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Influence of different levels of potato peels on growth performance and carcass analysis of Nile Tilapia (*Oreochromis niloticus*)diets

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Abstract : This experiment was carried out to evaluate the performance of Nile tilapia *O. niloticus* fed different levels of potato peels (PP). The different levels of potato peels in different experimental diets were 0 (control), 15, 30, 45 and 60% of maize percentage (all diets were isonitrogenous (25% CP) and isocaloric (3300 ME/kg diet) P/E ratio of 90 mg protein/kcal (ME). During the experimental period diets were fed to Nile tilapia *O. niloticus* fingerlings for 6 days /week at 3% of live body weight through 12 weeks experimental period. 300 fingerlings (25±0.3g) were randomly distributed to five treatments and each treatment had triplicates. The greatest increase in daily body weight gain was (2.25g) of fish were fed on diets (30%) of PP, this was followed by PP60(1.97g), while the least increase in body weight was (1.72g) in PP15. No significant differences were observed between the control and treatments groups in specific growth rate (SGR%) and feed conversion rate (FCR%). In Nile tilapia would be tolerate up till 60% levels of PP as alternative source of yellow corn (YC) in their diets with non significantly effect for all growth parameters (BW, WG and GR), feed utilization (FI, FCR and PER) and the results tack the same trend also in carcass composition. PP could be used into fish nutrition for least cost diets formula.
Kew words : *Oreochromis niloticus*, potato peels, growth performance, carcass analysis.

Introduction

During the last years, increase the attention to the aquaculture production to solve the shortage of animal production and face the problem of increasing the human population demands [1]. Feeding stuff, which used in aquaculture and nutrition costs are the most expensive component and representing around 40-60% of the operating cost depending on the intensity of production [2]. Thus, dietary energy requirements of fish species (yellow corn) is of fundamental importance, because dietary energy significantly influences growth, survival and yield of fish as well as economics of farm industry. Therefore, finding alternative sources should be lower price and safe than yellow corn, which is a tradition source of plant protein in fish. In Egypt, it is commonly known that, there is an observed shortage in the traditional feedstuffs rather than the continuous increase in their prices from time to time. Also, the high costs and/or fluctuating quality of soybean meal lead to identify alternative protein sources for use in fish feed formulation [3,4,5]. Therefore, attempts have been carried out to search for alternative untraditional low price by products. In Egypt, the yield of potatoes crop was 1984013 tons in 1999 and the waste was determined by 12.2% [6]. The metabolizable energy content of PBM is 3.2 kcal/g which is comparable with that of corn being 3.47 kcal/g [7]. Potato processing is a very specialized field which cannot be described briefly. The potato processing industry produces several products and by-products. The main aspects are dealing with the following; peeling potatoes for processing, processing of potato chips, frozen French fries, dehydrated mashed potatoes as granules or flaks and potato starch flour. Potato waste meal (potatoes, potato pulp and peeling) is a product produced by drying and grinding of culls of potatoes, potato trimming, pulp, peeling and off-color parts of French fries and potato chips. The present study aimed to investigate the possibility of using the low price potato by-products (potato peels) as energy sources instead of the high piece common sources, yellow corn in Nile tilapia diets.

Material and Method

Experimental design:

The experimental work of the present study was carried out at private fish farm, Sharqia, Egypt. The experiment was conducted to evaluate the effect of replacing the energy source of YC by PP as a by-product in Nile tilapia *O. niloticus* diets.

Collection and acclimatization of experimental fish:

Three hundred mono-sex fingerlings of Nile tilapia (O. niloticus) of the same brood stock (mean weight 25±0.03g) obtained from the central laboratory for aquaculture research, Abbassa, Abo-Hammad, Sharqia, Egypt, were used for this investigation. The fingerlings were acclimatized to laboratory conditions for 15 days. During the time of acclimatization fish were fed on a commercial pellets diet twice per day.

