ISSN 1682-8356
ansinet.org/ijps

INTERNATIONAL JOURNAL OF

POULTRY SCIENCE

ANSInet
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan
Mob: +92 300 3008585, Fax: +92 41 8815544
E-mail: editorijps@gmail.com

International Journal of Poultry Science 5 (3): 284-288, 2006
ISSN 1682-8356

Aspects of the Serum Biochemistry, Carcass Quality and Organoleptic Characteristics of Broilers Fed Alkali-Treated Date Pits

M. Al-Bowait[1] and S.I. Al-Sultan[2]
[1]Central Animal Production and Veterinary Training, Al-Ahsa, Saudi Arabia
[2]Department of Public Health and Animal Husbandry, College of Veterinary Medicine and Animal Resources, King Faisal University, P. O. Box 11647, Al-Ahsa 31982, Saudi Arabia

Abstract: The effects of feeding alkaline treated date pits (TDP) on serum biochemistry, carcass quality and organoleptic characteristics were investigated in 396 commercial broiler chicks of the Hybro strain. The values of glucose, albumin, protein, calcium, pH and GPT and GOT showed no significant difference when compared with the values obtained from the control broilers (feed on corn). Similarly no significant difference was obtained in the values of the meat composition, carcass quality, visceral and abdominal fat between the treated and control broiler. Sensory evaluation parameters of cooked meat were highly accepted to panelists. Replacement corn with alkaline treated date pits as high as 62.4% in broilers diets did not produce serous adverse affects on performance, serum biochemistry, carcass and eating quality of broilers.

Key words: Date pits, alkali-treatment, broilers

Introduction

Saudi Arabia is the second largest producer of dates with 14 million date trees producing 17.6% of the world's marketed dates and an annual production of 568,000 tons in 2002. Most of these trees are grown in Al-Ahsa, which is the world's largest oasis. A significant portion of dates is consumed locally within the Kingdom, while many are exported to outside market. Date pits (stones, kernels or seeds) form 6-12% of the date fruit depending on variety and quality grade. The date pits have the advantage of being locally produced in large quantities, are cheap and high in energy content. Date pits are usually included in livestock and poultry feeds.

The chemical composition of date pits revealed percentages of 9.78, 5.12, 5.22, 0.84 and 11.58 for moisture, crude protein, ether extract, ash and crude fiber, respectively together with 12.53 MJ of metabolizable energy (Al-Hiti, 1978). Kamel *et al*. (1981) fed dates to broiler chicks at levels of 5 to 47% as a replacement for corn and reported that the highest level depressed weight gain and feed efficiency. When they were fed dates meal substituting for corn at 0, 5 and 10, broiler weight gain and feed conversion improved with increasing level.

In this study we investigated alkali treatment of date pits and the effects feeding such treated date pits (TDP) on broiler growth, blood parameters, body composition, carcass and meat equality.

Materials and Methods

The chicks were obtained from a private hatchery at Al-Ahsa town in eastern Saudi Arabia.

On arrival at the site of the experiment at the Veterinary and Animal Production Training Center in Al-Ahsa the chicks were weighed and divided into nine groups of 44 chicks each. The groups were assigned at random to nine experimental diets. A control conventional diet composed of 65% corn, 32.5% Soya and 2.5% concentrate was formulated.

The corn contained 109 g crude protein and 3300 Kcal of Metabolizable energy per kg the dry matter that was 919 g/kg .The corresponding values for Soya bean were 480 g and 2500 Kcal, while those of the concentrate were 60 g and 2500 Kcal.

The remaining treatment diets were formulated as follows:

1. An experimental diet with similar composition as the control diet except that 15.4% of corn was replaced by date pits that was treated by 3% NaOH.
2. An experimental diet with similar composition as the control diet except that 30.8% of corn was replaced by date pits that was treated by 3% NaOH.
3. An experimental diet with similar composition as the control diet except that 46.2% of corn was replaced by date pits that was treated by 3% NaOH.
4. An experimental diet with similar composition as the control diet except that 61.8% of corn was replaced by date pits that was treated by 3% NaOH.
5. An experimental diet with similar composition as the control diet except that 15.4% of corn was replaced by date pits that was treated by 6% NaOH.
6. An experimental diet with similar composition as the control diet except that 30.8% of corn was replaced by date pits that was treated by 6% NaOH.
7. An experimental diet with similar composition as the control diet except that 46.2% of corn was replaced by date pits that was treated by 6% NaOH.
8. An experimental diet with similar composition as the control diet except that 61.8% of corn was replaced by date pits that was treated by 6% NaOH.

