The use of date waste in broiler nutrition

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Introduction

Feedstuffs for economical animal production especially yellow corn are considerably limited in many regions of the world. This is becoming even worse due to the use of different crops such as corn in biofuel production. (Farrell, 2005; Lumpkins and Batal, 2005; Swiatkiewicz and Korleski, 2008). According to the published statistics of the Ministry of Agriculture and Water (2000), a considerable amount (20%) of produced dates is inedible and is not suitable for human consumption due to its poor quality. Egypt, Saudi Arabia, Iran, Iraq, UAE, Algeria and Pakistan are seven leading countries that produce more than 90% of the world's date supply (Daghir, 2008).

Najib et al., (1995) evaluated the chemical composition of date meal from 1-12 date cultivars grown in Saudi Arabia. The results showed that the average of protein ranged from 2.12 to 4.10 %, fat levels average ranged from 0.09 to 0.64% and the level of ash ranged from 1.74 to 2.50%.

Afzal et al., (2006) found that no significant differences were detected in feed intake, live weight and feed conversion ratio (FCR), when dates were used for up to 30%.

Therefore, two experiments was undertaken to evaluate the date waste meal as a source of dietary energy for broiler chicks, supplemented with both enzymes, probiotics and their combination.

Materials and Methods

The current experimental work was carried out at King Abdulaziz University, Faculty of Meteorology Environmental and Arid land Agriculture. Four hundred and eighty unsexed seven-day old broiler chicks were used in experiment (1) weighed individually and wing banded. Chicks were randomly and equally divided into twenty treatments of 24 chicks each. Each group contained three replicates of 8 chicks. So, 20 experimental diets were adjusted to

be iso-nitrogenous and iso-caloric, using five dietary date wastes meal (0, 7, 14, 21 and 28%) without or with either enzyme (0.5 g/kg), probiotics (0.5 g/kg) and their combination. The enzymatic preparation supplement used was Optizyme-5 And the probiotics used in this study was "livesac".

In experiment (2) three hundred chicks were randomly distributed to six dietary treatments, each contained five replicates of ten chicks each. Chicks were kept under the same management conditions during brooding. A representative two samples of DW was collected for proximate chemical analyses for measuring dry matter DM, CP, EE, CF, ash, NFE, according to Association of Official Analytical Chemists (AOAC; 1990), (Table 1)The composition of the experimental diets is shown in Table (2 and 3).Slaughtering was performed on a random sample of five birds from each treatment.

The carcass, including the front and hind parts abdominal fat, were weighed and.

The physical characteristics of meat, targeting tenderness and water-holding capacity (WHC) were measured according to Volovinskaia and Kelman (1962 Colour intensity and pH value were measured according to the methods of Aitken et al., (1962), respectively.

Digestibility of nutrients of the total gut was determined using five males per treatment (one male per replicate). At 42 days if age, birds were fasted for 24 h, followed by feeding their corresponding experimental diets for 72 h, so that the feed intake and excreta were collected for each replicate, cleaned from feathers and feed, weighed, dried in a forced air oven at 70oC for 36 h. They were finally ground and placed in screw-top glass jars until analysed. The procedure described by Jakobsen et al., (1960) was applied to excreta samples to separate faecal nitrogen. CP, EE and CF of the excrement as well as those of feed were determined according to AOAC (1990). The digestibility Data were analysed using of GLM procedure of Statistical Analysis Systems Institute (1990). In order to determine significant differences between all possible mean comparisons, Duncan's Multiple Range test (1955) was applied to the data.

Results and Discussion

Proximate analysis of date waste (DW) used in exp. (1) and experiment (2) are shown in table (1). There were apparent differences in chemical composition, ME value and amino acid profiles among different samples, as well as in biological variation due to different samples of WD. On the other hand, when WD was compared with corn, The CP and ME values presented 36.5% and 69.3%, respectively. In addition, the amino acids of maize were higher

than those of WD. Regarding the macro elements, it can be noticed that calcium and total phosphorus of the tested material were much higher than those of yellow corn (0.02 and 0.28%, respectively).