Formulation of the experimental dies:

The potato peels used in diets formulation were obtained from fresh potatoes which properly and sun-dried for 10 days under hygienic condition (placed on pasteurized while tray and covered with wire-mesh after which they were winnowed and sieved to get rid of any foreign material. The peels were then milled to be a fine powder and sieved through a 0.5mm mesh screen. Proximate analysis of the processed potato by- product peels n(PP)is presented in table 1.

Table (1): Proximate analysis of potato by-product peels (PP)

Nutrient content	Composition (DM%)
Moisture	8.44
Crude protein (CP)	4.66
Ash	4.53
Ether extract (EE)	4.06
Crude fiber (CF)	3.71
* Nitrogen free extract (NFE)	74.60

*Nitrogen free extract (NFE) =100-(CP+EE+CF+Ash)l

Other raw ingredients of the experimental diets were fishmeal, soybean meal, wheat bran, rice bran, sunflower oil, vit. and min. starch and potatoes peels. These diets were designated PP0 (control), PP15, PP30, PP45 and PP60, respectively.

Table 2 shown the ingredient and proximate composition of experimental diets. All experimental diets were isonitrogenous (25% CP) and isocaloric (3300 ME/kg diet)

2: Ingredients and proximate chemical composition of experimental diets.

Ingredients(%)	PP0	PP15	PP30	PP45	PP60
Potato peels	0	4.5	9	13.5	18
Yellow corn	30	25.5	21	16.5	12
Soybean meal	44	43.37	42.94	43.54	42.38
Fish meal	8	8	8	8	8
Wheat bran	5.05	4.87	5.46	4.59	5.66
Rice bran	6.1	6.48	6.05	6.22	6.13
Sun flower oil	4.85	5.28	5.55	5.65	5.83
Vit.& min.[1]	1	1	1	1	1
Starch	1	1	1	1	1
total	100	100	100	100	100
Proximate analysis (determined on dry matter basis)					
CP	24.16	25.06	25.88	25.26	25.57
EE	7.55	7.95	7.93	7.82	7.58
CF	4.57	5.11	5.38	5.69	5.91
ASH	7.15	6.85	7.17	7.65	7.96
NFE[2]	56.57	55.03	53.64	53.58	52.98
Gross energy	446.35	441.01	439.71	434.96	431.96
P/E ratio	5.5	5.68	5.88	5.81	5.92

[1]Vitamin & mineral mixture/kg premix : Vitamin D3, 0.8 million IU; A, 4.8 million IU; E, 4 g; K, 0.8 g; B1, 0.4 g; Riboflavin, 1.6 g; B6, 0.6 g, B12, 4 mg; Pantothenic acid, 4 g; Nicotinic acid, 8 g; Folic acid, 0.4 g Biotin,20 mg , Mn, 22 g; Zn, 22 g; Fe, 12 g; Cu, 4 g; I, 0.4 g, Selenium, 0.4 g and Co, 4.8 mg.
[2]Nitrogen free extract (NFE) =100-(CP+EE+CF+Ash)

Experimental set up:

After two weeks of acclimatization fish were divided into control and four treatments. The fish were starved over night to empty their gut and increase their appétit and reception for the new diets. A total of 24 fish were randomly selected, sacrificed and used in determining initial carcass proximate composition. For the experimental trial, 20 fish were weight (25±0.3g) and introduced into each of experimental pond. Each fish was weighted individually, and the fish were stoked in 15 concrete ponds each pond (1×4×1.5m) containing 6m of water (triplicate pond per diet) at a density 20 fish in each pond. The average initial weight for individual fish was 25±0.3g. The experimental lasted for 12 weeks. The fish were fed (3% body weight) twice daily at 8 am and 6 pm. Mean water quality parameters during the experimental period were 6.19±0.02, 26.67^{o}C±0.18, 22.6±0.018mg/l, 2.04±0.05 mg/l and 5.67±0.09 mg/l for PH, temperature, alkalinity, carbon dioxide and dissolved oxygen, respectively.

