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SULFURIC ACID TREATED DATE PITS AS DIETARY INGREDIENT IN TILAPIA (*Oreochromis niloticus*) DIETS

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SUMMARY

Five isonitrogenous (40% CP) and isocaloric (19 MJ/kg) diets were formulated to investigate the utilization of acid treated date pits as carbohydrate source for tilapia fingerlings (*Oreochromis niloticus).* Tilapia with an average body weight of 6.61 ± 0.04 g were randomly stocked for 42 days in self-cleaning, fiberglass tanks. Diet 1 (control) contained 30% wheat flour as the main source of carbohydrate. Wheat flour in diets 2 and 4 was replaced by 50% (15% of the total diet) and 100% (30% of the total diet) untreated date pits, respectively. Also, treated date pits replaced 50% and 100% of the wheat flour in diets 3 and 5, respectively. Date pits were immersed in 70% H_2 SO_4 for 30 min. and neutralized to pH 7 by sodium hydroxide. Growth performance, feed conversion ratio and protein productive value were significantly ($P<0.05$) higher in fish fed diet 3 (15% treated date pits), whereas fish fed diet 4 gave the lowest values ($P>0.05$). Fish received diets containing treated date pits had better productive performance values than that fed untreated date pits, within the same replacement percentage. Carcass analysis showed significantly ($P<0.05$) higher dry matter and crude protein content in fish received treated date pits compared to the groups received untreated date pits. The inorganic matter contents were not affected by treatments.

Key words: Date pits, treated, performance, tilapia

INTRODUCTION

Around the world in tropical and sub-tropical areas, the numbers of date palm trees are increased vigorously because of its suitability to be grown under arid conditions. Wasted date is a promising non-traditional carbohydrate source in animal nutrition. The utilization of date byproducts in animal feeds was first carried out by Ali *et al.* (1956) for dairy cows. Al-Azzawi (1960), Afifi *et al.* (1966), Al-Hiti & Rous (1978) Al Yousef *et al.* (1986) investigate the utilization of date byproducts for broiler and Nagib *et al.* (1994) for layer hen and Aldosari *et al.* (1995) for sheep.

The use of date and date pits as fish feed source was first mentioned by Yosif *et al.* (1996). They found positive growth performance in all fish groups fed diets containing date pits and were superior on that fed date pulp. Date pits contain approximately 9% moisture, 6.1% crude protein 10.7% crude fat, 14.4% crude fiber and 66.1 carbohydrate (Yousif et al, 1996). Al Yousef *et al.* (1986) reported that sodium hydroxide treatment of date pits increased the rate of *invitro* digestibility by solubilizing some of the cell wall. Also Belal and Al Jasser (1997)

found that the total replacement of cornstarch by date byproduct improve tilapia weight gain, feed conversion and protein efficiency ratio.

The purpose of the present study was to evaluate the utilization of acid treated date pits in *Oreochromis niloticus* diets.

MATERIALS AND METHODS

Diets preparation: Diet ingredients were obtained from the local market. Five isonitrogenous (40% CP) and isocaloric (18.9 Mj/Kg) diets were prepared. Date pits were included in the experimental diets in a rate of 0, 15, 15, 30 and 30% for diets 1(control), 2, 3, 4 and 5, respectively. The date pits in diets 3 and 5 were immersed in 70% H_2 SO_4 for 30 min. to remove the outside cover and washed-up after that with tap water and neutralized with diluted sodium hydroxide then washed again with tap water. Date pits (untreated and treated) were ground in 2mm-mesh sieve. Chemical analyses of treated and untreated date pits are presented in table 1.

In preparing the diets, dry ingredients were first ground to small particle size, then they were thoroughly mixed and water was added to obtain a 30% moisture content. Diets were passed through a mincer with 0.6-mm diameter and were dried at 55° C for 16 h using a dry oven. After drying the diets were broken up and sieved into convenient pellet size. All diets were frozen (-15° C) until feeding.