The difference in ME value of date waste could be attributed to its varieties as well as chemical and physical related characteristics. Sawaya et al., (1983) and Najib et al., (1995) reported that different values of the proximate composition of date meal may be due to the variety, stage of maturation of the fruits, agronomic conditions of dated and length of storage.

Generally, Increasing the tested material up to 28% significantly reduced LBWG. This decrement may be attributed to the decline in the availability of the nutrients at high levels of the studied meal. This finding agreed with that reported by Pektov et al., (1979) and Al-Homidan et al.,(2003). Also, Onwudlikee,(1986a,b) reported that date meal contains lower levels of essential amino acids such as lysine, methionine, leucine and isoleucine. In support to the present results, Mahmoud (2005) reported that feeding date seed meal containing diet led to negative effects on the intestinal morphological properties which reduced the absorptive surface in the digestive tract and consequently decreased chickens performance. The beneficial effect of feed additives in improving LBWG of broiler was associated with the improvement in protein, fat and carbohydrate digestibilities (Ritz et al., 1995, Danicke et al., Nahas and lefrancois, 2001 and He et al., 2003).

The current results of feed conversion during the whole studied period (7-35 days) revealed that substitution of yellow corn by date waste meal did not yield any deteriorations where the differences among treatments were significant (table 4). It is clear that supplemented diets with either enzymes, probiotics or their combination did not give any significant differences.

The presented results in table (4) showed insignificant variations for breast %, thigh % and water holding capacity among the experimental treatments as compared with those of the control. A different trends was seen with abdominal fat percentage which showed that increasing dietary date waste up to 28% increased the abdominal fat %. It may be related to the finding of Crespo and Esteva-Garcia (2001) who reported that abdominal for content could be influenced by the fatty acid profile of diet.

Digestion coefficients of crude fiber and ash of the experimental diets are shown in Table (4). Results revealed that increasing date waste meal levels up to 28% decreased the digestion coefficient value of crude fiber. The opposite was true with that of ash which was significantly improved by about 6.73% over that of the control.

Table (5) shows the effect of different levels of DW in exp. (2) on growth performance of broiler chicks. There were no differences due to inclusion of DW for up to 15% diet on growth, feed intake and FCR.

DW had no adverse effect on dressing percentage. However, it should be mentioned that the inclusion of DW above 3% in broiler diets insignificantly improved dressing percentage by 2.8% to 3.6%.

DW for up to 15% diet had no significant effects on DM, CP, EE and ash of breast and thigh meat mixture. On the other hand, there were no significant effects of dietary DW for up to 15% on the physical parameters of meat such as tenderness, WHC, colour intensity and pH of meat.

Similar to the present results, Kamel et al., (1981), Vandepopuliere et al., (1995), Hussein et al., (1998), Al-Homidan (2003) and Afzal et al., (2006) reported that WD for up to 24% in the starter and finisher diets did not significantly affect BW gain (BWG), FCR and feed intake of 49-day-old broiler chicks. This may be due to the high levels of glucose and fructose as available carbohydrate in WD 50% and some sucrose (Sawaya et al., 1983).

In harmony with the present results, Hmeidan et al., (1993) and Al-Homidan (2003) concluded that DW had no adverse effects on dressing percentage with or without. The absence of significance effects of DW on the nutrient contents (CP and EE) and physical characteristics of meat tissues (tenderness, WHC and pH) confirmed that the experimental diets containing DW for up to 15% have met the broiler requirements during 15 to 42 days of age .Similarly, Hmeidan et al., (1993) and Al-Homidan (2003) observed that DW did not significantly affect carcass quality of broilers.

Table (5) shows the effect of different levels of DW on digestibility of nutrients. The digestibility of OM, CP, EE, CF and apparent of ash were not significantly affected by DW for up to 15% diet.

