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Dietary Wheat Germ Oil Affected Growth Performance, Feed Utilization and Carcass Composition of NileTilapia(*OreochromisNiloticus*)

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Abstract: This experiment was conducted to check the effect of dietary supplementation with Wheat Germ Oil (WGO) on growth performance, body composition and feed utilization of *O.nilotica* fingerlings with an average 20 ± 0.21g. 75 days feeding trial was conducted in 12 aquariums (50 – 50 – 80cm in diameters).with three replications per treatment. Diets contain 0% (control), 0.5, 1.0 and 1.5% WGO. All experimental feeds contained isonitrogenous (27% crude protein) and isocaloric (425 Kcal gross energy/100g). The results revealed that WGO supplementation significantly enhanced the fish growth over the control group. Also survival rate was significantly increased with increasing WGO percentage in the diets. While, feed conversion ratio gradually significantly improved with increasing WGO percentage in the diets 1.5% inclusion level after that, without significantly increased. was A significant increasing in body protein content with increasing WGO percentage in the diets was observed. While moisture and fat content were significantly decreased with increasing WGO percentage in the diets. On other hand ash content was significant difference by diet.In conclusion, the present study suggested that WGO could be used as a growth enhancer in Nile tilapia *O. niloticus* feeds.
Keywords: Wheat germ oil. Growth performance.Nile tilapia.Aquaculture.

Introduction

Global tilapia aquaculture has been increased at high rate during the past few years, especially in Asia, Africa. subsequently, the world production of farmed tilapia has increased from 383,654 tones in1990 representing 4.5% of total farmed fish production to 4,507,02 tones in 2012, representing 6% of total aquaculture production and 10.2% of farmed fish production, and about 13.5% of the average annual growth (FAO,[1]). This rapid industrialization of tilapia production made gradual change in tilapia culture from extensive and semi intensive production system to more intensive, high input and costly system, with an increasing dependence on formulated feeds (El-Sayed, [2]). Therefore, the formulation and production of appropriate and cost-effective tilapia feeds have become a major challenge facing tilapia feed industry.

Wheat germ is rich in fiber, high fiber content diet is very useful in bowel regulation (treats constipation), also may be recommended for high risk diabetic patient , colon and heart disease (Mahan and Stump, [3]) wheat germ oil was claimed anti-inflammatory and described as a suitable natural antioxidant due to its high content of vitamin E (Paranich*et al*.,[4]) wheat germ oil contains also octacosanol, along chain fatty alcohol, reported to be helpful in cholesterol management (Singh *et al*.,[5]). The oil was reported also to be

available sores of essential fatty acids(i.elinolenic acid), which insufficiency was observed to cause tiredness, dry skin, immune insufficiency, anorexia, digestion and cardiovascular disorders (Mohamad*et al*.,[6])

Wheat germ oil (WGO) is considered unrefined oil and it is usually extracted from the wheat corn germ. It contains more vitamin E than any other oil. It is also an excellent source of many important nutrients such as vitamin A, vitamin D,Lecithin, and different sorts of proteins. It is very efficient in the topical application to the skin and that is the main reason why bit is often includes in numerous different sorts of skin care products. (WGO) has high antioxidant properties (vitaminE interact with zinc and selenium subsequently it act as powerful antioxidants) and has the ability to overall health and boost the immune system. Most health benefits of the (WGO) is because of its high multivitamins, essential minerals. Proteins and fatty acids content.

Materials and Methods

Fish experimental.

A group of 120 monosex (all male) Nile tilapia fingerlings (20g) used in the present study was obtained from Al-abbassa fish hatchery. They were acclimated to the culture system for 2 weeks, during which they were fed the test diets. Triplicate groups of fish were stoked in 12 aquaria represent 4 treatment (0, 0.5, 1, 1.5g), each aquarium (50x50x80cm) containing 200L of water at a density 10 fish in each aquarium .At the end of the acclimation period , a random sample of fish was netted, weight collectively and average weight were recorded .