Composition and chemical analysis of the experimental diets are presented in table 2.

Experimental fish: *Oreochromis niloticus* fingerlings (6.6 g/ fish) were obtained from the fish stock of the fish culture laboratory. Fish were acclimated for one week indoor 10-liter fiberglass tanks at a rate of 1 fish/ 1 liter and fed the control diets (40% CP and 19 Mj/ Kg). Three tanks were used per treatment. Fish from each tank were weighed at the beginning of the experiment, every 2 weeks and at the end of the feeding trial. The fish were fed the experimental diets for 6 weeks twice a day, 6 days per week at a level of 5% of the body weight per day. At initiation and end of the feeding trial fish were retained for carcass analysis. Fish were decapitated homogenized in blender, stored in polyethylene bags and frozen for subsequent ash, protein and lipid analysis. After homogenization, a 15 g sample was oven dried at 105 C for 24h for moisture determination.

Growth performance and feed conversion were measured in terms of final fish weight, specific growth rate (SGR, %/ d), feed conversion ratio (FCR), feed intake, protein efficiency ratio (PER) and protein productive value (PPV%). Growth response and feed utilization parameters were calculated as follows:

SGR (%/day) = $\{\ln W_i - \ln W_0) / T\} \times 100$

Where: W_i is the final body weight of the fish, W_0 is the initial body weight of the fish and T is the culture period in days

FCR= Total feed fed (g/ fish) / total wet weight gain (g/ fish), PER= Wet weight gain (g/ fish) / amount of protein fed (g/ fish), PPV= {Amount of protein retained (g/ fish) / amount of protein fed (g/ fish) } x 100

Experimental system: The feeding trial was conducted in 15 (10 L) fiberglass tanks, which were a part of a complete recirculating water system provided with biological and mechanical filters. Continues aeration was provided by an air blower and air stones. Throughout the experimental period, water temperature was maintained at 26 ±1° C by using thermostatic electrical heater. The water in the system was partially exchanged at

a rate of 5% daily. Each tank was supplied with water at a rate of 3 L/ min.

Chemical analysis: Chemical analyses of the experimental diets and fish body were performed according to the standard methods of AOAC (1984). The nitrogen free extract (NFE) was calculated by difference {100 – (crude protein + crude fat + crude fiber + ash)}. Gross energy was calculated based on the conversion factors: protein 16.74 kJ/ g, lipid 37.67 kJ/ g and carbohydrate 16.74 kJ/ g (Garling & Wilson 1976).

Statistical analysis: Data were statistically analyzed by analysis of variance (ANOVA) using the MSTAT4 (Nissen 1987). Duncan's multiple-range test was used to compare differences among individual mean at $P<0.05$.

RESULTS AND DISCUSSION

One of the biggest problems facing the utilization of date pits in fish nutrition is the layer coating the stone. These unavailable fiber component prevent the digestive enzymes to act on the starch content of the date pits. Mechanical or chemical treatment could remove this unwanted layer. In the present study both mechanical (grinding) and chemical (treatment with 70% sulfuric acid for 30 min.) were applied. The results in table 1 showed that the pH of the treated date pits was not differ than that untreated, also treatment of date pits with sulfuric acid and grinding reduced the fiber content to about 70% of which found in the untreated date pits.