Conclusion

Our results showed that it is possible to include DW for up to 15% in broiler diets from 15 to 42 days of age and up to 21% from 7-35 days of age without adverse effects on growth performance and meat quality. In addition a 28% dietary date waste meal plus enzymes and probiotics mixture supplementation could be ideal for the achieving of optimum broiler performance.

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Abstract

The feedstuffs available for poultry nutrition are limited, and forming a main problem confronting the poultry production worldwide. Date is considered an important national crop in Saudi Arabia. Date production was over million tons in year 2010. A considerable amount 20% of produced dates is inedible and is not beneficial for human consumption due to poor quality. Besides the average weight of date pits is 10% of the date's weight.

Two experiments were conducted with Lohmann broiler chicks to study the effect of dietary date waste (DW) of different levels (0, 7, 14, 21, and 28%) with or without natural (multienzyme and microbial probiotics) supplementation during the period from 7-35 day of age. DW levels (0, 3, 6, 9, 12 and 15%) were also included in the formation of isocaloric and isonitrogenous broiler diets from 15-42 days of age in experiment two.

The growth performance, carcass characteristics and meat quality measurements were evaluated. Three hundred unsexed Lohmann broiler chicks were randomly and equally distributed into six groups in the first expperiment and 480 chicks used through exp two, five males from each treatment were randomly chosen and slaughtered to determine carcass characteristics, internal organs and meat quality measurements. Digestibility of nutrients was measured at the end of the experimental period using five caged-individual males per treatment. The results of the first experiment indicated that date waste could be included in the broiler diets for up to 21% without any bad effects on the productive performance. In addition date waste plus enzymes and probiotics mixture supplementation could be ideal for the achieving of optimum broiler performance, while results of experiment two showed that date waste could be included in broiler chicks diet up to 15% during the period from 15 to 42 days of age without adverse effects on growth performance and meat quality. This would increase the availability of feed resource, especially in the regions where the supply of feedstuffs is limited.

Keywords: Date waste, broilers, growth performance, and meat quality.

Table 1. Proximate analysis of date waste used in experiment (1) and (2) compared to corn (on fed basis)

Item	Corn	Exp. (1)	Exp. (2)
Moisture %	11.00	10.05	7.20
Crude protein %	8.50	3.90	3.10
Ether extract %	3.80	1.72	3.88
Crude fiber %	2.20	5.70	7.00
Nitrogen free extract %	73.35	75.71	76.5
NDF	NR	NR	1.62
ADF	NR	NR	6.85
Ash %	1.15	2.92	2.35
Calcium %	NR	0.62	NR
Phosphorus %	ND	0.54	NR
Methionine %	.018	0.04	0.04
Lysine %	0.13	0.21	0.13
Cystine %	NR	NR	0.08
ME (kcal/kg)	3350	3570	2321

NR = not reported

ME = metabolizable (kcal/kg) energy value calculated according to Carpenter and Clegg (1956).

Table 2. Composition and calculated analysis of the diets used in experiment (1)

Ingredient %	Control	7% DW	14% DW	21% DW	28% DW
Yellow corn	64.52	55.62	46.72	37.82	30.8
Soybean meal (48%)	32.28	33.18	34.08	34.98	35.0
Vegetable oil	-	1.0	1.75	2.50	3.0
Date waste	-	7.0	14.0	21.0	28.0
Limestone	0.8	0.8	0.8	0.8	0.8
Di-calcium Phosphate	1.6	1.6	1.6	1.6	1.6
Vit+Min, premix	0.3	0.3	0.3	0.3	0.3
Salt (Iodized)	0.3	0.3	0.3	0.3	0.3
DL-Methionine	0.2	0.2	0.2	0.2	0.2
Sand	-	-	0.25	0.50	-
Total	100	100	100	100	100
Calculated analysis					
CP, %	20.97	20.93	20.88	20.82	20.52
ME, (Kcal/kg)	2894.1	2912.2	2907.87	2903.53	2889.86
C/P, ratio	138.01	139.14	139.27	139.46	140.8
Crude fiber	2.23	3.23	3.77	4.05	4.29
Ca (%)	0.88	0.88	0.88	0.88	0.88
Available P (%)	0.439	0.439	0.439	0.439	0.439