Table 1: The percentage physical composition; crude protein and Kcal of metabolizable energy in various dietary treatments

Date pits treatment level	%Treated date pits in diet	% Corn replaced by date pits	%Corn in diet	%Soya in diet%	% Concentrate in diet	Crude protein%	ME/kcal
0	0	0	65	32.5	2.5	22.95	3020
3	10	15.4	55	32.5	2.5	22.6	2990
3	20	30.8	45	32.5	2.5	22.33	2960
3	30	46.2	35	32.5	2.5	22.02	2930
3	40	61.6	25	32.5	2.5	21.71	2900
6	10	15.4	55	32.5	2.5	22.64	2990
6	20	30.8	45	32.5	2.5	22.33	2960
6	30	46.2	35	32.5	2.5	22.02	2930
6	40	61.6	25	32.5	2.5	21.71	2900

Table 1 shows the percentages made by the ingredients of the diets together with their crude protein and energy contents. Each treatment contained four replicates of 11 chicks each. Chicks in each replicate were separately penned. The replicate/ treatment combinations were randomly allocated within a large open-system pen.

Management of experimental birds: Birds of all treatments were reared on sand litter under similar environmental and management conditions throughout 42 day feeding period. All chicks were vaccinated against Newcastle and Gumboro diseases at 15 and 30 days of age. Food and water were provided via fountain drinkers attached to the roof of the pen. Feeders and drinkers were cleaned twice daily at early morning and mid-day. The deep litter was mixed twice a week so as to keep it dry throughout the test period. All management and rearing procedures were those recommended by the Commercial Chicken Production Manual (1981). Feed intake, body weight and hen-housed were recorded for each replicate pen separately.

Slaughter and samples collection: At the end of the feeding period, 5 birds from each replicate pen were selected at random and slaughtered according Islamic Shariah, by cutting the jugular veins and carotid arteries of both sides of the neck just caudal to the larynx. The slaughter was carried out manually for each individual bird. Five ml of blood was collected from each bird into properly labeled heparinized centrifuge tube. After complete bleeding was effected, the birds were weighed, and their blood volumes estimated. The birds were thereafter dressed following conventional industrial semi-automated method. After this, the weights of feathers were estimated.

The head was removed at the atlanto-occipital joint and weighed. The neck was weighed before and after skin removal. The shanks and feet were removed and weighed after cutting at the tibio-tarsal joint. All visceral organs were equally removed except the vent. Each dressed and eviscerated bird was put in a plastic bag and stored in a deep freezer at -15°C for later use.

Table 2: Protein (g/L), albumin (g/L) GOT (µ/L) and GPT (µ/L) in the different treatments

Treatment	Protein	Albumin	GOT	GPT
Treat effect	N.S	N.S	N.S	N.S
Control	4.3^{a}	1.8^{a,b}	275.9^{b}	8.8
10/3%NaoH	3.7^{b}	1.5^{a}	237.0^{b}	13.4
20/3%NaoH	3.9^{a,b}	1.4^{b}	294.2^{a,b}	19.6
30/3%NaoH	3.7^{b}	1.4^{b}	300.9^{a,b}	9.2
40/3%NaoH	3.6	1.3	328.7^{a,b}	19.5
10/6%NaoH	4.1^{a}	1.5^{b}	299.1^{a}	11.8
20/6NaoH	4.5^{a}	1.4^{b}	261.5^{b}	21.8
30/6%NaoH	4.7^{a}	1.9^{a}	389.6^{a}	54.9
40/6%NaoH	3.5^{b}	2.0^{a}	266.2^{b}	15.3
SE	0.4	0.2	48.79	20.8

NS= Not significant (p>0.05) . * =Significant at p<0.05

Means in a column that are followed by the same letter or no letter do not differ (P>0,05) significantly.

After 3 weeks of storage, the frozen birds were thawed out in a fridge overnight. The wings were removed by cutting interiorly at the humero-scapular joint. The ribs were cut laterally from their heads to the shoulder girdle. The whole breast was then pulled cranially and removed. The breast was kept in a plastic bag and stored in a deep freeze at -2°C for chemical analysis. Both legs were pulled cranially after being dislocated from their attachment to the femuro-acetabular joint. The legs were removed leaving the gluteal muscles on the ischium. Each leg was weighed and then dissected into skin, subcutaneous fat, intra-muscular fat, bone and muscle tissues.