Water quality parameters .

Water quality parameters were measured weekly including temperature via a thermometer, ph using Jenway Ltd., model 350 ph meters and dissolved oxygen using Jenway Ltd., Model 970 dissolved oxygen meters the average values of these parameters trough the study were T = 27.5 ± 1c , ph = 7.75± 0.20 and Do = 7.8 ± 1.2mg L-1

Feed preparation.

Four isonitrogenous (27% CP) with graded level of energy test diets were prepared in the laboratory. A control diet consistedfrom standard prepared diet without any treatment. The second, third and fourth diets containing WGO obtained from local market at a concentration of 0.5 1.0 and 1.5 % of the ration respectively, were mixed with the prepared diet. The ingredients of each diet were separately blended with additional 100 ml of water to make a paste. The pastes were separately passed through a grinder, and pelleted in a modified paste extruder to form the tested diets. The pellets were dried in a drying oven (Fisher oven 13 – 261 – 28A) at 85^{o}C for 24 hours and stored in plastic bags and finally kept in a refrigerator at -2^{o}C for further use. Experimental diets were formulated to meet the nutritional requirement of fish (NRC, [7]). The composition of the experimental diets was shown in Table (1). While proximate chemical composition of the experimental diets is shown in Table (2).

Table 1.Composition of the experimental diets.

Ingredients	Diet 1	Diet 2	Diet 3	Diet 4
Fish meal	80	80	80	80
Soya meal	400	400	400	400
Corn Glutein	190	190	190	190
Wheat bran	150	150	150	150
Yellow Corn	100	100	100	100
Fish oil	20	20	20	20
***Vit. & Min. mex**	20	20	20	20
Starch	20	20	20	20
Vegetable oil	20	15	10	5
WGO	0	5	10	15

* Each 100 gram of vitamin and mineral contained**:**

Minerals: Zn, 2.50 mg; Mn, 16.00 mg; Fe, 31.50 mg; Cu, 5.50; I, 0.55 mg; Ca, 1.15 gm and P, 450 mg. **Vitamins**: A, 7500000 Iu; Bi, 100 mg; B3, 500 mg; B6, 150 mg; B12, 2.5 mg; E, 100 mg; K, 100 mg; Pantothnic acid, 275 mg; Folic acid, 100 mg and vit. D3, 7500 Iu.

Table 2. Proximate chemical analysis (% on dry matter basis) of the experimental diets containing different levels of WGO.

Items	Diet 1	Diet 2	Diet 3	Diet 4
Dry Matter	91.82	91.18	91.15	92.17
Crude Protein	27.15	27.85	26.95	27.35
Ether extract	6.12	6.19	6.38	6.02
Ash	7.57	7.82	7.15	6.85
Crude fiber	7.61	7.92	7.81	7.89
[1]NFE	51.55	50.22	51.71	51.89
[2]G.E.(Kcal/100g)	423.1	422.25	425.09	424.68
[3]P/E ratio	64.17	65.96	63.4	64.4

[1]**NFE** (nitrogen free extract) = 100 – (protein % + lipid % + ash % + fiber %) [2]GE (gross energy) was calculated after NRC [7] as 5.64, 9.44 and 4.11 Kcal/g for protein, lipid and NFE, respect*ively*.

[3]P/E ratio = Protein to energy ratio in mg protein/kcal of gross energy

Feeding experiment.

After 15 days of acclimation period in the stock culture tanks, clinically healthy *O. niloticus* were divided into four equal groups at a rate of 10 fish/aquarium(50 x 50 x 80. cm in diameters). Each aquarium was filled with DE chlorinated tap water supplied with continuous aeration via air-stones using aquarium air pumps and a natural photo-period. About half of the water was changed daily in all experimental aquaria. Fecal matters were siphoned out once daily. The biomass of fish in each aquarium was measured at the beginning of experiment and after each sampling; thereby the daily ration was adjusted. Dead fish were daily recorded and removed. Fish were fed with their respective diets at the rate of 3% of their body weight per day for the period of the experiment. The daily ration was subdivided into two feeds.

