.1±0.06**	4.34±0.15	3.40±0.13*
Alanine	4.75±0.04	5.22±0.06**	5.35±0.17	5.48±0.12
Cystine	0.88±0.02	0.88±0.02	1.07±0.05	1.26±0.03*
Valine	3.95±0.03	4.44±0.07*	4.01±0.21	3.96±0.11
Methionine	2.37±0.03	2.04±0.27	3.16±0.11	3.19±0.02
Isoleucine	3.70±0.04	2.39±0.2*	4.32±0.18	3.98±0.11
Leucine	6.38±0.05	5.05±0.08**	7.49±0.14	7.46±0.13
Tyrosine	2.64±0.12	3.15±0.02*	3.23±0.09	3.91±0.1**
Phenylalanine	3.10±0.04	3.35±0.1	3.89±0.09	4.53±0.11*

*** $P<0.001$, ** $P<0.01$, * $P<0.05$.

carotene and Se (Al Farsi 2008), which could have positive effects on meat physico-chemical parameters. Shekh Sajad (2017) reported that Se increased breast and eviscerated yields without altering the yield of visceral organs and abdominal fat. As known, meat keeps changing during post mortem storage where the main cause is the presence of amino-peptidases and proteases leading to an increase in free amino acids during the post-mortem storage of meat (Migita and Nishimura 2006). Furthermore, Perenlei *et al.* (2014) reported that the astaxanthin rich yeast is a powerful antioxidant, which can increase the content of free amino acids during the aging of broiler chicken meat.

Using energy-protein compound based on inedible dates as an alternative for maize in broiler chicken's diets showed positive effect on meat quality, ameliorating weight and amino acids content in broiler's muscles. Thus, EPC can be used as compound to substitute 20% maize in the broiler diets, without affecting production performance. Further testing is desired with even higher levels to determine the maximum maize substitution dosage.

REFERENCES

- Al Farsi MA. 2008. Nutritional and functional properties of dates: a review. *Critical Reviews in Food Science and Nutrition* **48**: 877–87.
- Alaeldein MA, Mutassim MA, Gamaleldin M S and Ahmed AA S. 2015. Effect of whole inedible date and amino acid supplementation on growth performance of ross 308 broiler chicks. *Animal Review* **2**(1): 9–18.
- Al-Harathi M A. 2006. The influence of date waste meal supplemented with either enzymes, probiotics or their combination on broiler performance. *Egyptian Poultry Science* **26**: 1031–55.
- Al-Homidan A H. 2003. Date waste, whole dates and date pits as ingredients in broiler diets. *Egyptian Poultry Science Journal* **23**: 15–35.
- Altmann B A, Neumann C, Velten S, Liebert F and Morlein D. 2018. Meat quality derived from high inclusion of a micro-alga or insect meal as an alternative protein source in poultry diets: a pilot study. *Foods* **7**(3): 34.
- AOAC. 1990. *Official Method of Analysis*. 15th edn, pp 1230. Association of Analytical Chemists, Virginia, USA.
- Attia Y A and Al-Harathi M A. 2015. Effect of supplementation of date waste to broiler diets on performance, nutrient digestibility, carcass characteristics and physiological parameters. *European Poultry Science* **79**.
- Chehma A, Longo H F and Siboukeur A. 2000. Estimation du tonnage et valeur alimentaire des sous-produits du palmier dattier chez les ovins (Estimation of the tonnage and food value of the date palm by-products in sheep). *Revue Recherche Agronomique INRAA* **7**: 7–15.
- El-deek A A, Attia Y A and Al-harathi M A. 2010. Whole inedible date in the grower–finisher broiler diets and the impact on productive performance, nutrient digestibility and meat quality. *Animal* **4**(10): 1647–52.
- Hmeidan M C Y, Al-Yousef N H and Al-Turki I. 1993. Dates as an energy source in broiler rations. *3rd Symposium of Date Palms*. pp 401–413. King Faisal University, Saudi Arabia.
- Issa S, Jarial S, Brah N, Harouna L and Soumana I. 2015. Use of sorghum on stepwise substitution of maize in broiler feeds in Niger. *Livestock Research for Rural Development* **27**(212).
- Kaidi F and Touzi A. 2001. Production de Biomethane a Partir des Dejections Animales. *Rev. Energ. Ren.: Production et Valorisation – Biomasse*. 75–78
- Kamel B S, Diab M F, Ilian M A and Salman A J. 1981. Nutritional value of whole dates and date pits in broiler rations. *Poultry Science* **60**: 1005–11.
- Khaled M T O and Ladjel S. 2014. Production of bioethanol from varieties of dates of poor quality. *African Journal of Agricultural Research* **9**(37): 2814–18.
- Kumar G, Nayak S, Baghel R P S, Patil A K, Khare A and Malapure C D. 2017. Effect of amylase supplementation on performance of broiler chicken. *Indian Journal of Poultry Science* **52**(1): 66–69.
- Masoudi A, Chaji M, Bojarpour M and Mirzadeh K H. 2011. Effects of different levels of date pits on performance, carcass characteristics and blood parameters of broiler chickens. *Journal of Applied Animal Research* **39**(4): 399–405.
- Meradi S and Alloui N. 2009. Effet de la substitution partielle du maïs par les rebuts de dattes sur les performances de production du poulet du chair. *Huitieme journees de la recherche avicole*. 25 et 26 Mars. St malo.
- Migita K and Nishimura T. 2006. Purification and characterization of a Cl⁻ - activated aminopeptidase from bovine skeletal muscle. *Bioscience, Biotechnology and Biochemistry* **70**(5): 1110–17.
- Perenlei G, Tojo H, Oda T, Kubota M, Kadowaki M and Fujimura S. 2014. Effect of dietary astaxanthin rich yeast, *Phaffia rhodozyma*, on meat quality of broiler chickens. *Animal Science Journal* **85**(10): 895–903.
- Shekh Sajad A, Wani M A, Hazarika R, Bhanja S K and Mandal A B. 2017. Response of broiler chickens fed diets supplemented with selenium during hot dry summer. *Indian Journal of Poultry Science* **52**(3): 259–63.
- Suthama N, Pramono Y B and Sukanto B. 2018. Improvement of broiler meat quality due to dietary inclusion of soybean oligosaccharide derived from soybean meal extract. *IOP Conference Series: Earth and Environmental Science* **102**(1): 012009.
- Thirumalaisamy G, Muralidharan J, Senthilkumar S, Hema Sayee R and Priyadharsini M. 2016. Most-effective feeding of poultry. *International Journal of Science, Environment and Technology* **5**(6): 3997–4005.