The left breast muscles were minced and dried, and subsequently analyzed for crude protein and fat using the procedures of the AOAC (1975). All analyses were carried out at the Nutrition laboratory of the College of Veterinary Medicine and Animal Resources, King Faisal University.

Serum biochemical analysis: Serum was separated from the blood samples by centrifugation at 4000 rpm for 15 minutes and thereafter stored at -20°C until analyzed. An auto-analyzer (Boehringer BH/ Hitachi 911, Germany)

Table 3: Least square mean (± standard error-se) for serum glucose (mmol/L), calcium (mmol/L) pH and ELSA titer (Log10) in the different treatments

Treatment	Glucose	Calcium	pH value	ELISA
Treat effect	N.S	N.S	N.S	N.S
Control	27.0[b]	4.1	11.8[a,b]	3.7
10/3%NaoH	52.8[a,b]	3.6	12.1[a,b]	4.2
20/3%NaoH	83.9[a]	4.0	10.7[a,b]	3.9
30/3%NaoH	25.6[b]	4.0	11.2[a,b]	3.6
40/3%NaoH	34.0[b]	4.1	10.8[a,b]	3.5
10/6%NaoH	67.9[a]	3.8	13.2[a]	3.8
20/6%NaoH	20.1[b]	3.3	8.9[b]	3.3
30/6%NaoH	73.2[a,b]	3.9	9.8[a,b]	4.0
40/6%NaoH	95.7[a]	3.6	12.7[a,b]	3.2
s.e	26.85	0.39	2.05	0.24

N.S= Not significant (P>0.05) * =Significant at P <0.05
Means in a column that are followed by the same letter or no letter do not differ (P>0,05) significantly.

was used to determine the concentrations of serum protein, glucose, calcium, albumin, (liver function test for Glutamic oxaloacetic transaminases (GOT) and liver function test for Glutamic pyruvic transaminases (GPT). All analyses followed the procedures described by Jerry *et al.* (1997).

Organoleptic evaluation: The right breast muscle from each slaughtered bird was used for sensory evaluation of cooked meat. The muscles from the nine treatments were separately cooked by boiling at the 97ºC for 45 minutes. Ten untrained panelists from the staff of the Veterinary and Animal Production Training Center in Al-Ahsa were asked to evaluate cooked meat samples from the nine treatments for flavor, tenderness and color using a scale of five points. The maximum score of 5-means excellent, while a score of 1-point means poor.

Data analysis: Live weight growth curves were plotted for all treatment groups. Survival rates and feed conversion ratios as well as weekly growth rates were computed. Analysis of variance was used determine treatment effects on all parameters. Least square means and standard errors were computed and compared. The procedures of the Statistical Analysis Systems (SAS) Institute (1986) were used.

Results

Serum biochemistry: Table 2 provided information on serum biochemical characteristics of the experimental birds. There was no significant (p>0.05) treatment effect on serum proteins. Generally, the chicks fed diet containing 3% NaOH treated date pits had slightly lower serum protein values than the birds fed on the control or the diets containing 6% NaOH treated date pits. Similarly, the treatment did not affect (p>0.05) serum albumin, GOT or GPT values. The latter values were, however, extremely variable.

Again, Table 3 showed that the treatments did not significantly affect (p>0.05) serum glucose, calcium, serum pH or ELISA titre values indicating that the treatment did not affect the immunity of birds.

Table 4 also revealed that treatments did not produce significant (p>0.05) effects on the weights of right or left leg or any of their components. Again the differences that were apparent between the different treatments in the absolute weights of tissues are explained in terms of differences in the weights of the birds.

Generally, subcutaneous fat was poorly developed in all treatments except the control, which had more subcutaneous fat than the others. Fat data were generally very variable. Similarly, the treatment did not influence the composition of the right and left leg in terms of intra-muscular fat or bone content. Intra-muscular fat was generally poorly developed in these tissue parts. The weight of bone in right or left leg varied between 48.6-26.7 g. These data were again subject to variation resulting from the accuracy with which deboning was carried out.

Table 5 showed that treatment did not affect protein or fat content of breast muscles. The protein content of the breast muscle from all treatments varied between 20.7-18.4%. On the other hand fat data were variable with mean content ranging from 2.7 to 1.1%.

The organoleptic evaluation results of cooked meat are shown in Table 6. The treatments did not affect (p>0.05) taste panel scores of cooked meat sample from the various treatments.

Taste panel flavor scores varied between 5-4, while those of tenderness ranged between 5-4. Color scores on the other hand did not vary.