Determination of indices of growth performance and feed utilization:

At the end of the experimental period fish in each experimental pond were collectively weight weekly for the determination of growth rates, growth performance and geed efficiency parameter were calculated the following equation.

Weight gain (WG) = W1-W0.
Specific growth rate (SGR%/day) = [(Ln W1− Ln W0)/T] × 100.
Where, Ln = natural log, W0 = Initial body weight (g), W1= Final body weight (g) and T= Time (day). N.E.
Feed conversion ratio (FCR) = feed intake (g)/body weight gain (g).
Protein efficiency ratio (PER) = total weight gain (g)/protein intake (g).
Protein productive value (PPV%) = 100 (protein gain/protein intake).

Energy retention (ER%) = 100 (gross energy gain/gross energy intake).
Survival rate (SR%) = 100 × (fish No. at the end/ fish No. stocked at the beginning)

Statistical analysis:

At the end of each experiment, five fish were randomly sampled from each pond and slaughtered. Statistical analysis was performed using the Analysis of variance (ANOVA) one way classification and Duncan's multiple Range Test to determine differences between treatments means at significance rate of $P < 0.05$. The standard errors of treatment means were also estimated. All statistics were carried out using Statistical Analysis System [8] program.

Results

Growth performance :

Mean of GR and SGR were represented in (table 3). IW of fish were near content (25.00±0.03)g in all the experimental diets as there was no significant differences ($P<0.05$) average all treatments. PP30 group had the highest significant WG (189.21g), while in PP15 recorded the lowest WG (144.61g). on the other hand SGR was the highest value in (PP30)

Feed utilization indices:

In PP30 utilized the experimental diets was better than the rest treatments. On the other hand, PP15 had the lowest FI. FCR, PER,PPV and SR obtained for the five experimental diets were not significantly different for all the experimental groups .

Approximate composition of fish carcass:

Carcass composition at beginning and at end of the experiment were showed in table 5. Carcass composition of control (PP0) had the lowest lipids content with non significantly different. The protein and ash content wear nearly content, as there were no significant differences among the rest groups.

In (PP60) the results revealed that, the highest level of ash amongst the rest groups with non significant differences detected.

Table 3 Mean growth performance indices of Nile tilapia fed different potato peel meal for 12 weeks.

Growth indices	**Diet designation**				
	PP0	**PP15**	**PP30**	**PP45**	**PP60**
Initial weight(g)	25±0.05a	25±0.07a	25±0.11a	25±0.013a	25±0.01a
Final weight (g)	175.05±0.09d	169.66±0.06e	214.23±0.07a	182.45±0.08c	190.29±0.06b
Weight gain (g)	150.05±13.65d	144.61±14.42e	189.21±17.39a	157.42±22.39c	165.26±9.079b
Specific growth rate (SGR)	0.97±0.08a	0.96±0.06a	1.09±0.09a	1.01±0.11a	1.03±0.06a

*values within the same row are not significantly different at 0.05 probability level.
**n=20 fish per pond , values in parentheses are standard errors of mean value.

Table 4: Mean feed utilization indices of Nile tilapia fed different potato peel meal for 12 weeks.

Growth indices	Diet designation				
	PP0	PP15	PP30	PP45	PP60
Feed intake(g/fish)	171.45±0.08b	158.94±0.11c	199.14±0.17a	176.92±0.22b	175.35±0.09b
FCR	1.16±0.05a	1.11±0.22a	1.06±0.19a	1.13±0.27a	1.07±0.73a
PER	3.53±0.02a	3.60±0.06a	3.8±018a	3.66±0.19a	3.71±0.16a
PPV	3.38±5.8a	4.4±2.53a	3.20±0.26a	4.24±4.57a	3.83.078±0.78a
SR	93.75±0.17a	95.00±0.02a	96.25±0.06a	97.5±0.09	96.25±0.16

*values within the same row are not significantly different at 0.05 probability level.
**n=20 fish per pond, values in parentheses are standard errors of mean value.
FCR=Feed conversion rate, PER= Protein efficiency rate, PPV= Protein production rate and SR= Survival rate

Table 5: proximate composition of carcass of Nile tilapia fed different potato peel meal for 12 weeks.