Group one (G1): Control diet without WGO
Group tow (G2): Diet with 0.5% WGO
Group three (G3): Diet with 1% WGO
Group four (G4): Diet with 1.5% WGO

At the end of the experimental period (75 days), the following parameters will be measured:

Chemical analysis of diets and fish.

The tested diets and whole-fish body from each group at the beginning and at the end of the experiment will be analyzed according to the methods of (AOAC, [8] and NRC, [7]).

Growth performance.

Weight Gain (WG) = W2-W1.
Where: W_1= Initial body weight (g) and W_2= Final body weight (g).
Specific Growth Rate (%) (SGR) = $[(Ln_{w1}–Ln_{w0}) \div T] \times 100$.
Where: Ln = Natural log, W_0= Initial body weight (g), W_1= Final body weight (g) and T= Time (day).
Feed utilization parameters.
Feed Conversion Ratio (FCR) = feed intake (g)/ body weight gain (g).
Protein Efficiency Ratio (PER) = gain in weight (g) / protein intake in feed (g).
Protein Productive value (PPV) = final fish body protein (g) – initial fish body protein(g) / crude protein intake(g)

Statistical analysis.

Statistical analysis was performed using the Analysis of variance (ANOVA) tow way classification and Duncan's multiple Range Test, (Dunkan, [9]) 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 (SAS) program (SAS,[10]).

Results and Discussion

The results of the present study revealed that Nile tilapia fingerlings fed all the test diets showed excellent rates and feed efficiency (Table 3). Growth rates significantly increased ($p<0.05$) with increasing WGO inclusion levels. Feed conversion ratio (FCR) significantly decreased, while protein efficiency ratio (PER) and protein productive value (PPV) increased ($p<0.05$) with increasing dietary WGO up to 1.5 g/ kg level.

The dietary WGO in Nile tilapia diets significantly affected ($p<0.05$) the carcass composition of the fish (Table 4). Body protein and body lipid were higher in the third and fourth treatments (t3, t4) but there were no significant differences ($p<0.05$) in fish fed the graded levels of WGO. The ash contents were significantly lower ($p<0.05$) in the fish fed the T4 diet than in those fed the other diets. However, no regular pattern was observed in ash content. This improvement in the performance of WGO diets could be attributed to the different competent found in this oils.

Wheat (*Triticum aestivum* L.) was one of the first grains domesticated by humans. Wheat germ is considered as an important source of food(breads and cereals). WGO is nutritional oil derived from expeller – pressed wheat germ that contains lipids soluble vitamins.

Lipids mainly consist of essential fatty acids, (arachidonic acid linoleic, and linolenic acids). These fatty acids play an important role in controlling cholesterol level and decrease atherosclerosis probability. Essential fatty acid is important in prostaglandins synthesis which prevents deposition of saturated fats and cholesterol on the walls of arteries, so they have anti-atherosclerosis properties (Cesare*et al.,*[11]).

WGO has also high vitamin E content which has natural antioxidant effect that protects EFAs from being oxidized and decrease toxin formation in the body. Also it helps in blood cholesterol levels management. Presence of both vitamin E and EFAs categorized WGO as a very important natural arteriosclerosis and cardiovascular disease-preventer and it is valuable also in cholesterol blood level controlling (Cesare *et al.,*[11])

Octacosanol is along-chain fatty alcohol derived from WGO and is responsible for many of the benefits of WGO. Octacosanol has been found to improve energy in muscles, enhance performance, endurance and stamina, even at high altitudes, and improve oxygen utilization balance metabolism, and increase ability to handle stress. It is also a good source of omega-3 fatty acids and zinc (Kim *et al.,*[12]) and relatively high levels of carotenoids and phytosterols (Zhou *et al.,*[13]).