Table 3. Composition of the broiler diets fed during 15 to 42 days of age at experiment (2)

	Date waste %					
	0	3	6	9	12	15
Ingredients and composition						
Yellow corn	58.40	54.09	50.00	45.10	41.00	36.50
Date waste	0.0	3.00	6.00	9.00	12.00	15.00
Soybean meal (44%)	35.0	35.5	35.9	36.98	37.50	38.20
Limestone %	0.8	0.8	0.8	0.8	0.8	0.8
Dicalcium phosphate %	1.60	1.70	1.70	1.70	1.70	1.70
NaCI %	0.3	0.3	0.3	0.3	0.3	0.3
Vitamin+ mineral mix %	0.3	0.3	0.3	0.3	0.3	0.3
DL-methionine %	0.1	0.11	0.11	0.12	0.12	0.12
Soybean oil %	3.5	4.2	4.8	5.7	6.28	7.08
Total	100	100	100	100	100	100
Calculated analyses						
AME (kacl/kg)	3060	3060	3060	3060	3060	3060
CP %	19.7	19.8	19.9	20.0	20.10	20.20
Methionine %	0.42	0.43	0.44	0.44	0.43	0.43
Methionine + cystine %	0.76	0.76	0.77	0.77	0.76	0.76
Lysine %	1.09	1.10	1.11	1.13	1.14	1.15
Calcium %	0.82	0.82	0.82	0.83	0.83	0.84
Nonephytate phosphorus %	0.40	0.40	0.40	0.40	0.40	0.40
Crude fat %	5.12	5.97	6.42	7.29	7.82	8.56
Crude fibre %	3.60	3.78	4.10	4.17	4.36	4.55

AME = apparent metabolisable energy. Vitamin and mineral mixture provided per kilogram of diet: vitamin A (all-trans-retinyl acetate) 12000 IU, vitamin E (all rac- a-tecpopheryl acetate) 10IU, K_3 3mg, Vitamin D_3 2200 ICU, riboflavin 10mg, Ca pantothenate 10 mg, niacin 20 mg, Choline chloride 500 mg, vitamin B_{12} 10 ug, vitamin B_6 1.5 mg, thiamine (as thiamine mononitrate) 2.2 mg, folic acid 1 mg, D-biotin, 50 ug. Trace mineral (mg/kg of diet): Mn 55, Zn 50, Fe 30, Cu 10, Se 0.1 and ethoxyquin.

Table 4. The effect of different levels of date waste supplemented with either enzymes, probiotics or their combination on broiler