The results in table 3 showed that replacement of 100% of wheat flour in the diets of *Oreochromis niloticus* fish by untreated date pits (diet 5) reduced significantly ($P<0.05$) weight gain % and SGR. However, the differences between gain of groups (control, 2, 3 and 4) was not significant ($P>0.05$). Fish group received diet 3, where 50% of the wheat flour was replaced by treated date pits showed the highest growth values. It seems that sulfuric acid treatment had reduced the crude fiber content of the date pits which consequence increases the utilization of the diets. Vandepopuliere *et al.* (1995) concluded that high fiber content in diets of monogastric animals decreases their weight gain. Also Belal and Al-Jasser (1996) found that with increasing the inclusion rate of date by-products up to 30%, instead of corn flower in *Oreochromis niloticus* diets, fish weight gain was increased significantly ($P<0.05$) and increasing replacement percentage higher than that weight gain was decreased. They suggested a certain dietary ratio between complex and simple sugar of 3:1 for best performance of tilapia fish. This may explain the reduction of weight gain obtained in the present study when untreated date pits (high fiber content) was the only source of carbohydrate in fish feeds (diet 4). Shiau and Lin (1993) concluded that tilapia fish utilizes complex carbohydrate (starch) more readily than those simple sugars.

Group 3 (15% treated date pits) showed the best feed conversion ratio (FCR) values followed by control, diet 2 and 5 than group 4 which were differ significantly ($P<0.05$) than the previous groups. Replacement of 100% wheat flour by untreated date pits reduced significantly ($P<0.05$) the feed utilization parameters, with treating the same replacement level with 70% sulfuric acid, feed utilization was improved.

Protein utilization values of groups 2 and 3 (15% untreated and treated date pits, respectively) were superior significantly ($P<0.05$) on all other fish groups including the control. More than 15% date pits in the diets decreased the utilization values of the dietary protein.

Table (1) : Chemical analysis of date pits (% DM).

	pH	Moisture	CP %	EE %	CF%	Ash%	NFE%
Date pits (untreated)	6.8	8.68	5.46	8.27	31.59	0.95	54.68
Date pits (treated)*	6.6	8.24	5.90	7.20	22.26	1.78	62.77

*) Date pits immersed in H_2SO_4 (70%) for 30 min.

Table (2) : Composition and chemical analysis of the experimental diets.

	Diets				
	Control	2	3	4	5
Feed composition (%)					
Fish meal	34	35	35	37	37
Soybean meal	25	25	25	25	25
Wheat flour	30	15	15	--	--
Date pits	--	15	15*	30	30*
Corn oil	5	5	5	5	5
Vitamin mixture**.	3	3	3	3	3
Cellulose	3	2	2	--	--
Chemical analysis (%)					
Dry matter	95.9	94.2	94.7	95.1	94.9
Crude protein	40.4	40.4	40.2	41.5	40.3
Ether extract	6.7	7.5	7.4	9.0	8.6
Crude fiber	4.1	8.7	7.7	11.4	10.5
Ash	10.7	10.8	10.4	11.3	10.2
NFE	38.1	32.6	34.3	26.8	30.4
Gross Energy (MJ/kg)	18.7	18.8	18.9	19.1	19.1

*) Treated. **) Vitamin mixture: Shrimp tonic, JV Marine East. Co. Ltd, Thailand.

Table (3) : Performance of *Oreochromis niloticus* fingerlings fed the experimental diets.

	Diets					
	Control	2	3	4	5	± SE
Initial wt.	6.61	6.58	6.61	6.59	6.63	0.04
Final wt.	13.97^{a}	13.54^{a}	14.92^{a}	11.25^{b}	13.10^{ab}	0.62
Gain (g/ fish)	7.35^{a}	6.96^{a}	8.31^{a}	4.76^{b}	6.47^{ab}	0.63
Weight gain (%)[1]	114.17^{a}	105.80^{a}	125.70^{a}	72.17^{b}	97.53^{ab}	10.0
SGR	1.77^{ab}	1.72^{ab}	1.94^{a}	1.43^{b}	1.61^{ab}	0.11
Feed intake	15.98a	15.85ab	16.39a	14.84 b	15.58 ab	0.31
FCR	2.23b	2.30 b	1.98 b	3.22 a	2.45 ab	0.23
PER	.05bc	1.19ab	1.33a	0.83 c	1.04 bc	0.08
PPV	24.01b	27.58 ab	29.87a	15.85 c	23.82 b	1.68