Paranich et al., [4] showed that in oral administration WGO efficiency saturates the body with vitamin E which improves the flow of blood and strengthening the veins and capillaries. WGO significantly increased the regeneration of platelets. It reduced platelet aggregation thrombus formation and protected the red blood cells membranes from oxidative damage (Lass and Sohal, [14])

WGO was found to decrease lipid peroxidation marker and stimulates erythrocytes anti-oxidant capacity in radiated rats. So, the tendency of blood cell peroxidation is lowered and the blood picture got better. WGO also have vitamin B-complex (B6, B12 and folic acid) which is important red blood cells synthesis (Vicky *et al.,*[15]).

Paul et al., [16] found that diet rich WGO protects from alcohol-induced duodenal ulceration. WGO was reported to increase endurance and to assist muscular dystrophies and other neuromuscular disorders (Vicky *et al.,*[15]). it has an anti-inflammatory effect and introduced as an appropriate natural antioxidant because of its vitamin E rich content (Paranich *et al,*[4]). WGO is considered a good source of essential fatty acids, i.e linoleic acid and linolenic acid, which its deficiency observed to make dry skin, tiredness, anorexia, cardiovascular disorders and immune insufficiency (Mohamed *et al.,*[6])

Supplementation of rat with WGO (81 mg/kg body wt.) for 10 successive days before body gamma irradiation and 7 successive days post , significantly improved blood lipid profile levels and decreased the

intensity of variation in serum CPK activity and modified the change in a LDH activity and its iso-enzymes patterns in comparison with irradiated rats (Said and Azab[17]).

Furthermore, Nobuko et al., [18] reported that guinea pigs supplied with WGO developed normal creatine values and didn't show any muscular dystrophy.

In conclusion, the present study suggested that WGO could be used as a growth enhancer in Nile tilapia feeds.

Table 3. Growth performance and survival rates for Nile-Tilapia fingerlings fed on different levels of *P. oleracea* seeds for 12 weeks.

Item	G1	G2	G3	G4
Initial Weight	20.15±0.17[a]	20.72±0.45[a]	20.31±0.31[a]	19.85±0.41[a]
Final Weight	60.56±2.15[c]	67.21±1.81[b]	76.37±0.36[a]	77.51±1.27[a]
Weight gain	40.41±0.51[c]	46.49±1.32[b]	56.06±1.21[a]	57.66±0.79[a]
SGR	0.637±0.01[c]	0.681±0.12[b]	0.767±0.02[a]	0.789±0.13[a]
FCR	2.35±0.23a	2.07±0.52b	1.85±1.81c	1.81±1.78d
PER	1.56±0.51c	1.74±0.21b	2.00±0.16a	2.01±0.23a
PPV	15.28±2.13c	33.43±1.23b	57.66±1.89a	57.22±2.3a
Survival Rate	83.3[c]	85.51[b]	93.68[a]	93.52[a]

The same letter in the same row is not significantly different at $P < 0.05$.

Table 4. Proximate chemical composition (% on dry matter basis) of experimental fish fed diets containing different levels ofWGO meal at the end of the experiment.

Item	Initial	G1	G2	G3	G4
Moisture	76.89b	79.18±1.11[a]	74.26±0.07[c]	72.82±1.81[d]	71.86±1.71[d]
Crude Protein	51.21±1.20d	55.3±0.21[c]	60.52±0.51[b]	66.75±1.00[a]	66.86±1.07[a]
Ether Extract	24.98±.025c	21.38±1.13[b]	22.15±0.23[b]	18.17±1.28[a]	18.85±0.91[a]
Ash	23.50±1.32c	23.26±1.51[c]	17.33±0.36[b]	15.08±0.68[a]	14.29±0.92[a]

The same letter in the same row is not significantly different at $P < 0.05$.

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