Proximate composition DM%	Initial carcass composition	Final carcass composition of fish fed diets				
		PP0	PP15	PP30	PP45	PP60
Dry matter	29.37	25.00±0.02a	25.67±0.19a	25±0.11a	25.62±0.018a	25.84±0.16a
Crud protein	25.56	61.07±3.30a	61.40±1.76a	61.61±2.53a	61.45±2.21a	61.35±0.74a
Crud lipids	18.41	15.21±0.01a	16.10±0.28a	61.61±2.53a	15.79±.44a	16.27±.28a
Ash	16.66	23.72±4.56a	22.50±1.47	22.40±0.94a	22.76±1.75a	22.38±0.45a

*values within the same row are not significantly different at 0.05 probability level.

Discussion

In this study the nutritional values of PP meal as determined by growth parameters was adequate and in terms of SR and PP could be successfully incorporated in cultured fish.

However, FWG and GR were higher in PP30 diet, followed by PP60, PP45, PP0 and PP15, respectively. Moreover, no observed depression in growth parameters were obtained in PP60, PP45and PP15%, respectively.

Additionally, In PP60 reduced growth parameters than PP30 diet similar trend result was observed by [9]. When used sweet potato peals meal is a cheaper replacement for maize in the diet of Cat fish (*clarias gariepinus*) which formulated to contain graded levels as 0, 25, 50 and 75% of corn the feeding trial lasted six weeks, the highest PWG was recorded fish feed diet containing 25% SPP meal followed by a consistent decreased in PWG which decreasing inclusion of sweat potato peals meal. However diet containing 25, 50 and 75% SPP meal performance better than the control experiment. Moreover, [10] who, founded that twenty mono sex fingerlings of the experimental fish was carried out to evaluate the performance of Common Carp (*cyprinus cprpio*) fed different levels of processed sweet potato meals 0, 5, 10, 15, 20 and 25% for a period of ten weeks in triplicates. The highest inclusion levels (25%) reduced performance by the fish was observed. Secondly, one of the most conmen difficulties observed when alternative resource of feedstuffs are used in fish diet in acceptance and palatability by the type fish. Similar results obtained by [11]. However, in their present study. The fish avidly consumed the experimental diet.

Another point of view [12] replaced a decrease in WG of (*O. nilotious*) with an increase in level of palm kernel meal. 100% replacement of fish meal with plant materials in fish diet with always lead to reduced growth. In this study, the highest feed intake was replaced in fish fed the PP30 diet followed by other diet FCR and PER of fish fed different experimental diet. In the observed nearly the name with no significant difference detected between different level of potato peals inclusion. Carcass Composition in this study was revealed that no evidence of expensive protein or fat deposition in the fat deposition in carcass fish is usually correlated to diet earn level, similar result was obtained by [13]. Therefore, the results indicated that newly in the selection of the good quality of the experimental diet with respect to protein and fat level.

Conclusion

The study reveals possibility of utilization of PP meals in the practical diet of Nile tilapia the good performance of the fish fed diet containing PP meal inclusion showed that fish production can be increased by substituting PP for maize in the diet of Nile tilapia at 15, 30 , 45 and 60%, respectively. However, weight gain, FCR, PER, and PPV in to be considered substitution level of 30% of PP for corn in effective and nutritionally a better choice. There are numerous feed stuffs available which may used in fish feed manufacture let their nutrient composition, cheaper coast and availability should be considered in selecting feedstuffs for each species. So the price, the problem of handling also processing methods and storage would also affect the selection of feed stuffs for fish diet preparation

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