Discussion

Date pits, which are known to contain high proportions of fiber, were used in feeding broilers in this study. The digestive system of birds, however, cannot coup with high dietary fiber and for that reason dietary fiber is conventionally included at low levels of 3-5% of the diet (Ewing, 1963). It is however possible to improve the digestibility of high fiber date pits by treatment with NaOH in this study. NaOH treated date pits replaced 15.4,30.8, 45.2 or 62.4% of the 65% corn inclusion in broiler diet. The inclusion of a high proportion of the treated fibrous material in broiler diet did not adversely affect growth performance as well as serum glucose levels. This is at variance with the findings of Onifade (1993) who reported that glucose was accentuated when high fiber diet was fed to broilers. However, this worker fed antibiotic (procaine penicillin) with the high fiber diet and this probably explains the discrepancy in the results on blood glucose levels.

The fact that the values of glucose, protein, albumin and protein in birds fed alkaline treated diets did not differ from those on control diet indicates nutritional adequacy of the former diets. The similarity in serum total protein

Table 4: Least square mean (± standard error-se) of weights (g) of offal parts in different treatments

Treatment	Carcass	Blood	Feathers	Gastro-intest. tract	Head	Liver	Abdo fat	Gizzard
Treat effect	*	*	N.S	N.S	N.S	N.S	N.S	N.S
Control	1447.8^{a}	82^{b}	88^{a}	180 (10.3)	62^{ab}	47^{a}	5.1	67^{a}
10/3%NaoH	1150.5^{b}	56^{b}	46^{c}	160 (9.8)	52^{b}	39^{b}	0.5	60^{a}
20/3%NaoH	1339.1^{a}	55^{b}	38^{c}	150 (10.3)	48^{b}	38^{b}	0.7	54^{b}
30/3%NaoH	1236.0^{a,b}	59^{b}	76^{a}	165 (11.5)	55^{b}	45^{a}	0.8	66^{a}
40/3%NaoH	940.1^{c}	63^{b}	71^{a}	138 (13.7)	62^{a}	39^{b}	3.8	62^{a}
10/6%NaoH	1170.7^{b}	57^{b}	71^{a,b}	152 (10.9)	48^{b}	31^{b,c}	0.6	58^{a}
20/6%NaoH	1243.4^{a,b}	46^{a}	58^{b}	130 (10.4)	44^{b}	28^{c}	0.0	49^{b}
30/6%NaoH	1016.2^{b,c}	64^{b}	75^{a}	152 (10.8)	50^{b}	38^{b}	1.3	49^{b}
40/6%NaoH	1170.6^{b}	50^{b}	49^{c}	157 (12.7)	52^{b}	39^{b}	1.4	55^{a}
SE	44.49	5.6	6.01	9.7	1.8	1.7	1.3	2.8

N.S= Not significant (P>0.05) * =Significant at P <0.05. Means in a column that are followed by the same letter or no letter do not differ (P>0,0%) significantly. Figures between brackets are the percentages from final weight

Table 5: Least square mean (± standard error-SE) crude protein and ether extract percentages of the breast muscles in different treatments

Treatment	Protein %	Fat %
Treat effect	N.S	N.S
Control	19.6	2.2^{ab}
10/3%NaoH	18.4	2.7^{a}
20/3%NaoH	19.8	2.4^{a}
30/3%NaoH	20.7	1.2^{b}
40/3%NaoH	20.5	1.4^{b}
10/6%NaoH	20.4	2.5^{a}
20/6%NaoH	20.7	2.5^{a}
30/6%NaoH	20.2	1.1^{b}
40/6%NaoH	20.6	2.0^{ab}
SE	1.02	0.27

N.S= Not significant (p>0.05) * =Significant at p<0.05. Means in a column that are followed by the same letter or no letter do not differ (p>0.05) significantly.

Table 6: Least square means (± standard error-SE) of taste panel flavor, tenderness and color scores of cooked meat from different treatments

Treatment	Flavor	Tenderness	Color
Treat effect	N.S	N.S	N.S
Control	5	5	5
10/6%NaoH	4	4	5
20/6%NaoH	5	5	5
30/6%NaoH	5	5	5
40/6%NaoH	4	4.5	5
10/3%NaoH	5	5	5
20/3%NaoH	4.7	4.3	5
30/3%NaoH	4	4	5
40/3%NaoH	4	4	5
SE	0.36	0.4	0

N.S= Not significant (P>0.05) * = Significant at P <0.05. Means in a column that are followed by the same letter or no letter do not differ (P>0,0%) significantly.

interprets normal protein metabolism. However, previous studies (Longe and Fagbenro-Byron, 1990; Onifade, 1993; 1997), reported that blood parameters are frequently lowered by high inclusion of fibrous ingredients due to their inferior nutritional quality. Probably date pits are of a better nutritional quality than the fibrous feeds used by these workers.