1) Weight gain % = (Gain/ initial wt) x 100

Table (4) : Carcass composition (% of dry weight) of *Oreochromis niloticus* fed the experimental diets

	Initial	Groups					
		Control	2	3	4	5	± SE
Moisture	71.96a	71.40a	70.09b	71.80a	68.13c	69.81a	0.36
Crude protein	52.25d	55.07c	56.40c	59.44 b	55.26c	63.52 a	0.37
Lipid	13.69c	14.97 b	16.43 a	14.63 bc	14.77 bc	11.56 d	0.31
Ash	21.17 a	17.50 b	17.79 b	18.66 b	18.14 b	18.37 b	0.30
Rest	12.89 a	12.44a	9.41c	7.22 d	11.83 b	6.56 e	0.14

Availability of energy through the fat and the carbohydrate sources (date pits) and the reduction of fiber content (by treatment) may spare the dietary protein to be utilized in fish growth. Belal and Al-Jasser (1996) found that incorporating wasted date in tilapia feeds improved the protein sparing effect of fat and carbohydrate during protein synthesis. Protein productive value (PPV) which express the percentage of dietary protein utilized in fish body protein synthesis showed that 15% untreated or treated date pits were significantly ($P<0.05$) higher than the other groups including control.

Chemical compositions of fish body are presented in table 4. In all groups including date pits in the diets fish body protein content was improved. Fish fed diet 5 (30% treated date pits) showed the highest significant ($P<0.05$) protein content and lowest significant ($P<0.05$) fat content. Elgasim *et al.* (1995) explained the protein deposition in animal tissue may due to the hormonal effect of date pits as a repartitioning agent (acts in a similar way as estrogen) which alter the energy deposition towards protein and away from fat. Generally, lower percentage of body fat was observed by increasing the treated date pits percentage in the diets.

In conclusion, the present experiment showed that treated date pits could be utilized in *Oreochromis niloticus* diets up to 30% instead of the carbohydrate source without any adverse effects on fish weight gain and feed utilization parameters.

REFERENCES

Afifi, M.; F. Abdou and M. Al-Sayed (1966). Date stone meal as substitute for barley inchick rations. Tropical Agriculture, Trinidad, 43: 167-170.

Al-Azzawi, I.I. (1960) The utilization of date pits in poultry diets. In: The proceedings of the First Conference, University of Baghdad, University Press, Baghdad, Iraq. Pp. 97-106

Aldosari, M.N.; A.A. Al-Hozab; M. Hmeidan and I. Alothaymeen (1995). Discarded dates and wheat straw as ingredients in the rations of growing sheep. Arab Gulf Journal of Scientific Research, Riyadh, Saudi Arabia. 13(1): 123-131.

Al-Hiti, M.K. and J. Rous (1978) Date waste without stones in broiler diets. British Poultry Science. 19: 17-19.

Ali, K.T.; N.C. Fine; M. Faraj and N.H. Sarsam (1956). The use of date products in the ration of the lactating dairy cow and the water buffalo.

Indian Journal of Veterinary Science. 26: 193-201.

Al-Yousif, Y.; R.L. Belyea and J.M. Vandepopuliere (1986). Sodium hydroxide treatment of date pits. Pages 103-104 in Proceedings of Second Symposium on date palms. King Faisal University, Al-Hasa, Saudi Arabia.

AOAC (1984). Official Methods for Analysis of the Association of Official Analysis Chemist, 14th edn. Arlington, Virginia.

Belal, I.E.H. and M.S. Al-Jasser (1996). Replacing dietary starch with pitted date fruit in Nile tilapia *Oreochromis niloticus* (L.) feed. Aquaculture Research, 28: 385-389.

Elgasim, E.A.; Y.A. Al-Yousef and A.M. Humeidan (1995). Possible hormonal activity of date pits and flesh fed to meat animals. Food Biochem., 52: 149-152.