Experimental treatments	body weight (g) at 35 d.	BWG (g) daily at 7- 35 d.	Feed intake (g) at 7-35 d.	Feed conversion at 7-35 d.	Dressing %	Breast %	Thigh %	Abdominal fat (%) %	Water holding capacity	Digestion Coefficitent of Fiber	Ash
Date waste levels %											
0	1830.23a	57.86a	3155 c.0	1.99	64.55ab	52.75	46.41	1.03b	85.14	34.63a	61.26c
7	1866.09a	59.25a	3275.50a	2.00	64.15ab	52.61	46.16	1.26ab	84.16	32.65b	60.89c
14	1796.88a	56.70a	3122.50d	2.01	64.35ab	52.11	46.70	1.21ab	83.68	33.33a	63.54b
21	1840.61a	58.24a	3226.36b	2.01	65.25a	51.44	47.33	1.24ab	83.51	30.57c	63.23b
28	1684.03b	52.63b	3022 e.0	2.09	63.75b	51.43	47.17	1.39a	83.97	28.32a	65.38a
Additives											
None	180338	56.99	3176.80a	2.03	64.16b	51.53	47.48a	1.16ab	83.42	28.97b	59.70b
Enzyme	1805.69	57.03	3144.20b	2.00	65.40a	52.09	46.85ab	1.06b	83.52	33.00a	61.64b
Probiotic	1796.0	56.64	3165.40a	2.04	63.60b	52.20	46.47ab	1.33a	83.46	31.68ab	64.81a
Enzyme & Probiotic	1812.13	57.24	3168.80a	2.01	64.48ab	52.44	46.22b	1.35a	83.11	33.95a	65.29a
SEM	11.738	13.30	0.2922	14.04	2.75	3.53	3.93	0.88	0.78	2.94	3.02
Significance											
Date waste levels	**	**	**	NS	**	NS	NS	*	NS	**	**
(D)	NS	NS	**	NS	**	NS	*	*	NS	*	*
Additives (A)	NS	NS	**	NS	**	NS	NS	NS	NS	*	*
DXA											

a,b,c Means of the same column with different superscripts are significantly different.

* = (P<0.05) ** = (P<0.01); NS = non significant.

Table 5. Nutrient digestibility, growth performance, relative weight of dressed carcass and inner organs, chemical composition and physical parameters of meat of broiler chicks as affected by the level of date waste.

Date Waste %							
Criteria (%)	0 control	3	6	9	12	15	P value
Growth performance							
BWG (g)	1482.0	1482.0	1482.0	1482.0	1482.0	1482.0	ns
FI g/bird	3499	3499	3499	3499	3499	3499	ns
FCR (g/g)	2.36	2.36	2.36	2.36	2.36	2.36	ns
Nutrient digestibility							
OM %	78.3	77.6	77.3	78.1	77.8	76.4	ns
CP %	77.2	78.2	76.3	78.0	77.9	77.1	ns
EE %	76.2	75.4	74.3	75.9	75.2	74.7	ns
CF %	26.7	25.1	24.9	24.7	27.9	28.7	ns
Ash %	25.9	24.9	25.9	23.2	24.8	24.5	ns
Carcass characteristics							
Dressing %	64.4	63.4	66.2	67.3	65.2	66.7	ns
Feather	8.66^{ab}	8.27^{b}	8.35^{b}	8.87^{ab}	7.61^{b}	9.76^{a}	**
Heart	0.562^{b}	0.785^{a}	0.513^{bc}	0.508^{bc}	0.570^{b}	0.444^{c}	***
Pancreas	0.342^{b}	0.442^{a}	0.258^{b}	0.223^{b}	0.286^{b}	0.264^{b}	**
Spleen	0.176a	0.173^{a}	0.143^{ab}	0.151^{ab}	0.108^{b}	0.089^{b}	**
Abdominal fat	0.44	0.48	0.56	0.53	0.62	0.74	ns
Chemical composition							
DM	28.1	28.3	28.5	28.2	28.4	28.9	ns
CP	20.2	20.2	20.4	19.8	20.1	20.0	ns

EE	6.61	6.47	6.54	6.75	6.91	7.23	ns
Ash	1.43	1.25	1.32	1.45	1.34	1.47	ns
Physical parameters							
Tenderness (cm^2)	2.77	2.73	2.65	2.71	2.68	2.63	ns
WHC (cm^2)	6.41	6.43	6.78	6.58	6.34	6.71	ns
pH value	6.54	6.66	6.43	6.75	6.86	6.55	ns
Colour	0.189	0.187	0.183	0.197	0.191	0.183	ns

OM = organic matter, DM = dry matter, EE = ether extract, CF = crude fibre, WHC = Water-holding capacity, pH. Ns = not significant.

abc = means within the same row not having similar superscripts are significantly different ($P<0.05$).

** $p< 0.01$; *** $p<0.001$.

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