Liver function tests for Glutamic oxaloacetic transaminase (GOT) and Glutamic pyruvic transaminase (GPT) produced similar results in the control birds and the experimental birds and is congruent with the similar reference values reported for chicks by Jerry *et al.* (1997).

The treatment resulted in insignificant differences in the weights of carcass, feathers, liver, gizzard and abdominal fat. Generally birds that were heavier at slaughter had heavier carcasses and slaughter by-products. This result is expected as body composition is a function of body weight and birds of similar body composition have been shown to possess similar carcasses and slaughter by-products composition. (Berg and Butterfield, 1972). Furthermore, inclusion of treated date pits at 30% and 40% increased the weight of gastrointestinal tracts. This result is harmonious with the finding of Brenes *et al.* (1993). While moderately low level of dietary fiber is needed to promote intestinal motility (Onifade, 1993) it appears that higher levels could result in hypertrophy of the cells leading to an increase in weight.

The treatment in this study did not affect abdominal fat weight, chemical fat percentage or inter-muscular and subcutaneous fat contents of the leg joint. The treatment birds increased their feed intake in an attempt to obtain enough dietary energy from the diets that have been diluted through the inclusion of fibrous feed with less readily available energy. This explains the non-significantly low fat deposition in birds fed alkaline treated date pits especially at higher inclusion level.

The treatment did not produce significant effect on the

weights of right or left leg or any of their components. Again, the apparent differences between treatments in absolute weights of tissues are explained in terms of differences in the weights of the birds. Generally, subcutaneous fat was poorly developed in all treatments except the control treatment, which had more subcutaneous fat than the others. Poor subcutaneous fat development may impair cookability of broilers especially when grilling is used.

The treatment did not influence the composition of the right and left leg in terms of inter-muscular fat or bone content. Similarly the protein content of the breast muscle did not vary between the treatments. Thus the treatment did not produce adverse affects on physical or chemical components of the meat. Likewise acceptability of cooked meat was not affected by the treatment. Taste panel scores for taste, flavor and tenderness of cooked meat did not differ between the treatments.

It is concluded that replacing corn with alkaline treated date pits as high as 62.4% in broilers diets did not produce serous adverse affects on serum biochemistry, carcass and eating quality of broilers. More studies are needed to improve the feed value of date pits possibly through soaking, fermentation, enzyme, and other additive treatments.

References

Al-Hiti, M.K., 1978. Date waste without stones in broiler diets. Br. Poult. Sci., V 19 p.1.

AOAC, 1975. Official methods of analysis. 12th ed., Association of Official Analytical Chemists, Washington DC.

Berg, R.T. and R.M. Butterfield, 1972. New concepts in cattle growth. AGC Sydney, Australia.

Brenes, A., M. Smith, W. Guenter and R.R. Marquardt, 1993. Effect of enzyme supplementation on the performance and digestive tract size of broiler chickens fed wheat and barley-based diets. Poult. Sci., 72: 1731-1739.

Commercial Chicken Production Manual, 1981. 2nd edition. AVI Publishing Company. INC Westport, Connecticut.

Ewing, S., 1963. Poultry nutrition. The Ray Ewing Co., Pasadena, California.

Jerry, J., J. Kaneko, W. Harvey and L. Michael, 1997. Clinical biochemistry of domestic animals, 5th Edition. Michael L., Brussels.

Kamel, B.S., M.F. Diab, M.A. Alian and A.J. Salman, 1981. Nutritional value of whole dates and date pits in broiler ration. Poult. Sci., 60: 1005-1011.

Longe, O.G. and J.O. Fagbenro-Byron, 1990. Composition and physical characteristics of some fibrous wastes and by-products for pig feeds in Nigeria. Bietr. Trop. Landwirtch Arch. Zootec., 46: 137-144.

Onifade, A.A., 1997. Growth performance, carcass characteristics, organ measurements and hematology of broiler chickens fed a high fiber diet supplemented with antibiotics or dried yeast. Die Nahrung., 41: 370-374.

Onifade, A.A., 1993. Comparative utilization of three dietary fiber sources by broiler chickens. Ph.D. Thesis, University of Ibadan, Ibadan, Nigeria.

SAS Institute, Inc., 1986. SAS user's guide: statistics. SAS Institute, Inc., Cary, NC, USA.