Garling, D.L. and R.P. Wilson (1976). Optimum dietary protein to energy ratio for channel catfish fingerlings, *Ictalurus punctatus*. J. Nutr. 106: 1368-1375.

Najib, H.; Y.M. Al-Yousef and M. Hmeidan (1994). Partial replacement of corn with dates in layer diets. Journal of Applied Animal Resources. 6: 91-96.

Nissen, O. (1987). MSTAT4 Michigan State University Statistical Package. Dept. Of Crop and Soil Science, Michigan State , East Lansing, Michigan.

Shiau, S.Y. and S.E. Lin (1993). Effect of supplemental dietary chromium and vanadium on the utilization of different carbohydrates in tilapia *Oreochromis niloticus* x *Oaureus*. Aquaculture. 110: 321-330.

Vandepopuliere, J.M.; Y. Al-Yousef and J.J. Lyons (1995). dates and date pits as ingredients in broiler starting and coturnix quail breeder diets. Poultry Science, 74: 1134-1142.

Yousif, O.M.; M.F. Osman and G.A. Alhadrami (1996). Evaluation of dates and date pits as dietary ingredients in tilapia (*Oreochromis aureus*) diets differing in protein sources. Bioresource Technology. 57: 81-85.

نوي البلح المعامل بحمض الكبريتيك كمادة غذائية في علائق البلطي النيلي (*Oreochromis niloticus*)

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تم تكوين خمس علائق متساوية المحتوى في البروتين الخام (٤٠%) و الطاقة الكلية (١٩ ميجا جول / كجم عليقة) وذلك لدراسة مدى استفادة إصبعيات البلطي النيلي (*Oreochromis niloticus*) من نوى البلح المعامل بالحمض كمصدر للكربوهيدرات في العليقة. تم تخزين إصبعيات البلطي النيلي (*Oreochromis niloticus*) بمتوسط وزن بداية ٦,٦١ ± ٠,٠٤ جم/سمكة عشوائيا على ٥ معاملات وذلك لمدة ٤٢ يوما في أحواض تتظف ذاتيا مصنوعة من الألياف الزجاجية. العليقة الأولى (المقارنة) تحتوي على ٣٠% من تركيبها مسحوق قمح كمصدر رئيسي للكربوهيدرات. تم استبدال ٥٠ % (= ١٥% من العليقة الكلية) ، ١٠٠ % (=٣٠% من العليقة الكلية) من مسحوق القمح بمسحوق نوى البلح الغير معامل (مطحون خام) في العلائق الثانية و الرابعة ، على الترتيب. كذلك تم استبدال ٥٠ ، ١٠٠% من مسحوق القمح بنوى بلح معامل بالحمض في العلائق الثالثة و الخامسة ، على الترتيب. ونوى البلح المعامل قد تم غمره في حمض كبريتيك تركيز ٧٠% لمدة ٣٠ دقيقة ثم معادلة الحموضة بواسطة أيدروكسيد الصوديوم للوصول إلى رقم حموضة ٧. أظهرت النتائج أن كفاءة النمو و التحويل الغذائي و أيضا الاستفادة من البروتين كانت أفضل معنويا ($P<0.05$) في المجموعة التي تم تغذيتها على العليقة الثالثة (١٥% نوى بلح معامل). بينما أظهرت المجموعة التي تم تغذيتها على العليقة الرابعة أدنى القيم ($P<0.05$). تحت نفس المستوى من الاستبدال اتضح أن الأسماك التي تغذت على علائق تحتوي على نوى بلح معامل أعطت نتائج أفضل من الغير معامل. كما أظهر نتائج تحليل الجسم أن المادة الجافة والبروتين ارتفعا في جسم المجموعات التي تم تغذيتها على علائق تحتوى على نوى بلح معامل بالمقارنة مع المجموعات التي تغذت على نوي بلح غير معامل ، بينما انخفض الدهن في نفس المجموعات. أما المادة الغير عضوية فلم تتأثر بالمعاملة.